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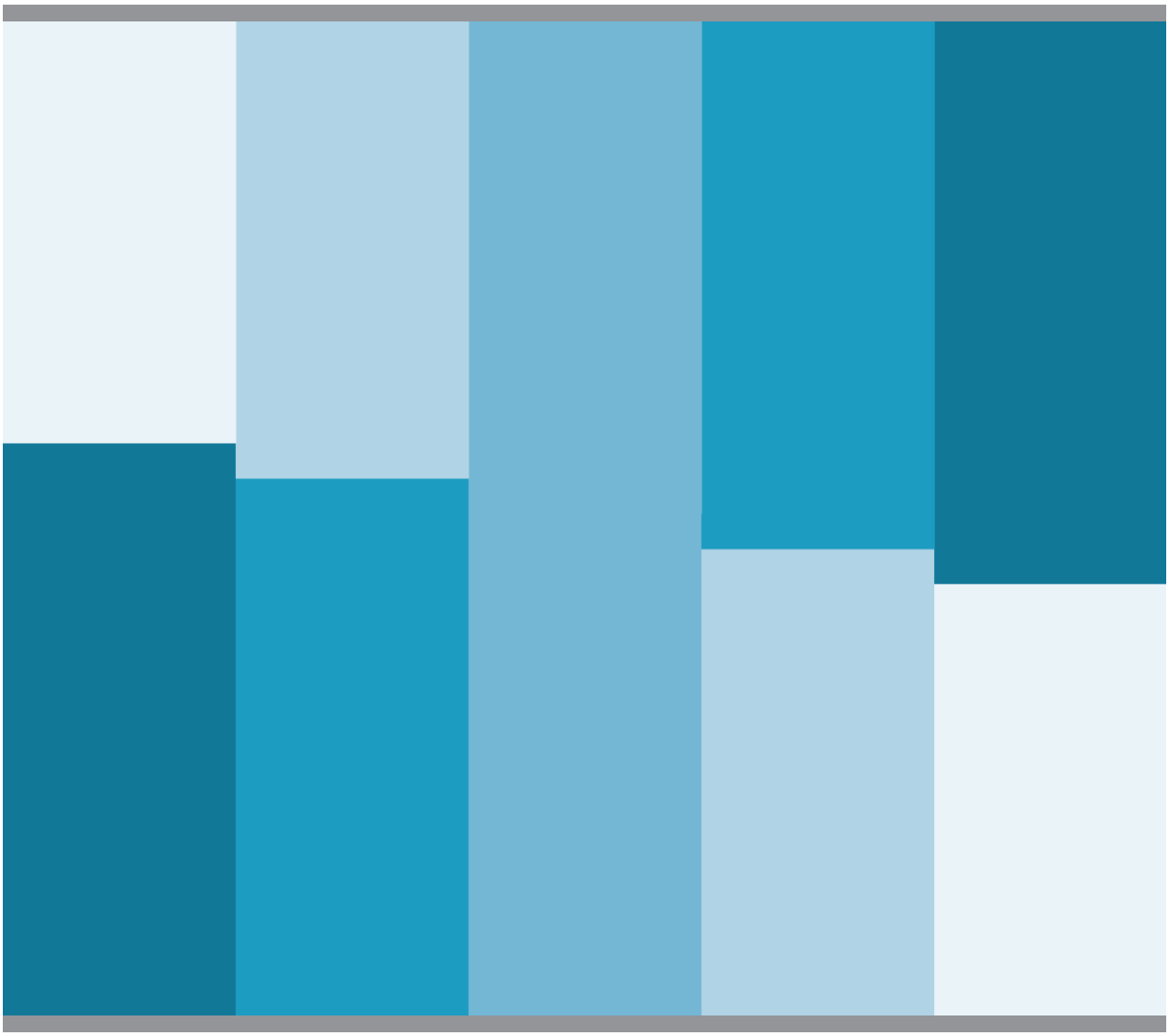

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学术争鸣

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学术争鸣于2009年元月1日在美国纽约马斯兰德出版社发刊，主要目标为提供科学家与工程师及社会工作者学术辩论的发表园地，专业领域包含哲学、科学、技术、宇宙学、数学、物理、化学、生物学、医学、土木、电机、化工、机械工程，等，编辑群将以最专业客观的立场为所有投稿作者服务。

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对“人性”的一些看法

张 洞 生 **Email: zhangds12@hotmail.com** **3/15/2010**

1957 年毕业于北京航空学院，即现在的北京航天航空大学

【前言】。人性太复杂了，没有人能够完全对此讲清楚说明白，因为人类的智慧可能永远也不能达到完全认识人类本身。甚至任何一个个人的人性都不可能被完全彻底地为他人所了解。但这并不妨碍人们从对人性不完整的认识中理解人性的某些重要的本质和规律。古人说：“人心之不同，如其面焉”。这里的人心可以理解为人性。就是说，每个人都有脸面，这是共性，但是每个人的面貌又不一样，这是个性。有多少个人，就有多少张不同的面孔。人性也一样，既有共性，也有个性。比如，“食色，性也”。食色是人的共性，而喜恶什么样的“食”和“色”,就是各人的个性，可以大不相同。**每个人都有爱恨，但是每个人所产生的爱恨的缘由、对象、程度都不相同。**所以毛泽东说：“世界上没有无缘无故的爱，也没有无缘无故的恨”。同样是“怒发冲冠”，吴三桂是为红颜，岳飞是为要“待从头、收拾旧山河，朝天阙”。**甚至一个人的“怒”也会因为缘由、对象、时间环境的不同而产生不同性质、不同形式、不同程度的“怒”。本文的重点在于 1*。**将一个人思想动机的“善恶”与其所达到对社会效果的利害程度联系起来看，**将人性分解和区分为 8 种独立的原始类型。当动机与效果不一致时，和八卦图一样，由 8 种原始类型可组合成 8×8 = 64 种叠加型。2*。**从人性的角度看人类社会的发展，阐明私有制和公有制、资本主义和社会主义都是合乎人性中不同的 2 个主要方面的需要的。只有合乎人性发展所需要的社会经济制度才能存在和发展，而那些不合乎人性发展所需要的社会经济制度将会被历史淘汰。**所以人类社会的发展进程和人性的发展进程是一致的。3*。提出了有关人性的几个规律。[Academia Arena, 2010;2(6):1-9] (ISSN 1553-992X).**

【关键词】：人性；人性的 8 种原始类型；人性和欲望的两重性；私有制和公有制、资本主义和社会主义符合人性不同方面的需要；人性的一些规律；人性的 64 种原型与中国古代 64 卦极其类似；

【一】。什么是人性？按照人的“善恶”动机和其行为对社会的利害效果来看，可将人性分解为 8种原始类型。人的个性与共性。人的思想动机和行为效果是对立统一的。

《1》。人性就是人的本质属性，先天人性来自遗传，后天人性是人在外界条件作用下结合先天人性而形成的人的思想行为的相对稳定的习性。故而本性，并非是一直停留在“人之初，性本善”的阶段，而是受其所处社会环境影响的。人性是从根本上决定并解释着人类行为的那些人类本性.，是人的先天和后天环境和经历相结合而形成惯性的产物，通俗的说，**人性是人的思想行为（为人处事）达到了“习惯成自然”的结果。欲望在人性中起着主导作用。**弗洛伊德：“正是为享受和快乐的欲望决定了个人的生活目标。欲望从人的出生一开始就控制了人的精神器官的活动”。每个人从一出生就有求生存和求发展的欲望，这是先天就有的。至于每个人的这种欲望后来如何发展，对自身的成败得失，对社会的影响和作用是有害还是有利，这是外因通过内因而互相作用的结果。同样，每个人一生下来就有先天的原始的“喜怒哀乐爱恨情仇”和“占有欲、任性、嫉妒、懒惰”等情感，通过成长的经历和环境的影响，与内因相结合而形成某些较稳固的本性。所有人的七情六欲都是人性的一部分。所谓**“江山易改，本性难移”，这说明人性在外界环境的强烈刺激下，是难以改变的，但不是不能改变的。**正如宇宙中任何事物都可以改变一样，人性也能改变，也会渐变、质变和突变。比如，由于“醍醐灌顶”、“茅塞顿开”所产生的人性改变就有可能是“突变”。“突变”是一个不可逆过程。**正如马克思所说的，整个历史也无非是人类本性的不断改变而已。**

《2》。人性是“善”还是“恶”是一个很古老的话题。人的先天的原始的本性本无“善恶”的问题。一个刚出生的婴儿的作为是无所谓“善恶”的。“食色，性也”。”饮食男女，人之大欲存焉”。就是说，人喜好“食色”是人的本性，也无所谓是“善”还是“恶”的，问题在于用何种手段获取“食色”，手段是“义”还是“不义”，获取“食色”的过程和结果是对他人和社会有“利”还是有“害”。因此，当一个人的思想和行为在其本性的驱使下为达到目的，而采用“义”的手段，过程和结果又对他人和社会有‘利’时，这个人的人性就可以说是‘善’的。反之，如果一个人用“不义”的手段，而“危害”他人和社会，那么，这个人的人性就可以说是“恶”的。因此，对一个人“善恶”的判断就只能根据其行为（包括手段）的社会效果来判断。但是

“动机”和“效果”是对立统一的，所谓“谋事在人，成事在天”。“手段”和“效果”也同样是对立统一的。就是说，有时候“正义的”手段，可能得到“坏的”后果，而“不义的”手段却有时可能得到“好的”结果。同时，任何“好的”结果，都会有一些“坏的”副作用。任何“坏的”结果，都会有一些“好的”副作用。正如”失败的”的结果，总有一点“收益”。这就是“祸福相倚”、“得失相随”的道理。“坏事” 之有可能变成“好事”，“好事” 之有可能变成“坏事”，就是因为事物在变化发展的过程中，由于受到外界环境不断地改变的刺激、干扰、影响和作用后，事物本身和外界环境都发生了意外变化的结果。

《3》。人性是复杂的、多方面的内禀属性。人们只能从其已暴露的外在表现来判断人性的“好坏善恶”，而无法窥透其内心的全部秘密和动机。但用什么标准来判断人性却是个大问题。比如，各宗教都有其教主和戒律可判断“好坏善恶”。当然也可将某些先圣先贤作为标准。共产党是最擅长树立“英雄、模范和样板”的。当然，还可以从人性的不同方面提出另外的许多标准或者模型。

作者在本文中是要找出一些思想行为（即为人处事）模式作为独立的原型，每个原型必须考虑在“动机和效果”对立统一的条件下，一个人的思想行为（即为人处事）模式“对己对人是利还是害”。即根据 一个人在其所形成的思想和行为方式的支配下，在实现其欲望、计划、方案的过程中，如何对待自己、别人、自己与他人之间的关系（个人与他人、群体、外界的关系），采用何种手段，对他人和社会是有“利”还是有“害”，将人“善恶”的思想行为方式和其所达到的社会效果联系起来，可将“评价人性的标准”分解为简单的 8 种原型，它们就像构成人性的 8 种不同的细胞一样。每一种原型只表明具有相同的性质，但其范围（大小、程度、级别、层次）却有着天壤之别。一个人的人性（特性）就是组成其人性中的各个方面在这 8 种原型的特定范围内的综合体，或者说对立统一体。而人性的共性就是所有人的人性中的各个方面在这 8 种原型都处在中间状态的相同的组合（集合）体，正如各原型都处在高斯正态分布曲线的中间部分一样，即中间地带。人性有多少方面，组合就有多少种。所以每个人不同的个性就是其超出中间地带的特性。而且每个人的个性在许多方面会随着时间和环境的改变而改变。可见人性是多么的复杂。所以说，人的共性就是指绝大多数人所共有的正常态。而一个人的某种（些）特性就表示该人在人性的某（些）方面超出了了正常态的结果。

在下面，为了简便，只讨论评判人性标准的 8 种原型，在这 8 种原型中，假设一个人动机的善恶和其行为效果的好坏（利损）是统一的。

第 1 种原型；利己=自利=自私（而不损人不利人），这是每个人的正常欲望，是人的本性的最基本最本能一方面，是人的进取心的动力，是推动人类社会进步发展的一种动力。人的“为己利己”欲望是其主要精神特征，即 “人性”的主要特征。为享受和快乐，每个人总是希望为获得自己所必需的生活费用作最少时间的工作，而腾出更多的时间去享受生活或去实现自己的梦想，这符合人的精神需要即“人性”。欲望是人的精神动力，它刺激着每个人为自己的生存、发展、享受和快乐幸福而行动。人作为一个个体、单身的人，为了自身的生存和发展而有保护自己和要求多劳多得是人的本性的表现，无可厚非。中国古代有位哲人杨朱，他曾说过一句至理名言：“人不为已，天诛地灭”。人最基本有效的利己思想行为是：注重安全健康、好好学习工作、保持心态平和。

第 2 种原型；利人（而不损己不利己）。爱人。乐于助人。借花献佛。 这是人类在生存和发展的长期过程中形成的必须有的互助合作精神的体现。**其最高境界也许就是“毫不利己，专门利人”，**但只有少数具有高度信仰和奉献精神的人才能作到。

第 3种原型；损己（而不损人不利人）。少数人的自暴自弃、破罐破摔、自残自杀等行为。人在失恋、失意、失业、失败后，精神受打击而灰心丧气的结果。忧郁症是其达到极点的结果。

第 4种原型；损人（而不损己不利己）。往往是由于嫉妒、仇恨所产生的使坏，报复，报仇等。这是少数人的一种极端的情况。过去所谓的“杀父之仇不共戴天”、“夺妻之恨”、“国恨家仇”等所产生的强烈的报仇行为。但人不可能总能作到害人而自己毫发无伤。欠债终究是要还的。

第 5种原型；利己利人=互利。爱人如己。这是亲情、爱情、友情等在人的生存发展中必不可少的重要精神支柱，**是人性中的中心和主体之一，是人的善的本性的另一重要方面，在人类和社会的进步发展中起着主导作用，**是人在长期的生产活动和抵抗外敌的友爱互助合作中的美好经历在思想感情里的结晶。**这种本性在人类还是动物时就储存在其 DNA 中。所有的文化和宗教都提倡“利人利己”的精神。**孔子的中心思想是“仁爱”精神、“己所不欲，勿施于人”、“爱人如己”等，它之所以永远地为绝大多数人所接受和奉行，因为它是人性中的主体和中心。**孔子和亚里士多德都大力提倡“中庸之道”，虽然两人的出发点不尽相同，但都主张，**人的性格修养也要注意平衡，不偏不激，刚柔相济，不走极端，去其两端，取其中而用之，其实质就是“人人为我。我为人人”。

西方的基督教文化，特别是最富革新精神的新教文化，推动“利他之心”（爱心，道德滥觞）与“利己之心”（私 心，进取动力）的“两心调谐”的结合，造就了一种有利于人类创造力循正道顺畅地发挥，也是产生“人人平等和人权思想”的主要来源。**总体而言，“利人利己”成为积极向上的主流，从而对人类社会的发展进步起了主导作用**。比如，在商业领域，一个企业要赢得全球性的尊敬，在企业责任、道德伦理、社会公益、造福公众等方面，都需要作出表率。美国某些商业巨头能够突破国家限制，被广泛地接受和推崇，**就在于它们体现了一种出于利己动机，但善于推己及人的公司文化。**正如福特公司的创始人老福特所提倡，伟大的企业不仅提供好的产品和服务，还应该让 身边的社会更加美好。**商业必须“流着道德的血液”**。

在利己利人方面，重要的既要看到”利人 /利己”比值的大小，还要看到”利人×利己”积值的大小，这些值也许可以作为评比一个人对社会贡献的标准。

第 6种原型；损人利己。这是人的自私本性恶性膨胀的结果。随着社会生产的发展进步，人们剩余的物质和财富愈来愈多，外界的引诱使许多人的占有欲和掠夺欲愈来愈膨胀，他们为了满足自己恶性欲望的膨胀而用合法甚至非法的手段欺骗、占有、掠夺别人和社会的财富，或者利诱霸占他人人身，而达到损人利己的目的。这就是犯过和犯罪的根源。**所以老子说：“罪莫大于可欲，祸莫大于不知足，咎莫大于欲得”**。随着社会财富的增多，人的智慧和手段更是增多，所以人变得更巧于掠夺和骗取别人和社会的财富。**老子对人性恶的一面看的很透，说：“智慧出，有大伪”。**

人性中本来就有恶的一面，也许就是基督教所说的“原恶”，即占有欲、懒惰、任性、嫉妒等。所以帕斯卡(Blaise Pascal 1623-1662，法国哲学家)曾说：**人是什么？一半是天使，一半是野兽。这是**人的欲望有两重性的根源。也许**负积值（损人×利己）**可以作为评定一个人的恶的程度的标准之一。而最小的无意的损人和小的无意的利己及其结合也许就形成了“圣人之过”吧。

第 7种原型；损己利人 =利他主义。这是人性中好的欲望发扬光大的结果，是少数人在后天的环境中修炼而成的。这是圣贤、英雄豪杰、大智大仁大勇者之所作所为。他们以利国利民、救国救民为己任。杀身成仁、舍生取义，他们的人生中有一个为终生奋斗的伟大目标。也许积值（**损己×利人**）可以作为评定一个人的“善的”程度的标准之一。

与上面的一条相反，有时一些人的好的欲望（愿望）对**社会的发展进步起到坏的效果。这就是动机和效果有时并不一致的的原因。因为动机是主观的，而效果是客观的。客观世界有其自身的发展规律，是不以个人的主观意志为转移的，而人对客观世界是难以有完整的认识和操控的。**因此，当一个人立志为社会作大事时，就应首先审时度势，要顺潮流而动。所谓对潮流“顺之者昌，逆之者亡”，就是这个道理。

第 8种原型；损己损人。即“恶有恶报”的结果。也有得失相当或者相差不多的情况，比如是杀敌 1000，自损 800的结果。在战争中，用比值“损人 /损己”评估战役中的胜败得失是一个重要的指标。也有 “少损己而多损人” 以为自己谋利或打击报复他人者。“多损己而少损人”往往能表示失败的严重程度。损己×损人的总积值可表示一个人的为害程度。

结论：人性中的“自私自利（1类型）”和“利人利己（5类型）”是人性中的 2个主要部分和方面，是推动社会进步和人性发展的主动力。

【二】。在一个人的思想动机和行动效果不一致的情况下，作者在下面提出的判断人性的标准可结合为 64 种排列方式，它们与八卦、64 卦的排列叠合方式是完全相同的。

《1》。在上节的《3》段节中，是在假设一个人动机的善恶和其行为效果的好坏（利损）是统一的条件下，得出了人性的 8 种独立的原型，并对各种原型分别给以阐述。对一个人来说，其人性的两个重要方面是：情感和理性。对成年人来说，其性格更多是受思想行为方式所支配，而较少感情用事。或者说，一个人在做较重要的事情时，是多为其理性所支配的。因此，所谓“性格决定命运”的实质，就是说，一个人的命运主要是有其性格中的理性（思想行为方式）所决定，而较少由意外的、偶然的、感情的因素所决定。

《2》。一个人的人性（≈性格≈思想行为方式）、命运与八卦的类比关系：有趣的是，如果在动机和效果不统一的情况下，就可以将上面的 8 种原型列为第 A 组，即列为动机组；另外用同样的 8 种原型列为 B 组，即列为效果组。2 组原型中各取 1 个原型排列叠加后，就可成为 8×8 = 64 种（次）原型。现在将 2 组的各 8 种原型列表如下：

A-动机组：A 1 利己;A2 利人;A3 损己；A4 损人;A5 利己利人;A6 损人利己;A7 损己利人；A8 损己损人；
B-效果组：B 1 利己;B2-利人;B3-损己；B4-损人;B5-利己利人;B6-损人利己;B7 损己利人; B8 损己损人；

可见，上面 2 组中的 8 种原型是相同的，与八卦的先天 8 卦数相同。如果先从 **A** 组中任取 1 个原型与 **B** 组中的任何一个原型相结合，**可结合成 64 种排列模式，这与后天八卦的 64 卦排列模式也完全一样，因为二者都是由 8 个独立原始叠加后排列而成。这不是巧合，是有内在关联的。这 64 种人性原型的排列方式体现了人的所有基本的性格（为人处事的态度）模式，也体现了性格的变更只有这 64 种模式。“性格决定命运”几乎已成了大多数人的共识。因此，用八卦图以根据人的思想行为方式（性格）推演其未来的命运的变更或许就有了较为合理的依据。**

从上面动机 A 组的 8 原型中取任何 1 种动机，在从动机到效果的实施过程中，由于内外因的相互作用和变化的不同，可能得出效果 B 组的 8 种原型中任何 1 个不同的效果。同样，也可以说，A 组 8 种各不相同的独立动机，每 1 种皆有可能达到 B 组同一种性质的效果。**至于在实践中能否达到（概率）、如何达到、效果的大小如何，那是另一回事。这是否就是中国古代先哲们用八卦图从人性和环境的变化来推演人的命运的重要根据呢？**比如，一个人从 A1 利己的动机出发，根据实行过程中，内外因的互相作用和变化，既可能达到 B1 利己的效果，于是可组成 A1⇒B1 模式。同样，一个人从 A1 利己的动机出发，因在实施过程中，有不同的内外因的互相作用和变化，也可能达到其它的 7 种不同的效果中的任何一种效果，比如，A1⇒B2 或 A1⇒B3 或 A1⇒B4，，，等。

在下面，举一组简便的例子加以说明和讨论。以买六合彩为例：设第 1 人化 3 元买六合彩，中了 5 元，此例为 A1B1 型；第 2 人化 3 元买六合彩，没有中，此例为 A1B3 型；第 3 人化 3 元买六合彩，中了头奖，500 万元，此例也为 A1B1 型；第 4 人化 1000 元买六合彩，中了 50 元，此例也为 A1B3 型。

结论：1*。第 1 人和第 3 人都属 A1B1 型，**同样的动机，但效果却是有天壤之别。2*。**第 2 人和第 4 人都属 A1B3 型，**动机的大小相差很大，但效果却差不多。 3*。2 件性质相同排列模式相同的事，如果不在相同的等级和层次上，或数量级相差很大的事情，是不可比拟的。所谓“窃钩者诛，窃国者侯”，**就是这个道理。**4*。无论是用八卦或者用其它的理性方法推演一个人的命运或重大事件，这些重大事件的始终是有重要的因果联系的，**在实施过程中是受重大的因素影响的。而那些日常的、众多的鸡毛蒜皮的小事影响不了一个人的命运或其重大事件的进程和因果关系。**5*。大事小事是因人而异的。**一个亿万富豪化 100 万要做的事是小事，一个中产者花 100 万要做的事可能就是有关前途和命运的大事。而对于一个底层民众来说，100 万可能比他的命还重要。**6*。一个计划或者一件事在执行过程中，动机和效果都可能会改变初衷，从原来的模式改变成完全不同的另外模式是不足为怪的。**比如，最初的 A5B5 型（**利己利人⇒利己利人**），中间通过一些模式的转变，最后变成 A8B8 型（**损己损人⇒损己损人**）是完全可能的。这些转变也许有可能符合 64 卦图的转变规律。**但作者仍然坚信“对事物的具体情况作具体分析”的原则。**而且，**即使同样是“损己损人”，“小损己大损人”和“ 大损己小损人”是有巨大差别的。**

【三】。从人性角度认识公有制和私有制各自符合人性中两个主要方面的需要的。

《 》。自从马克思提出消灭私有制以来，许多人，特别是社会底层民众，从仇富的心理出发，往往被马克思的错误理论所误导，认为私有制是万恶之源，认为只有消灭私有制，实行公（国）有制，才能实现社会的公平正义，才能实现社会和谐，才能实现世界大同。然而，前苏联东欧式、中国的毛泽东式、柬埔寨的波尔布特式、现在的北朝鲜式等各种各样的社会主义制度的彻底失败强有力的证明：**消灭私有制和实行单一的公有（国）制只能给社会和广大民众带来极大的灾乱，使社会退回到封建专制的极权社会，广大民众沦为贫困的失去自由的奴隶。**

为什么单一的公有（国）制的社会主义会失败？因为： **1*。当人们把自己所有的财产交给公有或国有时，他就同时失去了生活和工作的自由和能力，而只能任人摆布，**而掌握大量“公共”财富和资源的掌权者就可以作“利己”的分配、摆布和奴役赤贫的广大民众。 **2*。**当一个人失去财富而只能任人摆布时，他除了向上乞讨或者争夺更多一点的自由、财产和权力之外，他没有本钱、自由、能力去发挥自己的才智、理想、爱好和创造性，以为社会作更多的贡献。而正是这些好的自由竞争欲望所产生的创造力推进了社会、经济和文明的进步。**恩格斯说：“正是人的恶劣的情欲、贪欲和权势欲成了历史发展的杠杆” 。这说明即使一些恶的欲望也有可能推进社会的发展。**这就是造成所有社会主义国家消灭私有制后产生贫穷落后的根本原因。由此可见，**如果不从人性角度来认识公有制和私有制，马克思和恩格斯也只能互相矛盾。马克思是从他的理论和自己的贫困生活环境出发，推论出私有制是万恶之源，但是恩格斯从自由市场的历史发展和现实社会的实践中看到了自由资本主义的私有制具有极其强大的活力，是历史发展中的一个必须经历而不可逾越的阶段。 3*。现在人类社会已经进入知识经济时代，**个人的知识、技巧、思

想、观念等都已成为无形的私人财产，只要给予适合的条件和环境相配合，就可以转化为物质财富，而这些是无法公有的。这说明了财产或者生产资料公有（国）制的本质缺陷。

《2》。财产的私有制是合乎人性中的“个性自由”、“自由竞争”、“自由发展”的需要的。所以**自由资本主义的私有制是推动社会经济发展进步的主要力量**。所谓财产的“公有”，实际上只能由许多的“个人所有”组合而成。**一个没有“个人所有”的“公有”是假“公有”，实际上是为这些个人之外的少数别人所占有。**正如一个团体是由其中的所有个人所组成一样，如果没有组成该团体的所有个人，该团体就是一个空头团体。但人性有“两面性”或者说“两重性”，是“善”和“恶”同时并存。就是说，对每个人来说，都是如此。只不过每个人具有不同的“善”“恶”内容和不同的善/恶比而已。人无完人，金无足赤。一个人“善的发扬”和“恶的膨胀”都需要有其适合的条件和环境。因此，一个好的社会制度就应能制定出人性中所需的“善的发扬”和限制“恶的膨胀”的社会条件、环境和各种制度。所以说，好的社会政治经济制度就应能同时“反恶”和“扬善”，鼓励个人自由发展和创造，同时反对个人懒惰纵欲和犯罪。

普世价值中的“民主自由平等博爱人权”是符合人性中“个性自由发展”的需要的。所以由这些价值所产生的各种制度会随着社会的发展进步而逐步完善。而不合乎人性发展的制度会随着人性发展而为历史所淘汰。

《3》。那么，在现今的世界上，无论是“社会主义国家”，还是发达的“资本主义国家”，还是各种欠发达的或者落后国家，都存在着各种不公平正义的、不合理的、国家欺负掠夺其它国家的、少数人诈骗压迫剥削奴隶多数人等现象，其产生的根源在那里？**其根源在于社会政治经济制度尚未能限制少数掌权者和富豪们坏欲望的“恶性膨胀”，他们的权力没有得到应有的限制，他们可以利用手中的权力欺诈、掠夺、压迫他人为自己蒙利，而得不到必然的应有惩罚。**美国发动的历次对外战争都是为了军火、石油和金融集团的利益。美国 2008 年发生的大金融经济危机就是贪婪的华尔街和金融大鳄们无限制的鲸吞和掠夺国家和民众财富的结果，麦道夫（Medoff）就是其中之一。中国现在造成社会尖锐的“贫富对立”、“官民对立”和“黑（社会）民对立”就是贪腐的官员的绝对权力和国有企业高管所形成的“特殊利益集团”“无法无天”地掠夺、抢劫、出卖国家国民财产、资源和利益的结果，即“坏的人性恶性膨胀”的结果，

当自由资本主义变成垄断资本主义时，当权力被少数人或者个人操纵和垄断时，就会引起社会政治经济的巨大危机和灾乱。因此，**对“权力的垄断”和对“财富的的垄断”才是每个国家的灾乱之源。而“权力的垄断者”和“财富的的垄断者”又往往是互相勾结和互相输送利益的，是排斥和反对自由资本主义的自由和公平的竞争机制的。所以每个国家只有逐步建立有效地“反权力垄断”和“反财富垄断”的法制，才能保证其社会政治经济的稳定持续地发展，才能维持其社会的基本和谐和公正，才可能使世界免除战争的威胁。**就是说，只有把政府官员的权力“关进笼子里”和把垄断资本肆意窃取和掠夺国家和民众财富的权力也“关进笼子里”，才是每个国家稳定持续发展的根本出路。

只有社会有较公正的法治和民主制度，才能**有效地使**社会资源的分配趋向于大多数人。如果资源向少数人集中，则社会肯定专制，不同的是有些社会可能是“权力专制”，而有些社会可能是“资本专制”，**或者**“权力专制”**和**“资本专制”**同时并存并互相勾结。而将“权力垄断”和“财富垄断”完全有效地关进笼子里，是一个长期的历史任务，因为除了法律制度外，还需各种外界的监督，还需社会有很高的道德水平。 关键问题在于，法律几乎都是由“权力垄断者”和“财富垄断者”操纵制定的，是为他们的利益服务的，要使法律分他们的权力和为广大的普通民众的利益服务，只有广大的普通民众进过长期的历史斗争才能逐渐地得到。**

《4》。人性有友爱互助合作团结的美好的一面，即利人利己的互利互爱的一面。这种本性在人类还是动物时就储存在 DNA 中。随着人类社会的进步发展，社会分工愈细，这种好的本性就会愈发展。如果人人要求自由竞争、自由发展是人性固有的个性的话，那么，“**友爱互助合作团结”就是人性中的共性。因此，人性中的“自由发展”和“互助合作”二者在人性中的共存就是一个铜板的两面，是相辅相成的。**可见，随着社会经济的发展，政府应该从其财政收入、公有财产、公有资金和基金中提供全体国民所需的愈来愈多的社会福利保障，**即提供每个国民生老病死、教育、住房、工作的基本保障。这也是合乎人性的共性所需要的。**因此，财产的“私有制”和“公有制”都是合乎人性的需要的，是相辅相成的矛盾统一体。问题在于，各个国家应该根据其生产力的发展水平和国情使二者有不同的内容、比例和适当的配合。

《5》。可见，人性一方面是要求人人有基本的平等权利（互利），同时另一面又要求能自由发展（自利）。事实上几乎人人都有梦想，都想创造奇迹，都想追求个人幸福，社会的发展进步需要使每个人能有创造奇迹的机会和环境。在社会经济和文明有高度发展的现今世界，一个靠高压长久地剥夺个人基本权利、压制多数人的个性发展要求、和让少数

人拥有绝对权力的社会制度是不可能长久的维持下去的。

《6》。“两心调谐”（私心公心，利己利人）型心态文化（价值观）结合“权力制衡”型社会政治制度，造成一种十分有利于人类天赋灵性创造能力循正道顺畅发挥的大环境。由此孕育、焕发的强大创新和研发能力是保持经济和社会可持续发展的基础，是提升国家和企业竞争力的关键要素。

【四】。现今和未来社会中的“资本主义成分”和“社会主义成分”都是合乎人性发展的需要的，是社会稳定持续发展的两条腿。

《1》。发展资本主义是合乎人性中的个性自由发展需求的，马克思主义的最高命题或根本命题，是“一切人自由而全面的发展”。人性中的个性自由发展，竞争性，独创性，自我表现性都是人性中个性的必然表现和需要。**自由资本主义的自由市场的竞争机制符合人性的个性自由发展的需要。**资本主义是发展中国家由农业国到工业化发展中必须经历的不可跳过的历史阶段，是人性中自由竞争充分发挥的阶段。前苏联和东欧共产党的垮台和中国越南等国的转型的社会历史经验明确地证明，跨越资本主义阶段而直接进入无产阶级专政的‘社会主义’是必然会失败的，**因为压制了个人的自由竞争，就无法高速的发展社会的生产力，也就无法消除工农，城乡和地区 3 大差别，会成为一种畸形的落后的半死不活的‘社会主义’的早产婴儿，其社会活动力的效果竞争不过的资本主义，它们如果不转型，就只能解体消亡。所以邓小平说：“不改革开放，就只有死路一条”。**因此，这些国家必须打破单一的社会主义，重新回头填补发展‘资本主义’这个历史阶段的空缺。

但是资本主义的发展也有恶性膨胀的一面，它导致人性的恶性膨胀。马克思说：**“资本来到这个世上，每个毛孔都滴着血”。**人性都有两重性---奉献和索取，善与恶。所以人性中既有发展个人才智的冲动，又有占有欲、贪欲、自私、懒惰、嫉诟的恶性膨胀的一面，同时又有合作互助互爱的一面。**而社会主义所要求的公平，公正，平等同样是人性中不可缺少的另一面，这同样也是人性中的互助合作共存繁殖后代的共同需要所决定的。是人性中共性所要求的。**

社会生产力和经济愈发达，社会愈进步，人们的个性自由发展的空间愈大，但社会的分工也就愈细。这反过来又要求人们彼此之间的互助合作愈紧密。所以，**社会的发展进步必须使人们能同时发展自己人性中的共性和个性。**因此，**资本主义和社会主义都是人性发展所需求的一个铜板的两面，是相反相成和相辅相成的。可见，资本主义在发展后走向社会主义社会是符合人性的“个性”发展后要求“共性”发展的必然结果。**所以，现在发展中国家在发展资本主义的同时，应该根据自身的条件适当的发展一些社会主义成分，减少贫富的对立，增加彼此之间的互相依存和合作，使社会经济能在较稳定的状态下持续发展。由此可见，**在现代的每一个国家中，发展资本主义和社会主义不是对立的，不是谁战胜谁的问题，而是二者如何互补才能保证社会经济的持续稳定地发展。**西方媒体现在炒作资本主义和社会主义的势不两立是在为其幕后的垄断集团谋取利益。

即使发达国家的“后资本主义社会”经过发展和克服能源危机、金融经济危机、道德危机和战争危机等转入“社会主义社会”后，仍然需要“社会主义成分经济”和“资本主义成分经济”同时发展，[2]因为这符合人性的“自利”和“互利”需同时发展的需要。

《2》。社会文明随着生产力水平的的提高一定会符合人性的发展，即人类社会随着社会生产力的不断地提高，必然会使得每个人所需的私产（生活物质资料），知识和自由愈来愈多，个性自由发展愈来愈大。这就是马克思和恩格斯反复强调的由‘必然王国走向自由王国’的过程。

《3》。在资本主义经济高度发展到现代化的同时，必然会使每个国家的全体国民的生活物质和文化教育水平逐步提高，使国家公有财产和社会福利不断增高，即社会主义成分的增加，资本主义经济的现代化就逐步产生了**以普世价值观为核心内容的政治现代化，**即实行法制，人权，民主，平等，自由，博爱等。**这些普世价值正是资本主义国家经济的高度发展所带来的的政治现代化。经济和政治的现代化又会促进了人性的个性和共性的共同发展，使人性的发展趋向更加的完美，更多的真善美。**反过来，人性趋向更加的完美会激发个人在其事业中发挥更大的积极性和创造性，为社会作更多的贡献，从而推动社会各方面更好的进步发展。在过去现在和未来社会里的这种良性循环，就是人类社会政治经济和文明由低级向高级的发展的过程和历史。

《4》。普世价值包含着更多的是社会主义价值观，即实现社会的公平和正义，而这是专制独裁政权所反对的，也是垄断资本主义集团所被迫或拒绝接受的。现在**极力反对普世价值的是西方垄断资本主义集团首脑和中国的权贵（垄断）资本主义集团首脑及其代理人。因此，世界各国的共同任务就是一起反对其本国和世界各国的垄断集团及其首脑。**

【五】 人类社会的发展和人类欲望的膨胀；人的欲望和现实生活条件的差距（矛盾）是推动社会发展的动力

《1》。欲望是人性的重要组成部分。为揭露宇宙和自然界的秘密，为了探求科学真理，总是刺激着许多学者终生为发明和运用新科技而奋斗。其中，新动力(能源)和动力装置的发明和利用为推动人类社会的进步作了重大的贡献。正是社会生产的主要动力(形态)的质变最终决定了社会生产关系和社会经济形态的质的改变。[1][2] 这是人类“善的欲望”所产生的推动社会进步的必然结果.。但是，好人也会犯错误，好心也可能办坏事，这是人不能正确认识和运用客观规律和情况所造成的。

但是人类欲望本身就是双面刃，它也有坏的一面，即“恶性膨胀”。一方面，人的某些“坏的欲望”的“恶性膨胀”已随着社会的发展而向坏的方面更快的发展，它导致国家之间的冲突和战争，人与人之间的争权夺利，宗教种族间的冲突，自然环境的污染和毁坏等等。同时，过度的个人自由导致了大量的个人犯罪和纵欲、欺诈、惯窃、吸毒等。愈来愈多的社会福利也阻碍了社会经济的发展。但是，另一方面，人的某些“坏的欲望”的“恶性膨胀”也可能对社会的发展进步起推动作用。恩格斯说：“正是人的恶劣的情欲，贪欲和权势欲成了历史发展的杠杆”。可见，人的一些恶劣的欲望还可能对社会的发展进步起到好的效果。动机和效果之所以能产生背离，是因为从动机到效果之间有一个实施过程和距离，由于各种外界因素在此过程中的影响和作用，造成了动机和效果的背离。

《2》。正是人的“欲望”和“现实生活条件”这对矛盾（差距）推动着人类社会的发展和进步.

虽然科学技术的发展进步改变了社会生产力的主要动力形态，从而改变了人类社会的生产方式，极大地提高了人类社会生产力的水平，使人类社会由原始社会进步转变为奴隶社会、封建社会，并使现今世界各国分别走向“前资本主义社会”和“后资本主义社会”，[1][2] 这就使人类对物质和精神生活的欲望得到了很大的满足。然而，现实的生活条件与人的欲望的差距又不可能被消除，甚至只要人类存在就很难被缩短。反而是随着社会生产力的发展使这种差距不断扩大，**因为人类现实生活条件的改善和提高远不及人类的欲望的膨胀来得快。但正是人的“欲望”和“现实生活条件”这对矛盾和差距推动着人类社会的继续发展和进步**.

许多西方的学者曾经认定人们已经变为先进科学技术的奴隶。我认为，,纵然有大量的现代社会的人已经变为个人欲望“恶性膨胀”的奴隶，如权力、金钱、毒品、赌博、性等等，**但是科学技术永远是人类力量和智慧的源泉，而且总是在超越阻力而推动人类社会的前进**。虽然人类用先进的科学技术制造出来了能毁灭人类的核武器，但人类文明的发展，定会使人类不可能毁灭于自己制造出来的核武器。人类总会在未来能够利用制造核武器的技术为自己服务，使社会生产力的水平大大的提高，从而使现在的“资本主义社会”转变为更高级的“社会主义社会”。[2]

《3》。自由资本主义一方面使人的个性发展和创造力得到了充分的发挥，同时也使人类的欲望“恶性膨胀”，已成为打开的潘朵拉魔盒，而难以被控制，当自由资本主义发展成为垄断资本主义时，必然会造成不断的金融经济危机，而危害社会和广大民众。特别是那些发达国家的某些政府首脑和垄断财团的权、利、名欲望的恶性膨胀，对人类危害最大。因此，只有通过广大民众持续不断的斗争，用公正有效的法治和民主制度逐渐反对对“权力”和“金钱”的垄断，将政府首脑的“权力”和垄断集团首脑的“权力”都锁进笼子里，[2] 才是正途。

《4》、简而言之，西方文明的核心是重“利”轻“义”。而东方文明(中国文明)的核心是重“义”轻“利”。[3] 人类社会发展到今天，人们的生活物资已相当充分，但还不能对社会财富和资源进行更公平合理的分配。因此，只有**一方面使社会有公正有效的法治和民主制度，去除对权力和财产的垄断，同时也使大多数人有正确的价值观**，即使全社会的人的价值观产生大的转变，从重“利”轻“义”转变为重“义”轻“利”，使东西方文明的“义利”有效地结合起来，只有这样，才可能**使大多数富者作到“无骄”而“有礼”，也就无法垄断而守法，使社会中的贫弱者能过有尊严的生活，使社会中大多数中产者有合适的发挥其智慧、才能、创造力的环境和机会。也只有这样，人类社会才会转变为更高级更文明的社会，人性才能得到更完美的发展。这也许就是未来人类社会的“社会主义社会”和“世界大同”吧**.

【六】。绝对的权力产生绝对的腐败是铁律。逐步建立有效的制度反对对“权力”和对“财富”的垄断是人类社会文明进步的标志。

《1》。人性和人的欲望都有两重性，或者说，有两面性。“性善”或“性恶”是一个很古老的话题。每个人都是善和恶的矛盾统一体，每个人的善/恶比相差是很大的，其善恶的内容和分量也不一样。对一个人来说，其善/恶比也不固定，会随环境和经历的改变而会改变。人类社会经济、文化艺术、科学技术、互助合作的发展进步是人性中善的发扬。个人犯罪、损人利己、贪赃枉法、腐败堕落、发动战争等是人性中“恶的欲望”的膨胀。**所以老子说：“罪莫大于可欲，祸莫大于不知足，咎莫大于欲得”**。然而，可悲的是，随着社会经济科技文明的发展，到现在为止，人类总的善恶比却在下降，即善/恶的比值在减小。这就是悖论。为什么？因为随着社会经济的发展，财富增加了，人与人之间的合

作关系和环境变得更紧密复杂，但人的智慧和手段更加增多，所以人变得更易于巧取豪夺地掠夺和骗取别人和社会的财富。老子对人性的“恶”看的很透，而深感悲观，主张：“**绝圣弃智**”。

一个人作好事做多了会上瘾。同样，一个人作坏事做多了也会上瘾。这就**人性的第一定律：惯性定律**。人做好事做得越多，劲头越大，越作越想作，科学家、艺术家、工程师、医生均如是。人作坏事也一样，从小偷（贪）到大偷（贪），**恶习难改，**偷窃成癖，欺骗成性，赌博成瘾等，恶欲越来越大，手段愈来愈多、劲头也愈来愈大，**绝不会满足和难以自律**，看看那些被揭发出来的贪官污吏们，有谁是已经满足了的呢？**他们都是不撞南墙不回头、不见棺材不落泪的**。

《2》。美国华尔街的大鳄们不同样贪婪成性吗？现代高科技的互联网使华尔街的大鳄们坐在办公室敲敲打打键盘就能诈骗到亿万财富。这符合是**人性的第二定律：加速定律。老子：“智慧出，有大伪”。**贪得越多，动力越大，诡计越多，无利不早起。人生的过程是由一连串的循环或者震荡构成的。作善事和作坏事有类似的规律，在一个人连连作好事时，如果都**适时地**得到鼓励、奖赏或赞助，他就会越作越好，越做越多越大，这就是人性对外界环境的**共振效应**。相反，在一个人连连作好事时，如果都**适时地**得到打击、奚落、失助，他就可能灰心不干了，这就是**阻尼效应**。同样，如果一个人连连做坏事没有得到外界给予的应有惩罚，而是一路禄灯，他作坏事的欲望就会愈来愈高，胆子就会越来越大，手段愈来愈多，对别人和社会的危害就会愈来愈大。**这就是人性的第三定律：共振定律**，即一个人的人性会受强大外力的刺激或干扰而可能会有所改变，**或产生倍加效应，或产生倍减效应**。

由上所述，可以得出有关中国反贪腐的以下简单结论：

第一；贪腐是人性中恶的一面，是在其有利条件下（制度和环境）恶性膨胀的结果。任何制度，不管是民主制度，还是独裁制度，都不可能完全杜绝欺骗贪腐，而只能减少，并使其危害降低。有效的反贪和监督制度可大大的减少贪腐，坏制度和坏环境则助长贪腐。

第二；中国的普遍严重的官员贪腐根源于“党大于法”，而形成“权大于法”和“官员有权无责，百姓有责无权”。绝对的权力造成了绝对的腐败是铁律。简单的说，只有有效地分权和削权，才能建立广泛有效地监督。而且只有上梁正了，下梁才难歪。

第三；中国现在普遍的情况是：官员普遍严重的贪腐、公检法基本腐烂、黑社会在各地猖獗，在这种情况下，有效反贪的第一步只能学重庆的薄熙来一样，在高层坚决反贪的领导下，从“打黑除恶反贪”开始。反贪既要看到产生贪官污吏的环境和其发财的源头，也要看到他们赃财的出处。现在，中国(80~90)%贪腐都与房地产有关，90%以上的贪官都包二（多）奶、情人、小蜜。N 座房产是他们包养 N 奶的必要条件。因此，1*。征收房地产税是暴露贪官受贿的最有效的措施。2*。应该制定条例，重赏揭发检举贪官的二（多）奶、情人、小蜜们，因为她们除少数是共犯外，多数是受害者。重赏之下，必有勇妇”。这可能是一条有效地反贪措施。由于人的恶性欲望（贪欲）具有普遍性，我们不应把贪欲作为腐败必然产生的根源，主要的是应找出让贪欲得以恶性膨胀的制度性根源，这样才能制定出有效地反对腐败的制度和环境。贪官们贪得越多，冲破制度约束的欲望和能量也越大，办法也越多，对社会和民众的危害也越大。靠道德和高薪养廉是无法制止贪腐者的继续贪腐的。

【七】。几点简单的结论：

《1》。人性中的先天属性是人的自然属性，其中“自私”和“欲望”是与生俱来的本性。“食色，性也”，说明“食色”是人的最基本的欲望。人有欲望并不是坏事。欲望是推动人类社会进步发展的重要动力之一。甚至一些坏的欲望，比如贪欲、情欲、权力欲等也可能会成了历史发展的杠杆。“善的动机”不必然会得出“好的效果”，也有可能得出“坏的效果”，因为动机和效果是对立统一的。当然，许多人通过后天的修炼和耳濡目染的熏陶，可能变得“大公无私”、“损己利人”的超脱，这是人的后天修炼成的属性。

《2》。大多数人具有“利己利人”的本性，这是人性的主体和中心的重要的一面，是亲情、爱情、友情等是在人的生存发展中必不可少的重要精神支柱，是人的本性的另一重要的方面，是人在长期的生产活动和抵抗外敌的友爱互助合作中的美好经历在思想感情里的结晶。**这种本性在人类还是动物时就储存在其 DNA 中，并随着人类社会和文明的进步发展而逐渐进步。**

《3》、人的性情和欲望有“善”和“恶”的两重性。人无完人，金无足赤。在善与恶之间， 有一个绝大多数人所共有的小善小恶、不善不恶、善中无大恶的中性地带，即正态曲线的中间部分，那就是人的共性，即所谓人之常情。而能够明显地显示出的**“善”和“恶”的特性则是处在**中性地带的两边外侧，或者说处在正态曲线的两端。所以，一个人的“好坏”、“美丑”、“善恶”、“爱恨”、“哀乐”等等矛盾都统一在其相对应的“中间体”，或者说“中间地带”的两端上。比如说，一个人不能时时事事都在为“善”或者为“恶”，他在大多数的时间和地点是处在既“不为善”也“不为恶”或者“小善”

“小恶”的中间状态。

《4》。 “自私”和“利己利人”是人性中相辅相成的两个基本面，两方面合起来形成了“人之常情”，构成人性的主体和中心，促进了社会经济文明的发展进步。反过来，社会经济文明的发展进步又促进了人性在这 2 方面的协调地进步发展。这种良性循环促使人性和社会文明向真、善、美的方向不断提升。

《5》。因此，私有制、资本主义、市场经济等是符合人性中的自私自利、个性发展、自由发展等方面的需要的。而公有制、社会主义、和公正人权民主等具有普世价值的法治民主制度是合乎人性中的互助合作、平等互利等方面的需要的，即合乎人性中“利己利人”的“共性”所需要的。因此，只有从人性的多方面的同时同样的需要来看资本主义、社会主义、法治民主等制度，就可清楚地了解这些制度的进步发展与人性的进步发展是一致的，是合乎人性的进步发展的方向的，而那些不合乎人性进步发展的制度，必然会由于社会文明和人性的进步发展而必定被历史所淘汰，因为这样的制度为大多数人所厌恶，就是通常所说的“不合人性”。所以人类社会的发展进步和人性的发展进步是一致的。所以马克思说：“整个历史也无非是人类本性的不断改变而已”。

《6》。实际上，从人类开始有人与人之间的斗争的奴隶社会开始，人与人间的斗争就是“争权”与“分权”、“争财”与“分财”的斗争，经过 3000 年的斗争，到今天尚未有结果，斗争还在继续。这就是人类社会的全部真实历史。

在阻碍社会发展和人性发展的过程中，最主要的是来自对“权力的垄断”和对“财富的垄断”，这是人性中恶的方面“恶性膨胀”的结果。人类社会发展的今天，在不同的国家，还有严重尖锐的“阶级对立”、“官民对立”、“贫富对立”和国家间的战争，都是由于没有建立起有效的制度打破对“权力的垄断”和对“财富的垄断”的结果。因此，反对本国和外国的这 2种垄断是各国广大民众的共同责任。如果未来的世界各国，都无“权力垄断”和“ 财富垄断”的个人、家族和集团，人人都可以在平等的基础上自由发展，又可以得到公平的财富分配，人性就会发展到更加完美，这种社会也许就接近于“大同世界”和“和谐世界”了，即未来的“社会主义社会”了。

3/15/2010

====全文完====

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Some Views On The Questions Of Human Nature

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【Abstract】: Human nature is the most complex problem, even a personal human nature can't be clearly and completely understood by anybody. In this article, the focal points are: 1*. To resolve human nature into 8 original types. 2*. To expound that the private ownership and the public ownership of property、capitalism and socialism are all accordant with the different needs of human nature; and that the historical development of Human is accordant with the change of human nature. 3*. To advance some lows of human nature.

【Key words】: human nature; 8 original types of human nature; desires in human nature; the private ownership of property 、 the public ownership of property、capitalism、socialism and the different needs of human nature; some laws of human nature; 8 original types of human nature and the ancient 8 Gua of China;

DOES ENERGY AND IMPULSE ARE INTER CONVERTABLE

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Abstract : The new mathemathematical model allows us to calculate energy stored in particle as the function of impulse applied on it.It is shown that the impulse and energy are interconvertable.The paper also describes impulse is indirect measure of energy and relativistic variation of mass with position.th mathematical expressions was developed based on wave theory, classical mechanics, atomic physics and mathematical concepts [Academia Arena, 2010;2(6):10-13] (ISSN 1553-992X).

Key words : Energy, Impulse, Photon,Wave theory.....

Consider a photon of relativistic mass **'m'** moving with speed **'c'** is associated with the wavelength **'λ'** is given by the relation ***λ=h/mc,*** Where ***h=planck's constant (6.625*10^-34 JS).***

According to **wave theory,** speed of the photon wave is given by **c = λ /T**, where **T**= time period.

By substitution of value of **'c'** in the equation **λ = h/mc,** we get the expression **m λ^2 = hT.**

According to **wave theory,** as frequency of photon wave is given by **f=1/T.**

Then the equation **m λ^ 2 = hT** becomes **f=h/mλ^2**

De Broglie wavelength associated with the photon is given by **λ= h/p,**

thus the equation **f=h/mλ^2** becomes **f=p/mλ.**

Angular frequency associated with the photon is given by **ω= 2 πf.**

By putting the value of **f=p/mλ.** in the above equation we get **ω= 2 πp/mλ.**

The above equation **ω= 2 πp/mλ.** can be applied to both photons and material particles like electron in motion. Debroglie wavelength associated with the electron is given by **λ=h/mv**

Where v=velocity of electron in motion

Then the equation **ω= 2 πp/mλ** becomes **ω= 2 πpmv/mh** i.e **ω= 2 πpv/h.**

Part : 2

Consider a electron of mass **"m_e"** at rest, total energy associated with the electron is given by **"m_e c^2".** Suppose radiation of energy **hf** is incident on this electron at rest. Part of energy **hf"** is absorbed by electron and part of

energy **hf'** is scattered by electron . Absorbed energy **hf"** is converted to motion of electron, hence electron travels a distance **'x'** in time **'t'.** let **θ** is the scattering angle.

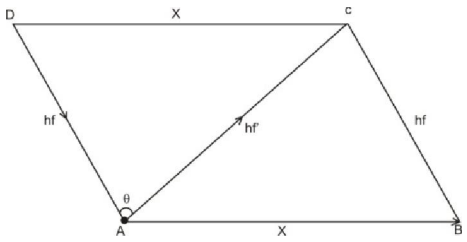

Figure :1 –schematic diagram of scattering of energy of photon by electron

x= Linear displacement of electron

hf = Energy of incident radiation

hf' = Energy of scattered radiation

θ = scattering angle

Consider a parallelogram ABCD constructed as shown in the figure 1.

Let AB=CD=x, AD=BC=hf, AC=hf'(opposite sides in parallelogram are equal)

Law of cosine is given by **a^2=b^2+c^2-2bc cos θ.** Let a = x, b=hf, c=hf', cos A = cosθ.

By applying the law of cosine to the triangle ADC, we get

X^2=(hf)^2+(hf')2-2(hf)(hf') cos θ = 1

By law of conservation of momentum of photon.

We get $\vec{p}_y = \vec{p}_{y''} + \vec{p}_{y'}$ where $\vec{p}_y, \vec{p}_{y''}, \vec{p}_{y'}$ be the momentum of incident, absorbed and scattered photon respectively.

Let us assume absorbed momentum of photon = momentem of electron

i.e. $\vec{p}_{y''} = \vec{p}$

Thus $\vec{p}_y = \vec{p} + \vec{p}_{y'}$ where $\vec{p}$ = momentum of electron

$\vec{p} = \vec{p}_y - \vec{p}_{y'}$ Squaring on the both sides we get

P^2= $\left(\vec{p}_y - \vec{p}_{y'}\right)$^2, as (a-b)^2=a^2+b^2-2ab

Thus the above equation becomes **p ^2=p_y ^2+$p_{y'}$ ^2-2** $|\vec{p}_y \cdot \vec{p}_{y'}|$

According to dot product rule $|\vec{a} \bullet \vec{b}|$= **|a||b|cosθ**

Then we get **p^2= p_y ^2+ $p_{y'}$ ^ 2-2| p_y | | $p_{y'}$ | cos θ**

Let us multiply the above equation by **c ^ 2**we get

Where **c** = speed of light in vaccum **(3* 10 ^ 8 m/s)**

P ^2 c ^2 = p_y ^ 2c ^2 +$p_{y'}$ c^2-2| p_y | | $p_{y'}$ |c^2 cos θ

As we know frequency of photon is directly proportional to it's momentum

i.e **hf = pc** thus the below equation is obtained

p ^2 c ^ 2= =(hf)^2+(hf')2-2(hf)(hf')cos θ = 2

By comparison of 1 and 2 we get **x ^ 2 = p ^2 c^ 2**

i.e **x = pc** (position of electron is defined as the function of it's momentum)

As told earlier position of electron is defined as a function of it's momentum i.e **x = pc**

Small change in momentum of electron causes small change in it's position **i.e. dx = dpc** hence,

dp = dx/c

Newton second law of motion is mathematically represented by equation **F=dp/dt**

Where **F =** force exerted by photon

dp = Small change in momentum of electron with respect to time

As dp = dx/c then the above equation becomes **F= dx/dtc.**

as velocity of electron is defined as **v = dx/dt.**

Then **F =v/c** is obtained

Force exerted by photon is defined as function of velocity of electron

As impulse exerted by photon is mathematically given by **I = F dt.**

then the equation **F= dx/dtc** becomes **Fdt = dx/c**

i.e I =dx/c

Impulse exerted by photon is defined as function of change in position of electron
At point A and B mass of electron is m_ei.e total energy assosiated with electron is m_ec^2. (as electron is at rest at

point Aand B)
But in between point A and B mass of electron is mc^2 (since electron is in motion in between point A and B)
Hence total energy of electron in motion is mathematically given by **E= m_ec^2+hf'**
(As absorbed energy adds up to rest mass energy) where E= total energy of electron in motion
hf'=absorbed energy of photon
m_ec^2=rest mass energy of electron
As absorbed momentum of photon equals the momentum of electron i.e $p_{y''}$**= p**
As **x=pc** (position of electron is defined as the function of it's momentum) then x= $p_{y'}$c
$p_{y'}$**c=hf'**then **x=hf'** then the equation **E= m_ec^2+hf'** becomes equation **E= m_ec^2+x=3**
According to Einstein equation **E= m_ec^2+E_k=4**
By camparison of 3and 4 we get E_k **= x** i.e kinetic energy of electron = position of electron
Small change in kinetic energy of electron causes small change in it's position i.e **d E_k = dx** i.e **I =dx/c**
i.e **I= d E_k/c** i.e **d E_k=Ic**
According to **<u>workenergy theorm</u>**
Work done on particle equals change in kinetic energyof particle **i.e W= d E_k** i.e **W= Ic**
Work done on particle involves storage of energy in particle i.e **W=E_a** where E_a= Energystored in particle.
E_a =Ic ,energy stored in particle is defined as a function of impulse applied
Thus $E_a \propto I$ (as c is constant) i.e impulse and energy are interconvertable.

2) <u>Proof for Einstein predicted formula</u> E=tc

As **x = pc** (position of electron is defined as the function of it's momentum)

As momentum of electron can be given by **p=mv** then the equation **x = pc** becomes **x=mvc i.e x/v=mc**
According to newton **v=x/t i**.e equation **x/v=mc** becomes **t=mc**
According to Einstein **E=mc^2** hence **E=mcc** becomes **E=tc**

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4/1/2010

The volume of matter and dark energy dominated universe

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Abstract: The new mathematical model allows us to calculate the volume of infinite universe which varies with respect to time (t).It is shown that the mathematical equation for calculation of volume of infinite universe which varies with respect to time (t) accounts for scale factor of universe (a (t)),vacuum energy density, density parameter of present dark energy and matter dominated universe, density parameter of present dark energy dominated universe. The mathematical expressions was developed based on the cosmological concepts. Radius of Hubble sphere, vacuum energy density, critical density of universe and cosmological constant are brought togather in one frame of reference to explain the phenomenon of rate of expansion of universe. [Academia Arena, 2010;2(6):14-18] (ISSN 1553-992X).

Key words: Density parameter of universe, Scale factor of universe, vacuum energy density, critical density of universe, volume of universe

The Universe comprises everything we perceive to physically exist, the entirety of space and time, all forms of matter and energy. However, the term Universe may be used in slightly different contextual senses, denoting such concepts as the cosmos, the world, or Nature. Recent observations indicate that this expansion is accelerating because of dark energy, and that most of the matter in the Universe may be in a form which cannot be detected by present instruments, and so is not accounted for in the present models of the universe; this has been named dark matter. The universe is not expanding into anything, almost by definition; there is simply more space at later times than at earlier times. It may be that the size of the universe is infinite, which is easy to conceptualize.Even if the universe is finite, it is possible to make more space without having any "outside" space. It is believed the that the Universe has expanded from a primordial hot and dense initial condition at some finite time in the past .

Figure-1: Matter and dark energy dominated universe

Let us consider matter dominated universe.Mass density of matter dominated universe varies with respect to time (**t**)due to the cause of expansion of universe.If the universe is matter-dominated, then the mass density of the universe(**ρ)** can just be taken to include matter so

$$\rho_m = \rho_{m0} / a^3 \quad \text{.....(1)}$$

Here ρ_m =Mass density of universe which vary with respect to time(**t**) i.e $\rho_{m(t)}$, ρ_{m0} =Present mass density of universe ,**a**=Scale factor of universe(which is the function of time) i.e **a(t)**.

Density parameter of present matter dominated universe is given by

$$\Omega_m = \rho_{m0} / \rho_c \quad \text{.....(2)}$$

Here ρ_c=Critical density of present matter dominated universe
Thus (1) becomes

$$\rho_m = \Omega_m \rho_c / a^3 \quad \text{.....(3)}$$

The critical density is the watershed between an expanding and a contracting Universe**.**

Critical density of matter dominated universe is given by

$$\rho_c = 3H_o^2 / 8 \pi G \quad \text{.....(4)}$$

Here H_o= Present hubble parameter (it indicates rate of expansion of universe),**G**=Universal gravitational constant .

Thus (3) becomes

$$\rho_m = \Omega_m 3H_o^2 / 8 \pi G\, a^3 \quad \text{.....(5)}$$

By multiplying the equation (5) by C^2

Here **C**= Speed of light in vaccum**($3*10^8$m/s)**

We get

$$\rho_m C^2 = \Omega_m 3H_o^2\, C^2 / 8 \pi G\, a^3 \quad \text{.....(6)}$$

Vacuum energy is an underlying background energy that exists in space even when devoid of matter (known as free space). The vacuum energy is deduced from the concept of virtual particles, which are themselves derived from the energy-time uncertainty principle. Its effects can be observed in various phenomena (such as spontaneous emission, the Casimir effect, the van der Waals bonds, or the Lamb shift), and it is thought to have consequences for the behavior of the Universe on cosmological scales**.**

The vacuum energy density is constant and given by

$$\rho_{vaC} = \Lambda C^2 / 8 \pi G \quad \text{.....(7)}$$

Here Λ=Cosmological constant(dark energy).

$$\rho_{vaC} / \Lambda = C^2 / 8 \pi G$$

Recent observations indicate that the rate of expansion of universe is accelerating because of dark energy, and that most of the matter in the Universe may be in a form which cannot be detected by present instruments, and so is not accounted for in the present models of the universe; this has been named dark matter**.** **I**f the universe is both matter-dominated and dark energy-dominated. Let us now consider matter and dark energy dominated universe

Thus(6)becomes

$\rho_m C^2 = \Omega_m 3H_o^2 \rho_{vac} / a^3 \Lambda$.....(8)

Present cosmological (Dark energy)density parameter is given by

$\Omega_\Lambda = \Lambda C^2/3H_o^2$

$3H_o^2/\Lambda = C^2/\Omega_\Lambda$.....(9)

Thus (8) becomes

$\rho_m C^2 = \Omega_m \rho_{vac} C^2 / a^3 \Omega_\Lambda$.....(10)

$\rho_m = \Omega_m \rho_{vac} / a^3 \Omega_\Lambda$.....(11)

Present density parameter of matter and dark energy dominated universe is given by

$\Omega = \Omega_m + \Omega_\Lambda$.....(12)

Thus (11) becomes

$\rho_m a^3/\rho_{vac} = (\Omega - \Omega_\Lambda) / \Omega_\Lambda$.....(13)

$\rho_m a^3/\rho_{vac} = (\Omega / \Omega_\Lambda - 1)$.....(14)

Density of matter and dark energy dominated universe which vary with respect to time (t) is given by

$\rho = \rho_m + \rho_\Lambda$

Here ρ= Density of matter and dark energy dominated universe which vary with respect to time (t)
ρ_m = Density of matter dominated universe which vary with respect to time (t)
ρ_Λ= Density of dark energy dominated universe which vary with respect to time (t)

Thus (14) becomes

$\rho = \rho_{vac}/ a^3 (\Omega / \Omega_\Lambda - 1) + \rho_\Lambda$.....(15)

Density of matter and dark energy dominated universe which vary with respect to time (t) is given by

$\rho(t) = M(t) / V(t)$

Here **V(t) =** Volume of matter and dark energy dominated universe which vary with respect to time (**t**)

Thus (15) becomes

$V(t) = M(t) / [\rho_{vac}/ a^3 (\Omega / \Omega_\Lambda - 1) + \rho_\Lambda]$.....(16)

Here **M(t)=** Mass of matter and dark energy dominated universe which vary with respect to time(t).
a=Scale factor of universe.
ρ_{vac}= vaccum energy
Ω= Present density parameter of matter and dark energy dominated universe

Ω_Λ=Present density parameter of dark energy dominated universe.
ρ_Λ= Density of dark energydominated universe which vary with respect to time (t)

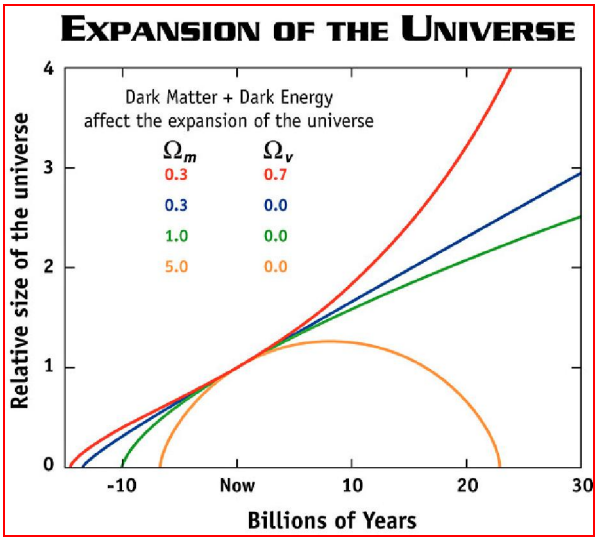

Figure-2:Expansion of matter and dark energy dominated universe.

Critical density of matter and dark energy dominated universe is given by

$\rho_c = 3H^2/8\pi G$.....(17)

Here **H**=Hubble parameter which is the function of time **H(t)**.

Divide (17) by C^2

$\rho_c / C^2 = 3H^2/8\pi G C^2$.....(19)

Radius of hubble sphere is given by

$r_{hs} = C/H$

Thus (17) becomes

$r_{hs}^2 = 3C^2/8\pi G \rho_c$.....(20)

From (7) we know

$\rho_{vaC} = \Lambda C^2/8\pi G$

Thus (20) becomes

$r_{hs}^2 = 3\rho_{vaC} / \Lambda \rho_c$.....(21)

Here r_{hs} = Radius of hubble sphere.
Λ = Cosmological constant

ρ_c=Critical density of universe
ρ_{vac}=Vacuum energy density

Result:
The volume of matter and dark energy dominated universe is given by the relation

$$V(t) = M(t) / [\rho_{vac} / a^3 (\Omega / \Omega_\Lambda - 1) + \rho_\Lambda].$$

[Here **M(t)=** Mass of matter and dark energy dominated universe which vary with respect to time(t),**a=**Scale factor of universe, ρ_{vac}= vaccum energy,**Ω=** Present density parameter of matter and dark energy dominated universe**,** Ω_Λ=Present density parameter of dark energy dominated universe,ρ_Λ= Density of dark energydominated universe which vary with respect to time (t)]

Acknowlegement :
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Conclusion : The mass density of universe is not constant but varies with respect to time (t) due to the cause of expansion.The dark energy accelerates the rate of expansion of universe.The mathematical determination of the mass density of matter and dark energy dominated universe according to the formula(15)take into account vaccum energy, scale factor of universe and density parameter of universe respectively.The radius of hubble sphere can be calculated mathematically by knowing the value of ρ_{vac}, Λ ,ρ_c. The constants like **C,** Λ are included in the paper to lay a foundation for the mathematical equation to come into existence.

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Role of Sacred Plants in Religion and Health-care system of local people of Almora district of Uttarakhand State (India)

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Abstract: Uttarakhand, the mountainous state of Indian Himalayan Region (IHR) is famous for its religious culture, traditions and pronounced as Dev Bhoomi (Land of Gods). People of this state are highly religious and variety of rituals related to God, Goddess worships are performed in various ways, round the year by the local people in which plants have their defined roles and importance. A preliminary survey was carried out to find the role of sacred plants in the lifestyle and health-care system of local people of Almora district of Uttarakhand State. It was observed that 19 plant species have high utility and importance in such religious activities as well as traditional healing system. These believes not only show the human relation with plant diversity but also help in conserving these species. [Academia Arena, 2010;2(6):19-22] (ISSN 1553-992X).

Key words: Religious beliefs, Traditional culture, Sacred rituals, Healing system

Introduction: The human culture, customs, ethos, religious rites, legends and myths, folk tales and folk songs, food as well as medicinal practices are deeply associated and influenced by the plants (Badoni and Badoni, 2001). Indian culture has cosmic believes for all happenings in their life, including sickness and sufferings, besides also have a close association and respect for many animals and plants in religious activities (Ranta and Pirta, 2007).

Hindu religion and culture firmly preached that all constituents of our ambient nature are part and creation of supreme power itself. The God has bestowed some specific powers to certain plants, animals and even rivers, mountains and places, which play an important role in prosperous human life. Hindu scriptures tell us that a wide range of plants like *Ficus religiosa*, *Azadirachta indica*, *Ocimum sanctum*, *Centella asiatica*, *Curcuma longa*, *Cynodon dactylon* has divine qualities, hence used in a number of religious activities and rituals from marriage, baptism to health care systems (Robinson and Cush, 1997).

Materials and Methods: The present study was carried out in Almora district in the year 2008, to find out the importance of plants in the religion, culture and health care system of local people. The information regarding the use of plants in the religious activities and traditional healing system, amongst the local people, was collected through consulting the local people and traditional herbal healers.

Results: Present study shows that 19 plant species are associated with the sacred beliefs and have religious importance. These plant species are regularly used by the local people in various religious activities and traditional healing system. The uses of each plant are enumerated in Table 1.

Table 1: Plant species of religious values with their medicinal utility

S. No.	Botanical Name	Local / English Name	Sacred Belief with their utility
1.	*Aegle marmelos* Corr.	Bilwa / Holy fruit tree	Leaves are offered to please Lord Shiva. In many ayurvedic formulations, its leaves and fruit are being used as anti diabetic agents. Local people use the squash of pulp of fruit to cure the digestive disorders.
2.	*Artemisia nilagirica* (Cl.) Pamp.	Paati / Fleabane	Leaves, mixed with ghee (clarified butter) are used as incense to attract positive powers. The paste of leaves are used in skin diseases and Aroma therapy.
3.	*Capsicum annum* Linn.	Mirch / Chilly	The smoke of the red chillies is

			inhaled to ward off the evil spirits. Local people use its powder with mustard oil on dog bite.
4.	*Cedrus deodara* (Roxb.) Loud.	Devdar / Cedar	The fragrance of wood repeals poisonous animals like snake and scorpion, while its oil is used in Aroma therapy.
5.	*Curcuma longa* Linn.	Haldi / Turmeric	Powder of rhizome is considered as a good antiseptic. Associated with planet Jupiter, its paste is applied on the face and body of the bride and groom to get blessing, as an auspicious ritual on the day of marriage.
6.	*Cynodon dactylon* (L.) Pers.	Dubra / Bermuda grass	It is used in almost all religious rituals supposed to please Lord Ganesh (The Elephant Head God). The paste of plant is applied on the cuts and wounds.
7.	*Euphorbia ligularia* Roxb.	Suyal / Crown of thorns	The plant is potted on the roof top and is believed that it protects home from the natural lighting strokes. This plant is also worshiped to please Lord Shiva. Local people use its latyx in dental caries.
8.	*Ficus religiosa* Linn.	Peepal / Sacred fig tree	This is one of the most sacred tree, associated with planet Saturn and Jupiter, and worshiped to need of blessing on almost all rituals. The oil medicated with its leaves is used as ear drops.
9.	*Mangifera indica* Linn.	Aam / Mango	Wood is used in worship and to perform fire sacrifice (Hawans). Associated with planet Venus, its leaves are also used in making string for doors on every auspicious occasion to attract positive power of nature. The powder of seeds is prescribed in case of diarrhoea and dysentery.
10.	*Musa paradisiaca* Linn.	Kela / Banana	This sacred plant is worshiped mainly on Thursday, as associated with planet Jupiter. The stems are used to make pavilion during various sacred rituals. Fruits are offered to please deities. The fruit is given with milk to cure body weakness.
11.	*Ocimum sanctum* Linn.	Tulsi / Holy Basil	Associated with Lord Vishnu, the creator of this universe. This sacred plant is worshiped daily due to a belief that it wards off the evil spirits from home. The leaves are used with common salt to cure toothache and decoction in common cold.
12.	*Oryza sativa* Linn.	Dhan / Rice	Its husked seeds are used in various

			sacred rituals and worship. It is also used for auspicious mark (Tilak) on forehead with turmeric or sandle wood paste as blessing of fertility. Rice paste is also used to decorate place of worship. The rice water is used as nourishing drink.
13.	*Piper betle* Linn.	Pan / Betel pepper	Its leaves is used in all religious ceremonies and regarded as a pleasure to Goddess Lakshmi (Goddess of wealth). The leaves are chewed to sweeten the breathe and improve the voice.
14.	*Prunus cerasoides* D. Don.	Paiya / Wild Himalayan cherry	Its leaves are offered to deities to get their blessings. The seeds are chewed in case of kidney stones.
15.	*Pyrus malus* Linn.	Seb / Apple	The fruit is offered to the deities and its juice is used to improve the digestive system.
16.	*Rhododendron arboreum* Sm.	Buransh / Rhododendron	Flowers are offered to deities in almost all religious functions and its decoction is used to cure diarrhoea and dysentery.
17.	*Tegetes erecta* Linn.	Gainda / Marigold	The flowers are used to make garlands for deities. The paste of flower is used externally in eye diseases.
18.	*Urtica dioica* Linn.	Kandali / Stinging Nettle	The twig is carried with the new born baby in traveling to ward off the evil spirits. The root extract is used in case of tooth cavity
19.	*Zanthoxylum aromatum* DC.	Timura / Bamboo-Leaved Prinklish Ash	The twigs are kept in houses to keep away evil spirits. Local people use its seeds in making traditional tooth powder.

Discussion: The importance of plants in human life as food, fibre, cosmetics etc. was discussed time to time by many researchers. But the religious aspects of plants are not given any attention and not much explored. Some researchers explained the recognition of some specific plants in human culture such as Nargas and Trivedi (2003) pointed out that *Azadirachta indica* is worshiped in India and its leaves are used to keep away the evil spirits, while in case of Rajasthan, it is associated with the farmers traditional method of weather forecasting. The association of plants with folk songs was discussed by Manral and Pande (2004). Mao (2003) explained the use of plants in symbolic and superstitious activities of the Naga tribe in Manipur. Dafni *et al.* (2006) reported that the Muslims of Northern Israel use some sacred plants in cemeteries of graveyards to repel the evil sprits, as their good odour and divine medicinal qualities. Shah (2006) reported that the rhizomes of *Nardostachys jatamansi* are generally used as incense mostly in the temples in high Himalayas due to the believe that its smoke drives away the evil spirits and attracts Godly powers.

The traditional culture and religion of human beings have deep faith in the nature and its components in every walk of life. Dhiman (2003) have discussed the sacred plants and their medicinal importance with special reference to Indian context. Tiwari (1995) has explained that the Rajis and Shauka tribes of Uttarakhand depend on the spirit possessed person and some sacred plants for curing diseases. While western medicine has still not found efficient medicines for psychosomatic diseases, over 200 species of medicinal plants are being used in the cultural and religious activities of local people of Northern Peru, for the treatment of psychosomatic diseases (Bussmann and Sharon, 2006). Shirazi and Morowatisharifabad (2009) observed that greater

religious involvement play as a protective factor in high-risk sexual behavior, which promote safe sex. Similar to above studies, during the present research, it was observed that the religious activities boost up the mental health of local people of Almora district. Many of these sacred plants are found in almost every household in the study area and are used in religious activities as well as for health care. These sacred plants are even worshiped by the local people for get blessing of health and wealth by positive powers of nature. In this way these sacred plants play a major role in the mental as well as physical health of local people.

Dhar *et al.* (2002) reported that local people of Uttarakhand, consider Bughiyal (the alpine zone, which is full of variety of herbs, grasses and Cedar trees), as the abode of Gods. It is believed that these Gods and fairies visit these sacred zones on special occasions and on fullmoon nights, with supernatural powers. These traditional believes supports CBD (Convention of Biodiversity) in the way of sustainable utilization of natural resources. The religious customs, protect the part of the forests, where deities resides and worshiped and tend to preserve that area as sacred grove (Adhikari and Adhikari, 2007). The religious activities as well as hypothesis also act as conserving tool for bio-diversity. So, it is necessary to preserve and promote these aesthetic values to conserve bio-diversity and nature, which will surely play a role in betterment of human beings.

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Mathematical Theory On Evolution Of Universe

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Abstract:-Most of the theories like Big bang ,Steady state theory..... were proposed to explain the evolution of universe. The inherent goal of proposal of this theory is to explain the early evolution of universe to some extent through mathematical derived equations. The fundamental concepts like energy,time,temperature ,mass ..are incorparated to frame this mathematical theory to explain the formation of universe . The new mathematical model allows to calculate Poynting–Robertson force. It is shown that the equation for the calculation of Poynting–Robertson force accounts for the force exerted by incoming solar radiation,gravitational radius of sun and dust grain's orbital radius. The new mathematical model is putforward to calculate momentum of emitted hawking radiation. [Academia Arena, 2010;2(6):23-36] (ISSN 1553-992X).

Key words : Energy ,time , mass speed of light in vacuum.

The empty space was dominant in the early universe. To fill the emptiness energy occupied the empty space leading to the emergence of energy dominated universe .We know that energy in turn implies motion .The concept of time came into existence followed by the concept of motion(energy).

According to the equation **E=tc**

Here E=Energy, t = Time, c = Speed of light in vacuum($3*10^8$m/s)

E ***a*** t.

The huge temperature and huge pressure prevailed in the universe.Moreover high energy content leaded to unstability of universe.

Energy ***a*** 1/stability

According to the mathematical equation $\mathbf{E=X^2t/h}$

Here E=Energy content of universe ,X=Space ,t=time ,h=Planck's constant($6.625*10^{-34}$JS)

Let us assume E = constant [since total energy of universe is constant]

$$\mathbf{X^2 \; a 1/t}$$

Space varies inversely with time in the absence of mass. Rate of expansion of universe occurs in short time or contraction of universe occurs in long time.

NOTE :- In the absence of concept of mass, [space and time] behaved as separate factors.

As the time passed ,huge fluctuations in temperature occurred .These fluctuations caused the conversion of some part of energy to mass [matter+antimatter]. Although space and time behaved as two different concepts before but now they both unified togather to form spacetime.The presence of mass caused curvature of spacetime.

According to the equation $\mathbf{E=MC^2}$

Conversion of energy into mass and its vice versa is beautifully explained by Einstein's famous equation **$E=MC^2$**,here **C** is not just the velocity of a certain phenomenon—namely the propagation of electromagnetic radiation (light)—but rather a fundamental feature of the way space and time are unified as space time. The equation implies conversion of energy into mass and its vice versa accounts the unification of space and time. In other words in presence of mass there is unification of space and time .In absence of mass ,space and time behave as two separate factors. The space, time, mass are different concepts in physics and these concepts are brought to gather in one equation. Moreover the question arises in human mind the need of unification of space and time in conversion of energy into mass and its vice versa.

Equation **m=X^2t/h(1+D)** (where m=total mass content of universe, x=space, t=time, D=spacial distance, h=planck's constant) describes how space, time, mass, spacial distance are related to each other. Created mass [matter+antimatter] varied directly with the value of' X'withrespect to time 't'such that the value of spacial distance'D'is reduced to some extent. As more mass prevailed in the universe, more gravity began to come into existence. Gravity has control on rate of expansion or rate of contraction of universe with respect to time 't'. More over pressure become negligible compared to mass density of universe: $P= wpc^2$

Here $w = 0$ for matter dominated universe

Consider elementary particles like electron ,proton,neutron,positron ,neutrino were created in the early in the early universe .thus electro magneticforces came into existence.The antiparticle [antielectron]and particle [electron] were brought togather by{electrostatic force of attraction+gravity}.Hence they exerted impulse on each other resulting in the release of energy in the form of photons[radiation]

E=Ic

Here E= Energy released ,I=Impulse ,c = Speed of light in vacuum

Thus the electromagnetic radiation filled the early universe.

The protons were attracted towards the electronby the force of attraction to form the neutrons.These neutrons ,protons were clubed togather by [gravity] to form nucleus and this nucleus clubed with electrons by [electrostatic force+gravity] to form atom .Thus nuclear force came into existence .

Similarly sun , solarsystem ,galaxy..... were formed .

Energy which was unaffected by fluctuations in temperature remained as [dark energy+darkmatter] that filled the universe homogeneously.

Proof for the above equations:-

Derivation of the equation $E=X^2t/h$

Part :1

Consider a photon of relativistic mass 'm' moving with speed 'c' is associated with the wavelength 'λ' is given by the relation

$\lambda=h/mc$

where h= Planck's constant ($6.625*10^{-34}$JS).

According to wave theory, speed of the photon wave is given by

$c = \lambda / T$

where T= time period.

By substitution of value of 'c' in the equation $\lambda = h/mc$

we get the expression $m \lambda^2 = hT$.

According to wave theory, frequency of photon wave is given by f=1/T.

Then the equation $m \lambda^2 = hT$ becomes $f=h/m\lambda^2$

De Broglie wavelength associated with the photon is given by $\lambda= h/p$,

Thus the equation $f=h/m\lambda^2$becomes $f=p/m\lambda$.

Angular frequency associated with the photon is given by $\omega= 2 \pi f$.

By putting the value of $f=p/m\lambda$. in the above equation we get $\omega= 2 \pi p/m\lambda$.

The above equation $\omega= 2 \pi p/m\lambda$. can be applied to both photons and material particles like electron in motion.

Debroglie wavelength associated with the electron is given by $\lambda=h/mv$

Where v=velocity of electron in motion

Then the equation $\omega= 2 \pi p/m\lambda$ becomes $\omega= 2 \pi pmv/mh$ i.e $\omega= 2 \pi pv/h$.

Part: 2

Consider a electron of mass "m_e" at rest, total energy associated with the electron is given by "$m_e c^2$".

Suppose radiation of energy hf is incident on this electron at rest. Part of energy hf " is absorbed by electron and part of energy hf' is scattered by electron . Absorbed energy hf " is converted to motion of electron, hence electron travels a distance 'X' in time 't'. let θ is the scattering angle

.

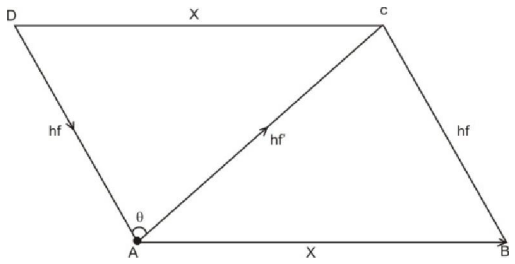

Figure :1 –Schematic diagram of scattering of energy of photon by electron

X= Linear displacement of electron

hf = Energy of incident radiation

hf' = Energy of scattered radiation

θ = scattering angle

Consider a parallelogram ABCD constructed as shown in the figure 1.

Let AB=CD=X, AD=BC=hf, AC=hf'(opposite sides in parallelogram are equal)

Law of cosine is given by $a^2=b^2+c^2-2bc\cos\theta$.

Let a =X, b=hf, c=hf', cos A = cosθ.

By applying the law of cosine to the triangle ADC, we get

$X^2=(hf)^2+(hf')^2-2(hf)(hf')\cos\theta$ .....(1)

By law of conservation of momentum of photon.

We get $\vec{p}_y = \vec{p}_{y''} + \vec{p}_{y'}$ where $\vec{p}_y, \vec{p}_{y''}, \vec{p}_{y'}$ be the momentum of incident, absorbed and scattered photon respectively.

Let us assume absorbed momentum of photon = momentum of electron

i.e. $\vec{p}_{y''} = \vec{p}$

Thus $\vec{p}_y = \vec{p} + \vec{p}_{y'}$ where $\vec{p}$ = momentum of electron

$\vec{p} = \vec{p}_y - \vec{p}_{y'}$ Squaring on the both sides we get

$p^2 = \left(\vec{p}_y - \vec{p}_{y'}\right)^2$

Since $(a-b)^2=a^2+b^2-2ab$

Thus the above equation becomes $p^2=p_y{}^2+p_{y'}{}^2- 2\ |\vec{p}_y . \vec{p}_{y'}|$

According to dot product rule $|\vec{a}\bullet\vec{b}| = |a||b|\cos\theta$

Then we get $p^2= p_y{}^2+ p_{y'}{}^2-2|p_y||p_{y'}|\cos\theta$

Let us multiply the above equation by c^2 we get

where c = speed of light in vaccum ($3* 10^8$ m/s)

$p^2 c^2 = p_y{}^2c^2 + p_{y'} c^2-2|p_y||p_{y'}|c^2\cos\theta$

As we know frequency of photon is directly proportional to it's momentum

i.e hf = pc

Thus the below equation is obtained

$p^2 c^2 = (hf)^2 + (hf')^2 - 2(hf)(hf')\cos\theta$ .....(2)

By comparison of (1) and(2)

we get $X^2 = p^2 c^2$

i.e X= pc

(position of electron is defined as the function of it's momentum)

After absorption of energy hf" from the photon, total energy of electron increases from $m_e c^2$ to mc^2.

Then total energy associated with the electron in motion is given by $E= mc^2$.

Amount of motion associated with the electron is given by p =mv, thus we can write m=p/v.

By substitution of value of 'm' in the equation $E=mc^2$.

We get $E= pc^2/v$

As position of electron is defined as the function of it's momentum.i.e. X=pc

Then the above equation $E= pc^2/v$ becomes E=xc/v

By rearranging the above equation

we get

v/c = X / E.....(3)

Angular frequency associated with the electron during it's motion can be given by

$\omega= 2\pi pv/h$, i.e $\omega= 2\pi xv /hc$

Since X= pc (position of electron is defined as the function of it's momentum)

Rearranging this equation we get

$h\omega/ 2\pi X = v/c$ .....(4)

By comparison of(3) and (4) we get the equation

$E= 2\pi X^2/ h\omega$

where E=Total Energy of electron

X = Position of electron

ω = Angular frequency of electron

h =Planck's constant ($6.625*10^{-34}$ JS).

Part : 3

Consider a material particle like electron moving in a circular orbit with constant angular velocity "ω".

Then total energy associated with the particle can be given by the equation $E= 2 \pi X^{2}/ h\omega$

where E=Total Energy of electron in circular orbit

X = Position of electron in circular orbit

ω = Angular velocity of electron in circular orbit

h =Planck's constant ($6.625*10^{-34}$ JS).

Note : Angular frequency of electron can be defined as angular velocity when it moves in a circular orbit.

As orbit is circular $\omega = \theta/t$ (θ = angular displacement with respect to time t)

The above equation $E= 2 \pi X^{2}/h\omega$ becomes $E= 2 \pi X^{2}t/ h\theta$

Let $\theta = 2 \pi$ for one complete revolution

Then the equation $E= 2 \pi X^{2}t/ h\theta$ becomes $E= 2 \pi X^{2}t/ h2\pi$

i.e $E= X^{2}t/ h$ is obtained

Let "E" be total energy of particle at position "X" with respect to time "t"

We can also tell that total energy of particle "E" is distributed at position "X" with respect to time "t".

As we know that total energy of universe "E" is distributed along its space "X" with respect to time "t".

This energy is given by the equation **$E=X^{2}t/ h$** .....(5)

Fundamental equation of unified field theory is given by the equation

E=total m(1+D) .....(6)

By comparison of (5) and (6)

we get the expression

Total $m=X^{2}t/ h(1+D)$ where m = mass content of universe

X= space of universe

t = time

D = spacial distance

h = Planck's constant ($6.625*10^{-34}$ JS).

Derivation of E=Ic

Part : 1

Consider a electron of mass "m_e" at rest, total energy associated with the electron is given by "$m_e c^{2}$".

Suppose radiation of energy hf is incident on this electron at rest. Part of energy hf " is absorbed by electron and part of energy hf' is scattered by electron . Absorbed energy hf " is converted to motion of electron, hence electron travels a distance 'X' in time 't'. let θ is the scattering angle

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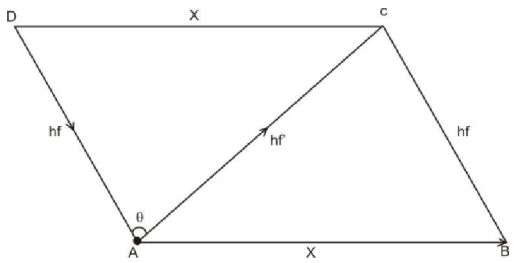

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According to dot product rule $|\vec{a} \bullet \vec{b}| = |a||b|\cos\theta$

Then we get $p^2= p_y^2+ p_{y'}^2-2| p_y | | p_{y'} | \cos \theta$

Let us multiply the above equation by c^2 we get

where c = speed of light in vaccum ($3* 10^8$ m/s)

$p^2 c^2 = p_y^2 c^2 + p_y' c^2-2| p_y | | p_{y'} |c^2\cos \theta$

As we know frequency of photon is directly proportional to it's momentum

i.e hf = pc

Thus the below equation is obtained

$p^2 c^2= (hf)^2+(hf')^2-2(hf)(hf')\cos \theta$ .....(2)

By comparison of (1) and(2)

we get $X^2 = p^2 c^2$

i.e X= pc

(position of electron is defined as the function of it's momentum)

Small change in momentum of electron causes small change in it's position

i.e. dX= dpc

Hence dp = dX/c

Newton second law of motion is mathematically represented by equation F=dp/dt

Where F = force exerted by photon

dp = Small change in momentum of electron with respect to time

As dp = dX/c then the above equation becomes F= dX/dtc.

velocity of electron is defined as v = dX/dt.

Then **F =v/c** is obtained

Force exerted by photon is defined as function of velocity of electron

As impulse exerted by photon is mathematically given by I = F dt.

then the equation F= dX/dtc becomes Fdt = dX/c

i.e **I =dX/c**

Impulse exerted by photon is defined as function of change in position of electron

At point A and B mass of electron is m_ei.e total energy associated with electron is m_ec^2.

(Since electron is at rest at point A and B)
But in between point A and B mass of electron is mc^2

(Since electron is in motion in between point A and B)

Hence total energy of electron in motion is mathematically given by $E= m_ec^2+ hf$ ''
(Since absorbed energy adds up to rest mass energy of electron)

where E= total energy of electron in motion

hf'=absorbed energy of photon

m_ec^2=rest mass energy of electron

As absorbed momentum of photon equals the momentum of electron i.e $p_{y''}= p$
As X=pc (position of electron is defined as the function of it's momentum) then $X= p_{y''}c$
$p_{y''}c =hf$ " then X=hf '' then the equation $E= m_ec^2+hf$ ''becomes **$E= m_ec^2+X$**.....(3)

According to Einstein equation $E= m_ec^2+E_k$.....(4)
By camparison of (3)and(4)

we get **$E_k = X$**

i.e Kinetic energy of electron = Position of electron

Small change in kinetic energy of electron causes small change in it's position

$d E_k = dX$ i.e $I =dX/c$

i.e $I= d E_k/c$ i.e $d E_k=Ic$

According to workenergy theorm

Work done on particle equals change in kinetic energyof particle i.e $W= d E_k$

i.e $W= Ic$

Work done on particle involves storage of energy in particle

i.e $W=E_a$ where E_a= Energy stored in particle.

$E_a =Ic$

Energy stored in particle is defined as a function of impulse applied
Thus E_a ***a*** I (As c is constant)

Thus impulse and energy are interconvertable.

Derivation of E=tc

Since X= pc (position of electron is defined as the function of it's momentum)

Momentum of electron can be given by p=mv

then the equation X= pc becomes X= (mv) c i.e X/v=mc

According to Newton's law of mechanics

velocity of moving particle is given by

v=X /t

Equation X/v = mc becomes t=mc
According to Einstein 's equation $E=mc^2$

Hence E=(mc)c becomes **E= tc**

Energy of particle is defined as the function of time

Result : -

1) Total energy of universe "E" is distributed along its space "X" with respect to time "t". This energy is given by the equation **"$E=X^2t / h$".**
2) Space, time, mass content and spacial distance are related to each other by the expression "**Total $m=X^2t/ h(1+D)$".**

3) Energy stored in the particle defined as the function of impulse is given by **"$E_a = Ic$" .**

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Additional information:-

Power of emitted hawking radiation

Power of the emitted hawking radiation from the evaporating black hole of mass 'M ' is given by

$$P= \hbar C^6/15360\,\pi\, G^2M^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Let us divide the above equation by M and then multiply by 3 we get

$$3\,P/M= \hbar C^6/5120\,\pi\, G^2M^3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Evaporation time of black hole is given by

$$\mathbf{T_{ev} = 5120\ \pi\ G^2M^3/\ \hbar C^4}\text{……..(3)}$$

Thus (2) becomes

$$\mathbf{3\ P/M= C^2/\ T_{ev}}\text{……(4)}$$

The power of emitted hawking radiation is also given by

$$\mathbf{P=h}\boldsymbol{f}^{\mathbf{2}}\text{……..(5)}$$

Thus (4)becomes

$$\mathbf{3(\ h}\boldsymbol{f}\mathbf{)}\ \boldsymbol{f}\ \mathbf{/\ M= C^2/\ T_{ev}}\text{……(6)}$$

By the equivalence of Einstein 's mass energy law and planck 's law we get

$$\mathbf{h}\boldsymbol{f}\mathbf{=mC^2}$$

Thus (6) becomes

$$\mathbf{3(mC^2)}\ \boldsymbol{f}\mathbf{=M\ C^2/\ T_{ev}}\text{……..(7)}$$

$$\boldsymbol{f}\mathbf{=M\ /\ 3m\ T_{ev}}\text{……..……(8)}$$

As frequency of emitted Hawking radiation is given by

$$\boldsymbol{f}\text{=C/}\boldsymbol{\lambda}$$

Thus (8) becomes

$$\mathbf{m}\ \text{C/}\boldsymbol{\lambda}\ \mathbf{=M\ /\ 3\ T_{ev}}\text{……..……(9)}$$

Momentum of emitted Hawking radiation is given by

$$\boldsymbol{p}\mathbf{=mC}$$

Thus (9) becomes

$$\boldsymbol{p}\ \boldsymbol{/\lambda}\ \mathbf{=M\ /\ 3\ T_{ev}}\ \text{……..(10)}$$

Wavelength of emitted Hawking radiation is given by

$$\boldsymbol{\lambda}\mathbf{=h/}\boldsymbol{p}$$

Let us divide the above equation by $\boldsymbol{p}$ we get

$$\boldsymbol{p}\ \boldsymbol{/\lambda}\ \mathbf{= h/}\boldsymbol{p}^{\mathbf{2}}$$

Thus (10) becomes

$$\boldsymbol{p}^{\mathbf{2}}\ \mathbf{=\ hM\ /\ 3\ T_{ev}}\text{……..…….(11)}$$

$$\boldsymbol{p}\ \mathbf{=\ [hM\ /\ 3\ T_{ev}]^{1/2}}$$

Poynting–Robertson force -:

Power of radiation can be given by **P=hf^2 i.e P= (hf)c/ λ** (1)

Force exerted by radiation can be given by **F=hf/ λ**

Proof for **F=hf/ λ** :

Determination of the Photon Force and Pressure

Reissig, Sergej

The 35th Meeting of the Division of Atomic, Molecular and Optical Physics, May 25-29, 2004, Tuscon, AZ. MEETING ID: DAMOP04, abstract #D1.102

In [1] the formula for the practical determination of the power of a light particle was derived: P = hf^2 (W) (1). For the praxis it is very usefully to define the forces and pressure of the electromagnetic or high temperature heat radiation. The use of the impulse equation F = fracdPdt = fracd(mc)dt (2) together with the Einstein formula for E = mc^2 leads to the following relationship: F = frac1cfracd(mc^2)dt = frac1cfracdEdt (3) In [1] was shown: - fracdEdt = P (4). With the use the eq. (1), (3), (4) the force value could be finally determinated: | F | = frachf^2 c or | F | = frachcλ ^2 = fracEλ [N]. The pressure of the photon could be calculated with using of the force value and effective area: p = fracFA [Pa]. References 1. About the calculation of the photon power. S. Reissig, APS four corners meeting, Arizona, 2003 -www.eps.org/aps/meet/4CF03/baps/abs/S150020.html

E=F λ

According to Planck's theory of radiation

Energy associated with radiation can be given by

E=hf

Thus the equation **E=F λ** becomes **F=hf/ λ**

Then the equation (1) becomes **P=FC** (2)

Here **P=** Power of radiation, **F**= Force exerted by radiation ,**C**= speed of light in vacuum , **h** = Planck's constant ,

f **=** Frequency of radiation , **λ =** wavelength of radiation .

Consider a dust grain orbiting the sun in the solar system . Newton's law of universal gravitation states that "Every massive particle in the universe attracts every other massive particle with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them ".

Gravitational force of sun experienced by the dust grains orbiting the sun can be given by

$$F= GM\ m\ /r^2 \quad (3)$$

Here F = Gravitational force between the sun and dust grain, G = Universal gravitational constant , M = Mass of the sun, m = Mass of the dust grain, r = Distance between the Sun and dust grain(orbital radius of dust grain).

Centrifugal force is an outward force associated with curved motion, that is, rotation about some (possibly not stationary) center. Centrifugal force is one of several so-called pseudo-forces (also known as inertial forces). Centrifugal force acts on dust grain to prevent the collapse of dust grain towards the sun can be given by

$$F = mv^2 / r \qquad (4)$$

Here F = centrifugal force , m = Mass of the dustgrain , r= Distance between the Sun and dust grain(orbital radius of dust grain) , v= velocity of dust grain .

By the comparison of (3) and (4) we get

$$r = GM / v^2 \qquad (5)$$

Here M_s= Mass of the sun, r = Distance between the Sun and dust grain(orbital radius of dust grain), v= velocity of dust grain, G = Universal gravitational constant .

Solar radiation causes a dust grain in the solar system to slowly spiral inward. The drag is essentially a component of radiation pressure tangential to the grain's motion. The first description of this effect, given by Poynting in 1903. The grain of dust circling the Sun (panel (a) of the figure), the Sun's radiation appears to be coming from a slightly forward direction (aberration of light). Therefore the absorption of this radiation leads to a force with a component against the direction of movement. (The angle of aberration is extremely small since the radiation is moving at the speed of light while the dust grain is moving many orders of magnitude slower than that.)

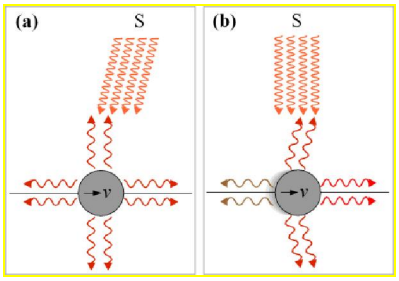

Figure:1

The Poynting–Robertson drag can be understood as an effective force opposite the direction of the dust grain's orbital motion, leading to a drop in the grain's angular momentum. It should be mentioned that while the dust grain thus spirals slowly into the Sun, its orbital speed increases continuously.

Poynting–Robertson force can be given by

$$F_{PR} = Pv/C^2 \qquad (6)$$

Here **P** is the power of the incoming solar radiation, **v** is the grain's velocity**, C** is the speed of light in vaccum, and **R** isthe dust grain's orbital radius , F_{PR} = Poynting–Robertson force .

From (1) we know that power of incoming solar radiation can be denoted by **P=FC**

Then the equation (6) becomes $F_{PR} = (FC)v/C^2$

$$F_{PR} = (Fv) / C \qquad (7)$$

Here F_{PR} = Poynting–Robertson force , **F**= Force exerted by solar radiation , **v** is the grain's velocity , **C** is the speed of light in vaccum **.**

Squaring the equation (7) we get

$$F_{PR}{}^2 = F^2 * (v/C)^2 \qquad (8)$$

From (5) we have $r = GM/v^2$ i.e $v^2 = GM/r$

Thus the equation (8) becomes $F_{PR}{}^2 = F^2 * (v^2/C^2)$

$$F_{PR}{}^2 = F^2 * (GM/rC^2) \ .$$

The Schwarzschild radius (sometimes historically referred to as the gravitational radius) is a characteristic radius associated with every quantity of mass. Gravitational radius of the sun can be given by

$$R_g = 2GM/C^2 \qquad (9)$$

From (9) the equation $F_{PR}^{\ 2} = F^2 * (GM/rC^2)$ can be written as

$$F_{PR}^{\ 2} = (F^2 * R_g)/2R \qquad (10)$$

$$F_{PR} = F * (R_g/2r)^{1/2} \qquad (11)$$

Here F_{PR} = Poynting–Robertson force , F= Force exerted by solar radiation , R_g= gravitational radius of sun, C is the speed of light in vaccum , r is the dust grain's orbital radius .

Result:-

1) Poynting–Robertson force can also be given by $F_{PR} = F * (Rg/2R)^{1/2}$
[F_{PR} = Poynting–Robertson force , F= Force exerted by solar radiation , Rg = gravitational radius of sun, C is the speed of light in vaccum , R is the dust grain's orbital radius]

2) Momentum of emitted hawking radiation is given by the relation $p = [hM / 3\,T_{ev}]^{1/2}$
[p = momentum of emitted hawking radiation,M=Mass of evaporating blackhole, Tev= evaporation time of blackhole] .

4/1/2010

Standardization of Sterilization Protocol for Micropropagation of *Aconitum heterophyllum*- An Endangered Medicinal Herb

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Abstract: A protocol has been standardized for sterilization of nodal segments and seeds of *Aconitum heterophyllum* for its micropropagation intended for its mass propagation and conservation. Three sterilizing agents *viz.*, $HgCl_2$, NaOCl and H_2O_2 were tested for sterilization by varying their concentration and time of exposure. 100% healthy shoots were obtained when explants were sterilized with 0.1% $HgCl_2$ for 5 minutes, inoculated on MS basal media with appropriate hormones and observing them for 30 days, while at 7.5% concentration of H_2O_2, 5 minutes exposure provided 90% of aseptic seed germination. Results showed that out of three sterilizing agents $HgCl_2$ was significantly reducing the contamination of explants and H_2O_2 of seeds in *in-vitro*, which shows that requirement of sterilization, may vary with the type tissue used for micropropagation. [Academia Arena, 2010;2(6):37-42] (ISSN 1553-992X).

Keywords: *Aconitum heterophyllum*, sterilization, micropropagation, conservation, contamination

Introduction

In-vitro propagation comprises of various stages: selection of explants; aseptic culture establishment; multiplication of propagules; rooting and acclimatization of plantlets. But the most important and challenging step is sterilization of explant for aseptic culture establishment. Sterilization is the process of making explants contamination free before establishment of culture. Explant contamination depends on the several plant and environmental related factors such as species, age, explant source and prevailing weather condition. In fact according to losses due to contamination under *in-vitro* conditions average between 3-15% at every subculture in the majority of commercial and scientific plant tissue culture laboratories (Leifert *et al.*, 1989), the majority of which is caused by fungal, yeast and bacterial contaminant (Leifert *et al.*, 1994). Consequently leading to the waste of time, effort and material which if not mitigated can have serious economic problems. *Aconitum heterophyllum* Wall is an important and endangered medicinal plant belonging to the family Ranunculacea. Conservation through vegetative propagation is slow and time consuming but tissue culture offers an alternative tool for rapid multiplication and conservation of disease free propagules in a short period, which will further enable uninterrupted supply of raw material, *Aconitum heterophyllum* for drug preparation. As *Aconitum heterophyllum* is an endangered medicinal herb optimum conditions like type of sterilizing agent, its concentration and time of exposure to that sterilizing agent are mandatory for asepsis of *Aconitum heterophyllum*. These sterilants are toxic to the plant tissue, hence the type, concentration, time of exposure and removal of traces of sterilizing agent becomes important in standardizing sterilization protocol.

Therefore, the present study has been done to standardize the sterilization method for explant and seeds of *Aconitum heterophyllum* for *in-vitro* propagation intended for its conservation by using different types of sterilizing agents by varying their concentration and duration of exposure.

Materials and Methods

Sample Collection

The plants and seeds of *Aconitum heterophyllum* were procured from Forest Nursery, Deoban, Chakrata, Uttarakhand. Seed samples were sent to NBPGR, Pusa Campus, New Delhi, for its germplasm conservation and the Accession No. IC-567646 was obtained. Seeds were washed and air dried at room temperature and sealed in sample bag till further use. Potted plants procured from the nursery were maintained in the polyhouse till further use. All the glassware and instruments to be used were thoroughly cleaned and autoclaved at 15 psi for 40 minutes after drying them at 90ºC in oven.

Explant Sterilization

Nodal segments of *Aconitum heterophyllum* were excised from the pot grown plants. These nodal segments were trimmed to approx 2 cm. in size and large fleshy leaves were removed. All the brown skins were cleaned thoroughly. Procedure of sterilization (Figure 1.) for *Aconitum heterophyllum* had been divided into two phases: Phase I (outside Laminar Air Flow) and Phase II (inside Laminar Air Flow). Three different kinds of sterilizing agents *viz.*, Mercuric Chloride ($HgCl_2$), Sodium Hypochlorite (NaOCl) and Hydrogen Peroxide (H_2O_2) are tested for explant sterilization by varying their concentration and time of exposure (Table 1).

Seed Sterilization

Seeds of *Aconitum heterophyllum* were subjected to float test for determining the viability. Seeds of *Aconitum heterophyllum* are small in size; this makes its washing and sterilization little bit uneasy. As these seeds run out from the flask while washing, using glass pipette (20-25ml) or hollow glass rod with one end sealed can avoid this situation. Process of seed sterilization has been shown through a flow chart (Figure 1). Table 1 shows the concentration and time of exposure to different sterilizing agents used for decontaminating the seeds.

Table 1. Type sterilizing agents used in a different concentration with varying time of exposure for sterilizing explants and seeds of *Aconitum heterophyllum.*

STERILIZING AGENT	CONCENTRATION	TIME OF EXPOSURE (minutes)
MERCURIC CHLORIDE ($HgCl_2$ w/v)	0.05 %	2, 5, 8.
	0.1 %	2, 5, 8.
	0.15 %	2, 5, 8.
SODIUM HYPOCHLORITE (NaOCl w/v)	0.5 %	2, 5, 8.
	1.0 %	2, 5, 8.
	1.5 %	2, 5, 8.
HYDROGEN PEROXIDE (H_2O_2 v/v)	5.0 %	2, 5, 8.
	7.5 %	2, 5, 8.
	10 %	2, 5, 8.

Inoculation

Murashige and Skoog basal medium supplemented with appropriate cytokinins and auxins were used for inoculation. Medium was checked for the contamination before inoculation. Sterilized explants were trimmed suitably to remove sterilizing agent affected parts/brown parts. Explants and seeds were then inoculated on the appropriate medium and labeled properly. Regular and proper record for contamination, browning and growth/bud break/germination (seeds) were taken for 30 days.

Statistical Analysis

Statistical analysis was done to find out the effect of different sterilizing agents its concentration and time of exposure on the asepsis of the said plant species. For each experiment, ten nodal segments and 20 seeds each in three replicates were used. The mean infected plant, healthy plant and dead plant percentage and mean germination percentage and their standard error was calculated. Data collected was subjected to two-way ANOVA (SPSS 15.0)

to find out the significance level of effect of varying concentrations and time of exposure of different sterilizing agent on growth and asepsis of plants of *Aconitum heterophyllum.*

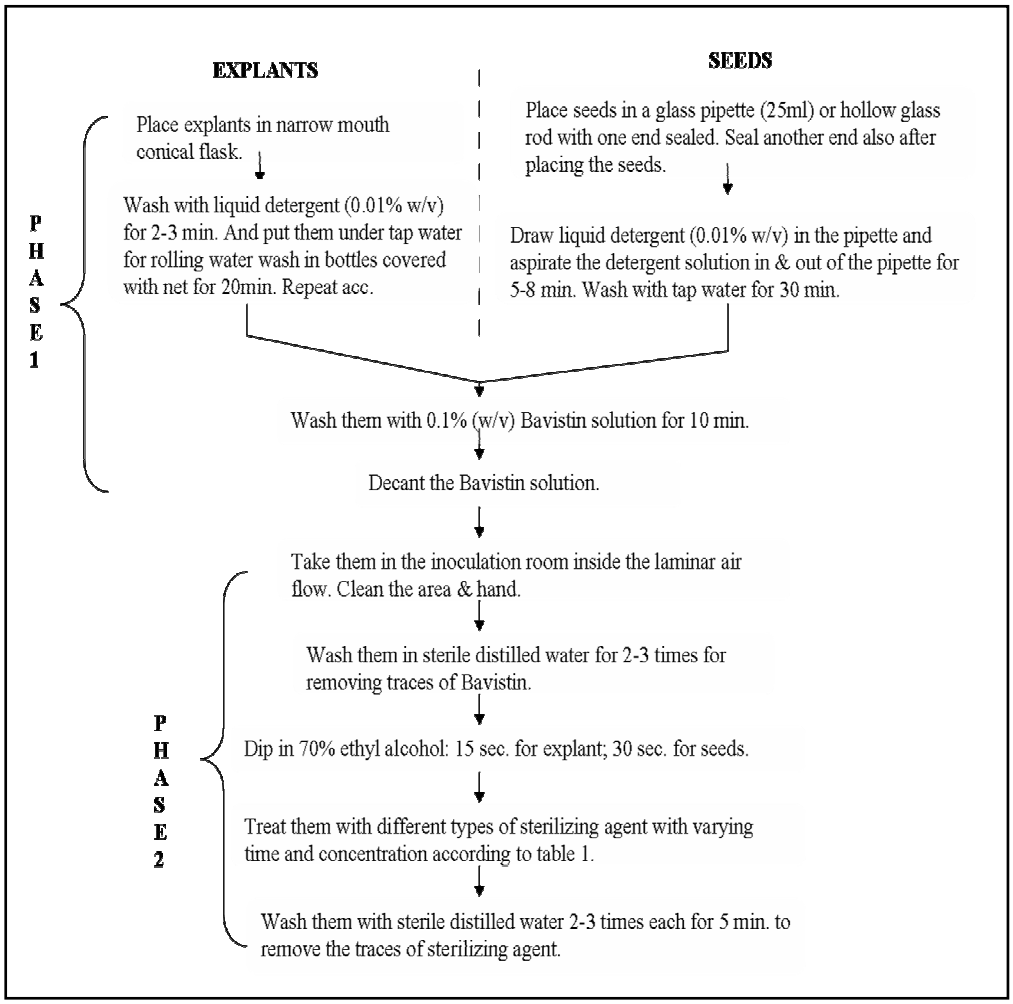

Figure 1. Procedure of sterilization of explants and seeds of *Aconitum heterophyllum*

Results

Explant Sterilization

After observing the inoculated explants for 30 days for growth and contamination, it was found that increasing time and concentration significantly reduced contamination but showed adverse effect on explants (Figure 2). Among all the three sterilizing agents *viz.*, $HgCl_2$, NaOCl and H_2O_2, treatment with 0.1% (w/v) $HgCl_2$ for 5 min. gave the 100% healthy shoots ($p<1.0\%$). Increasing concentration and time of exposure to $HgCl_2$ provided more population of dead shoots.

NaOCl being mild sterilizing agents provided more percentage of infection. Increasing concentration and time of sterilization with NaOCl, showed almost negligible reduction in contamination. Same was the case with H_2O_2 where infected explants were more even on increasing concentration up to 10% and time to 8 minutes.

Seed Sterilization

In-vitro propagation through seeds also provides a useful technique for conservation as *in-vitro* condition make the seeds of *Aconitum heterophyllum* to germinate dormant seeds. So sterilization of seeds before inoculation in the

media is obligatory.100% seed viability was obtained. Various sterilizing agent with different concentration and time of exposure (Table 1) were tested, out of which 7.5% (v/v) H_2O_2 for 5 min. gave the maximum (90%, $p<1\%$) germinated and healthy seedlings while less germination and more percentage of contamination was observed with NaOCl, while $HgCl_2$ showed adverse effect on germination. Here also increasing time and concentration significantly reduced the contamination, but on the other hand it also effected the germination of seeds (Figure 3).

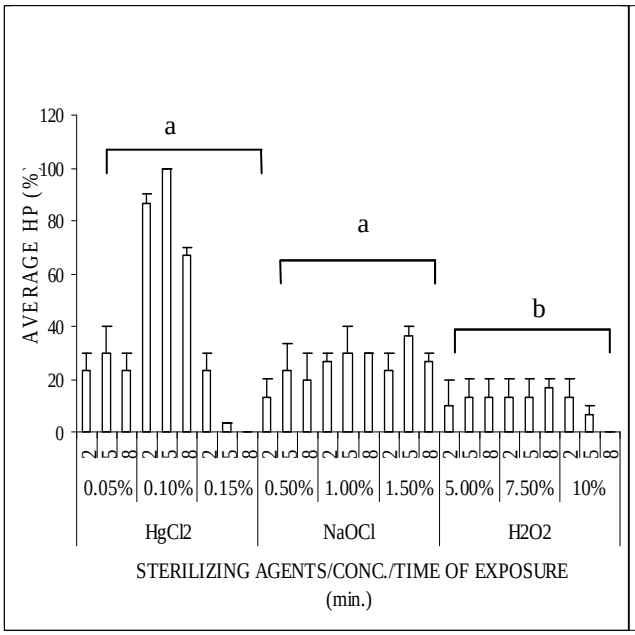

Figure 2. Percentage of Healthy Plants (HP) obtained after sterilization of explants of *Aconitum heterophyllum.* (a= significant at $p<1\%$: b=interaction b/w time and concentration non-significant).

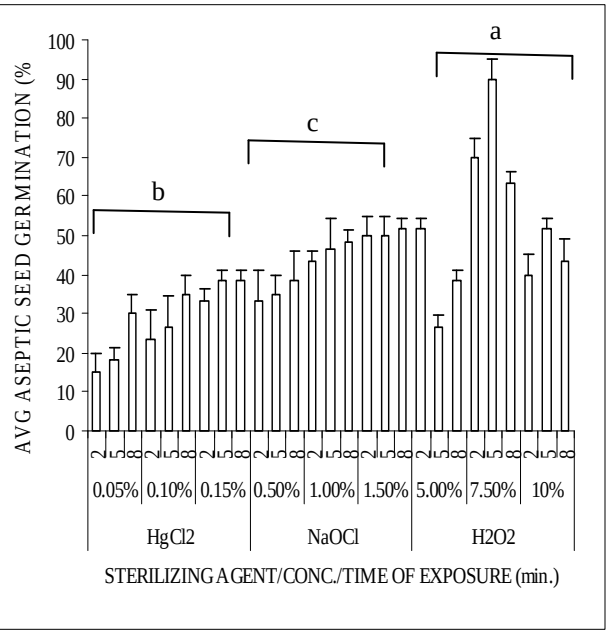

Figure 3. Average aseptic seed germination % after sterilization of seeds of *Aconitum heterophyllum.* (a= significant at $p<1\%$: b=interaction b/w time and concentration non-significant: c= time variation and interaction b/w time and concentration non-significant).

Discussion

Tissue culture provides a best tool for large scale production of propagules especially in case of endangered medicinal herb. *Aconitum heterophyllum* has been declared as an endangered medicinal herb of Uttarakhand by the CAMP Workshop, 1998 (Dhar *et al.,* 2002). *Aconitum heterophyllum* is reputed for its various medicinal and pharmaceutical properties. Due to its high demand in the local, national and international drug manufacturers, illegal, unscientific and indiscriminate extraction of *Aconitum heterophyllum* Wall from its wild habitat has increased. Micropropagation provides a best tool for large scale production of propagules and its conservation especially in case of endangered medicinal herb, where explant material is available in a very small quantity. Viability of seeds, age of explant and the tissue source from which the explant is excised are very important for high frequency of regeneration. The most important treatment prior to culture initiation is perhaps surface sterilization of plants. Since *in-vitro* propagation provide suitable environment for growth of fungus and bacteria, unsuccessful sterilization hinders the progress of micropropagation studies. Many of the organisms that are residents on mammalian skin can survive in *in-vitro* cultures and therefore faulty aseptic techniques can also result in contamination. Therefore, reduction of contamination requires efficient aseptic techniques in tandem with effective sterilization methods (Falkiner, 1990).

Sterilization of a material (explant/seeds) before subjecting them for *in-vitro* propagation is essential for the production of 'clean' *in-vitro* plantlets that ensures the reduction of the contaminants as well as high survival rate of explants.

Requirements may differ for different parts of plants depending on their morphological characters like softness /hardness of the tissue etc. Therefore, in the present study, three sterilizing agents in different concentration with varying time of exposure were tested for sterilization of explants as well as for seeds of *Aconitum heterophyllum.*

In case of nodal segments taken as explant, 100% healthy plants were obtained with 0.1% (w/v) $HgCl_2$ at 5 minutes showing significant reduction in both the bacterial as well as fungal contamination, while other two sterilizing agent

did not give acceptable sterilization percentage even on increasing time and concentration. The results are very much in conformity with other previous studies on various medicinal plants medicinal plants *viz.*, *Podophyllum hexandrum, Asparagus densiflorous, Balanites aegyptiaca* (L) Del., *Cinnamomum camphora and C. verum, Plumbago zeylanica* Linn., *Basilium polystachyon* etc. (Sultan *et al.*, 2006; Dasgupta *et al.*, 2007; Gour *et al.*, 2007; Soulange *et al.*, 2007; Sivanesan, 2007; Amutha *et al.*, 2008). Same concentration of $HgCl_2$ was effective in case of *Inula racemosa* Hook.f. (Jabeen *et al.*, 2007) and *Picrorhiza kurroa* (Sood & Chauhan, 2009) but the time of exposure was comparatively less, 2 min. and 30 sec respectively.

90% of aseptic seed germination was obtained when sterilized for 5 minutes with 7.5% (v/v) H_2O_2. The other two sterilizing agents NaOCl and $HgCl_2$ did not give acceptable sterilization even on increasing concentration. The statistical interaction between time and concentration with $HgCl_2$ was found to be significant, while it was insignificant in case of NaOCl. This difference shows that time and concentration of sterilizing agent may vary with the type of tissue used for sterilization. As compare to the hilum/radicle of the seeds, the nodal explants are more open to the external environmental elements, so it requires comparatively strong sterilizing agent which is observed in the present study.

The detailed review of the earlier studies reveal that there is only scanty published data on sterilization of *Aconitum heterophyllum*, as sterilization is the initial and vital step of micropropagation, minute error can lead to loss of whole culture with waste of time and labor. So, much attention is needed while sterilizing specially when dealing with such a valuable and endangered medicinal herb.

Rate of propagation of *Aconitum heterophyllum* is far less as compared to its exploitation. Results of the study reveal that the protocol developed for the sterilization of *Aconitum heterophyllum* has the potential to be reproduced and utilized for the large scale multiplication of disease free plants of *Aconitum heterophyllum* for its uninterrupted supply to herbal drug industries and simultaneously conserving this medicinal herb, an indigenous endangered medicinal plant.

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25/03/2010

Output Performance Of Food-Crop Farmers Under The Nigerian Agricultural Insurance Scheme In Imo State, South East, Nigeria

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ABSTRACT: The Nigerian Agricultural Insurance Scheme was established in 1984 by the Federal Government with the promotion of agricultural production as one of its specific objectives. This study was conducted to evaluate the output performance of the food-crop farmers who have embraced the scheme. The study also analysed the influence of socio-economic characteristics on the farmers output. Primary data and secondary information sources were used in the study. The primary data were obtained from 77 food-crop farmers selected through simple random sampling from a list of 145 food crop farmers under the scheme in Imo State. Data analyses were done using both descriptive and inferential statistics. The descriptive statistics such as mean, frequency were used to analyse the socio-economic characteristics of the farmers while inferential statistics (Z - test and multiple regression model) were used to determine the impact and influence of socio-economic characteristics like age, farming experience, educational background etc on the farmers' output respectively. The Z – test analysis of the impact of the scheme on the farmers' output showed that there was a positive and significant change in the farmers' output after insurance. The results of the analyses of the socio-economic characteristics of the respondent farmers showed that majority (66.23%) of the sampled farmers are males. It also showed that majority (46.75%) of the sampled farmers were within the age bracket of 41-50 years. Also, over 70% of the insured farmers had secondary school education and above. The Z – test analysis showed that there was an increase in farm output of the farmers after embracing the scheme. The average farm output was 16.01 metric tones before insurance but rose to 21.66 metric tones after insurance. The multiple regression analysis on the influence of socio-economic characteristics on the farm output after insurance showed that educational level, farming experience, farm size and number of technologies used in the farm are significant variables. While age, sex and household size are insignificant variables. The study therefore recommends that more effort should be put in to creating awareness of the laudable objectives of the insurance scheme to food-crop farmers (especially in the enhancing the nation's quest for food security. [Academia Arena, 2010;2(6):43-47] (ISSN 1553-992X).

Key words: Insurance, Output-Performance; Food-Crop; Food-Security, Farm- income; Nigeria

INTRODUCTION

Agricultural production is inherently a risky business and farmers face a variety of weather, pest, disease, input supply and market related risks.(Skees et al,1999). Because of risks inherent in agricultural production which lead to farm income uncertainty, many farmers express fears on their ability to meet overhead costs, family needs, and also repay any debt. On the other hand, formal lending institutions also express apprehension on farmers' repayment ability of loans. These lenders seek to reduce the possibility of poor loan recovery by reducing amount of loan to agriculture and in some cases seek collateral from the farmers before granting a loan. This has led governments all over the world to intervene with a range of risk management programmes for farmers thereby enhancing their credit worthiness before lending institutions (Mishra, 1996; Hazell, 1992)

Agricultural Insurance, in its widest sense may be defined as the stabilization of income, employment, price and supplies of agricultural products by means of regular and deliberate savings and accumulation of funds in small installments by many in favourable time periods to defend some or few of the participants in bad time periods (Arene, 2005).The term "insurance" is simply "a risk management strategy". The Nigerian Agricultural Insurance Scheme was established in 1984 with offices in all the 36 States of the Country of which Imo State is one. It has the broad objective to offer protection to the farmer from effects of natural disasters. Specifically, the Agricultural Insurance Scheme was designed to promote agricultural production; provide financial support to farmers in the event of losses arising from natural disasters; increase the flow of agricultural credit from lending institutions to the farmers and minimize the need for emergency

assistance provided by the government during periods of agricultural disaster (NAIC2007).

The primary motive of any agricultural insurance policy is to serve as a security for losses resulting from natural disasters. It also serves as collateral for agricultural loan to the farmers from banks.(Arene, 2005; Oguoma, 2002) There are some food-crop farmers who embraced the scheme since its inception to date in Imo state, with the hope of attaining the scheme's laudable objectives at least, in terms of increased output. Therefore, the focus of this study was to evaluate the impact of the insurance scheme on the farmers' output. It will also determine the influence of identified socio-economic characteristics on the insured farmers output.

MATERIALS AND METHODS

This study was conducted in Imo State, Nigeria. The State has a land area of 5,530 square kilometers and a population of 3.38 million people.(ISPEC,2008) The major food-crops grown in the state are yam, cassava, cocoyam, maize beans and melon.(MANR,2008) The state is divided into 27 local government areas and these are grouped into 3 Agricultural Zones – Okigwe, Orlu and Owerri. The sampling frame was the list of 145 insured Food Crop farmers obtained from the Nigerian Agricultural Insurance Company (the Scheme's operating agency). From the list, 77 farmers were selected through simple random sampling technique and a structured questionnaire administered on them by the researchers. The impact of the scheme on the farmers' output was determined using the Z – test statistic formula

$$Z = \frac{\bar{X}_2 - \bar{X}_1}{\sqrt{\frac{S_2^2 + S_1^2}{n_2 + n_1}}}$$

Where

$\bar{X}_2$ = average farm output after insurance (in metric tones)

$\bar{X}_1$ = average farm output before insurance (in metric tones)

S_2 = output variance after insurance

S_1 = output variance before insurance

n_1, n_2 = Sample size

The influence of the identified socio-economic characteristics of the sampled farmers on their farm output was determined using the multiple regression model which is implicitly stated thus

$Q = f(x_1, x_2, x_3, x_4, x_5, x_6, e)$

Where

Q = farm output after insurance (in metric tones)

X_1 = Age

X_2 = Gender (dumng, 1 = Male o = female)

X_3 = Household size

X_4 = Farming experience (in years)

X_5 = Educational level (in years)

X_6 = Farm size (in hectares)

The above model was tried on four (4) functional forms as stated by Olayemi (1998)

i. Linear

$$Q = a_0 + a_1 x_1 + a\, a_2 + a_{3+} a_4 x_4 + a_5 x_5 + a_6 x_6 + e$$

ii. Double log

$$\text{Log } Q\, \varphi = a_0 + a_1 \log X_1 + a_2 \log x_2 + a_3 \log x_3 + a4 \log x4 + a_5 \log x_5 + a_6 \log x_6 + e$$

Iii Exponential

$$\text{Log } Q\, \varphi = a_0 + a_1 x_1 + a_2 x_2 + a_3 x_3 + a_4 x_4 + a_5 x_5 + a_6 x_6 + e$$

iv. Semi log

$$Q = a_0 + a_1 \log x_1 + a_2 \log x_2 + a_3 \log x_3 + a4 \log x4 + a_5 \log x_5 + a_6 \log x_6 + e$$

The chosen functional form is the one that gives the best fit to the data based on number of significant variables, magnitude and conformity of the signs of the coefficients of the variables to *a priori* expectations and the value of the coefficient of determination (R^2).(Olayemi,1998)

RESULTS

Table 1 shows a summary of the socio-economic characteristics of sampled farmers .

Table 1: Socio-Economic Characteristics Of Sampled Insured Farmers In Imo State.

Variable	Frequency	Percentage
Age (in years)31-40		
31-50	5	6.49
51-60	36	46.75
61-70	26	33.77
Total	10	12.99
	77	**100**
Gender		
Male		
Female	51	66.23
Total	26	33.77
	77	**100**
Educational level		
Primary (1-6 years)		
Secondary(7 – 11 years)	18	23.38
Tertiary (12-15 years)	42	54.56
Total	17	22.08
	77	**100**
Farming experience (in years)		
1-10		
11-20	18	23.38
21-30	38	49.35
31-40	16	20.77
41-50	3	3.90
Total	2	2.60
	77	**100**
Household Size		
1-3		
4-6	14	18.18
7-9	31	40.26
10-12	26	33.77
13-15	5	6.49
Total	1	1.30
	77	**100**

Source: Field Survey data, 2008

The identified socio-economic characteristics of the farmers are age, sex, household size, farming experience, educational background and farm size: The result analysis shows that majority (46.75%) of the insured farmers are within the age bracket of 41-50 years while the lest (6.49%) are with the age bracket of 31-40 years. It also showed that 66.23% of the sampled farmers are males while 33.77% are females. Also, from the analysis of socio-economic characteristics of farmers, 76.64% of the farmers had secondary school education and above. The result analysis also showed that majority (49.35%) of the insured farmers had farming experience of 11-20 years. The analysis also showed that majority(40.26%) of the insured farmers have a household size of 4-6 persons.

The impact of the scheme on the farm output was determined using the ~~Z~~ – test statistic model. The following data obtained were fitted into the model inorder to determine the impact of the scheme on the farmers' output.

Average farm output after insurance (X_2) = 21.66 metric tonnes

Average farm output before insurance (X_1) = 16.01 metric

Output variance after insurance (S_2^2) = 18.85

Output variance before insurance(S_1^2) = 57.46

Number of respondents (n_1, n_2) = 77

This implies that

$$\text{~~Z~~} = \frac{21.66 - 16.01}{\frac{17.85}{77} + \frac{57.46}{77}} = 5.91$$

The farm output performance of the sampled farmers before and after the insurance is presented in table 2.

TABLE 2: FARM OUTPUT OF SAMPLED FARMERS BEFORE AND AFTER INSURANCE

Farm Output (in Metric, tones)	Number of farmers before Insurance	Number of farmers after Insurance
1.0-10.0	24	18
11.0-20.0	34	31
21.0-30.0	14	1
31.0-40.0	7	5
41.0-50.0	0	**77**
Total	**77**	

Field survey data, 2008

The results of the multiple regression analysis on the influence of identified socio-economic variables on farm output are presented in table 3.

TABLE 3: RESULTS OF MULTIPLE REGRESSION ANALYSIS ON INFLUENCE OF SOCIO-ECONOMIC CHARACTERISTICS ON OUTPUT OF INSURED FARMERS IN IMO STATE

Variable	Linear function	Double –log function	Exponential function	Semi-log function
Constant	-36.9822	0.401	-37.30	-37.30
Age (X1)	2.951	0.493	11.076	11.076
	(3.595)**	(3.964)**	(3.551)**	(3.551)**
Sex (x_2)	-0.000	0.002	-0.102	-0.103
	(-0.389)	(0.684)	?(-0.105)	(-0.105)
Household size (x_3)	0.060	0.057	1.996	1.996
	(0.347)	(0.421)	0.591)	(0.592)
Farming	11.684	0.721	18.553	18.553
experience (x_4)	(2.662)**	(“2.972)**	(3.049)**	(3.049)**
	0.279	0.169	3.650	3.650
Educational level (x_5)	(0.604)	(1.179)	(1.018)	(1.017)
	7.498	0.835	19.704	19.704
Farm Size (x_6)	(2.843)**	(2.694)**	(2.533)**	(2.532)**
	0.349	0.408	0.374	0.374
(R_6)				
	1.668			
^{t}(tab)	(5%)			

( ) = t-ratio of coefficient
** = Significant variable at 5%
Source: field survey 2008

From the results, the double-log form was chosen as it performed better than the other forms in terms of value of coefficient of multiple determination (R^2), number of significant variables and conformity of the signs of the coefficients to *a priori* expectations.

A variable is termed “significant” if its t - coefficient is greater than the tabulated t – coefficient at a chosen level of significance.

From the results, the significant variables at 5% level of significance are age, farming experience and farm size while, sex, household size, and educational level are insignificant variables in the determination of farm output of the insured farmers.

DISCUSSION

From the study, it can be inferred that majority of the insured food-crop farmers are middle aged. This may be due to the fact that it is within the age bracket that people are innovative.(Asiabaka,1998) Also, the study shows that the majority of the farmers had secondary school education and above. This is acceptable on the ground that education affects the way

farms are managed as well as overall production.(Nkang et al,2009) Educational level plays a good role in adoption of new policy and undertaking risks.

The Ƶ – test analysis on the impact of the scheme gave a Ƶ – calculated value of 5.91. At 5% level of significance, Ƶ value at 76 degrees of freedom is 1.67 it is therefore inferred that at this insured level of significance farmers had increased farm output after insurance. This is based on the ground that the Ƶ – calculated (5.91) is greater than the Ƶ – tabulated (1.67). It is in agreement with a study by Arene and Tee (1996) which posited that agricultural insurance enhances farm output. This is attributable to the fact that upon adoption of an agricultural

Insurance policy, the farmers become confident that in the event of any loss from risks and uncertainties in their operations, they will be indemnified by the insurer.

The double log multiple regression analysis which was chosen as the best fit from the results show that age, farming Age and farming experience are significant variables in output determination of a farm.(Obasi,2000). Also, it is agreeable that if a farm is managed well, an increase in the farm size will significantly increase the farm output. Experience and farm size are significant variables that affect farm output of insured farmers at 5% level of significance. This result agrees with *a priori* expectations that age, farming experience and farm size significantly influence farm output *cetaris paribus.*

CONCLUSION

The results of the analysis show that food crop farmers in the study area had increased farm output after insurance. It is therefore posited that the agricultural insurance scheme is promoting agricultural production in line with its specific objective. The study therefore recommends that more efforts should be put into creating awareness of the insurance scheme especially to farmers in the rural areas to enhance their output. This will go a long way in making the nation achieve its agenda on food security.

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Model for Computational Analysis of the Quantity of Water Evaporated during Initial Stage Drying of Wet Clay Designated for Production of Spark Plug Ceramic Component

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Abstract: A model has been derived for computational analysis of the quantity of water evaporated during initial drying of wet clay (designated for production of the ceramic component of spark plug). The drying process was carried out at the temperature range: 80-95^{0}C. The model;

$$\beta = \text{Antilog}[(0.9524\ \text{Log}(833/T)]$$

indicates that the quantity of evaporated water during the drying process is dependent on the drying temperature, the evaporating surface being constant. It was found that the validity of the model is rooted on the expression N Logβ = Log (A/T) where both sides of the expression are correspondingly approximately equal to 1. The maximum deviation of the model-predicted quantity of evaporated water from the corresponding experimental value is less than 11% which is quite within the acceptable deviation range of experimental results. It was observed that above 80^{0}C, both quantities of evaporated water as obtained from experiment and derived model show proximate agreement; both decreasing with increase in the drying temperature. Water evaporation per unit rise in the drying temperature evaluated from experimental and model-predicted results are -0.16 and -0.10g/^{0}C respectively, indicating proximate agreement. [Academia Arena, 2010;2(6):48-53] (ISSN 1553-992X).

Keywords: Model, Water Evaporation, Dried Clay, Spark Plug Ceramic Component

1. Introduction

Reed (1988) described firing as having three stages through which it proceeds; preliminary reactions which include binder burnout, elimination of gaseous product of decomposition and oxidation, sintering as well as cooling which may include thermal and chemical annealing.

Several works (Reed, 1988; Barsoum, 1997; Viewey and Larrly, 1978; Keey, 1978) have been carried out on shrinkage of clay during drying. In all these works, porosity has been shown to influence the swelling and shrinkage behaviour of clay products of different geometry. Past report (Reed, 1988) shows that drying occurs in three stages; increasing rate, constant and decreasing rate. The report pointed out that during the increasing rate; evaporation rate is high compared with evaporating surface hence more water is lost. At constant rate, the evaporation rate and evaporation surface are constant. The researcher posited that shrinkage occurs at this stage. Keey (1978) also in a similar study suggested that at this stage, free water is removed between the particles, and the inter-particle separation decreases, resulting in shrinkage. During the decreasing rate, particles make contacts as water is removed, which causes shrinkage to cease.

Model for calculating the volume shrinkage resulting from the initial air-drying of wet clay has been derived (Nwoye, 2008). The model;

$$\theta = \gamma^3 - 3\gamma^2 + 3\gamma \qquad (1)$$

calculates the volume shrinkage θ when the value of dried shrinkage γ, experienced during air-drying of wet clays is known. The model was found to be third-order polynomial in nature. Olokoro clay was found to have the highest shrinkage during the air drying condition, followed by Ukpor clay while Otamiri clay has the lowest shrinkage. Volume shrinkage was discovered to increase with increase in dried shrinkage until maximum volume shrinkage was reached, hence a direct relationship.

Nwoye et al. (2008) derived a model for the evaluation of overall volume shrinkage in molded clay products (from initial air-drying stage to completion of firing at a temperature of 1200^{0}C). It was observed that the overall volume shrinkage values predicted by the model were in agreement with those calculated using conventional equations. The model;

$$S_T = \alpha^3 + \gamma^3 - 3(\alpha^2 + \gamma^2) + 3(\alpha + \gamma) \qquad (2)$$

depends on direct values of the dried γ and fired shrinkage α for its precision. Overall volume shrinkage was found to increase with increase in dried and fired shrinkages until overall volume shrinkage reaches maximum.

Nwoye (2009a) derived a model for calculating the quantity of water lost by evaporation during oven drying of clay at 90^0C. The model;

$$\gamma = \exp[(\ln t)^{1.0638} - 2.9206] \quad (3)$$

indicated that the quantity of evaporated water γ, during the drying process is dependent on the drying time t, the evaporating surface being constant. The validity of the model was found to be rooted in the expression $(\text{Log}\beta + \ln\gamma)^N = \ln t$.

Model for predictive analysis of the quantity of water evaporated during the primary-stage processing of a bioceramic material sourced from kaolin has been derived by Nwoye et al. (2009a).

The model;

$$\alpha = e^{(\ln t/2.1992)} \quad (4)$$

shows that the quantity of water α, evaporated at 110^0C, during the drying process is also dependent on the drying time t, where the evaporating surface is constant. It was found that the validity of the model is rooted on the expression $(\ln t/\ln\alpha)^N = \text{Log}\beta$ where both sides of the expression are correspondingly approximately equal to 3. The respective deviation of the model-predicted quantity of evaporated water from the corresponding experimental value was found to be less than 22% which is quite within the acceptable deviation range of experimental results.

Model for quantifying the extent and magnitude of water evaporated during time dependent drying of clay has been derived (Nwoye, 2009b). The model;

$$\gamma = \exp((\ln t/2.9206)^{1.4}) \quad (5)$$

indicates that the quantity of evaporated water γ during the drying process (at 90^0C) is dependent on the drying time, t the evaporating surface being constant. It was found that the validity of the model is rooted in the expression $\ln\gamma = (\ln t/\text{Log}\beta)^N$ where both sides of the expression are correspondingly almost equal.

A model was derived (Nwoye, 2009b) for predicting the quantity of water evaporated during initial stage drying of wet clay designated for production of bricks. The drying process was carried out at a temperature range 80-110^0C. The model;

$$E = \exp[0.3424(\text{Log}T)^{2.3529}] \quad (6)$$

indicates that the quantity of evaporated water during the drying process is dependent on the drying temperature, the evaporating surface being constant. The validity of the model is rooted in the expression $(\ln E \times \text{Log}\beta)^N = \text{Log}\,T$ since both sides of the expression are correspondingly approximately equal to 2. The respective deviation of the model-predicted quantity of evaporated water from the corresponding experimental value is less than 20% which is quite within the acceptable deviation range of experimental results, hence depicting the usefulness of the model. Water evaporation per unit rise in the drying temperature evaluated from experimental and model-predicted results are 0.078 and 0.0502g/^{0}C respectively, indicating proximate agreement.

The present work is to derive a model for computing the quantity of water lost by evaporation during initial stage drying of wet Nsu (Nigeria) clay at a temperature range; 80-95^0C. The clay is designated for production of the ceramic component of a spark plug.

2. Model formulation

Experimental data obtained from research work (Nwoye,2007) carried out at SynchroWell Research Laboratory, Enugu were used for this work. Results of the experiment used for the model formulation are as shown in Table1.Computational analysis of the experimental data (Nwoye, 2007) shown in Table 1, gave rise to Table 2 which indicate that;

$$N\,\text{Log}\beta = \text{Log}\left(\frac{A}{T}\right) \text{ approximately)} \quad (7)$$

$$\text{Log}\,\beta = \text{Log}\left(\frac{\left(\frac{A}{T}\right)}{N}\right) \quad (8)$$

Introducing the values of A and N into equation (8)

$$\text{Log}\,\beta = \text{Log}\left(\frac{\left(\frac{833}{T}\right)}{1.05}\right) \quad (9)$$

$$\text{Log}\,\beta = \left(0.9524\ \text{Log}\left(\frac{833}{T}\right)\right) \quad (10)$$

$$\beta = \text{Antilog}\left(0.9524\ \text{Log}\left(\frac{833}{T}\right)\right) \quad (11)$$

Where

(β) = Weight of water evaporated during the drying process (g)

A = Area of evaporating surface (mm^2)

N = 1.05(Collapsibility coefficient of binder-clay particle boundary at the drying temperature range ;80-95^{0}C) determined in the experiment (Nwoye, 2007).
(T) = Drying temperature (^{0}C).

Table 1: Variation of quantity of evaporated water with drying temperature. (Nwoye, 2007)

(T)	A	(β)
80	833	9.60
85	833	8.80
88	833	8.35
90	833	8.01
95	833	7.98

3. Boundary and Initial Conditions

Consider a rectangular shaped clay product of length 49mm, width 17mm, and breadth 9mm exposed to drying in the furnace while it was in wet condition. Initially, atmospheric levels of oxygen are assumed. Atmospheric pressure was assumed to be acting on the clay samples during the drying process (since the furnace is not air-tight). The grain size of clay particles used is 425μm, weight of clay and binder (bentonite) used (for each rectangular product); 100g and 10g respectively, quantity of water used for mixing; 2% (of total weight), range of drying temperature used; 80-95^{0}C, area of evaporating surface;833mm^2 and drying time used; 130 minutes.

The boundary conditions are: atmospheric levels of oxygen at the top and bottom of the clay samples since they are dried under the atmospheric condition. No external force due to compression or tension was applied to the drying clays. The sides of the particles and the rectangular shaped clay products are taken to be symmetries.

4. Model Validation

The formulated model was validated by direct analysis and comparison of the model-predicted β values and those from the experiment for equality or near equality.

Analysis and comparison between these β values reveal deviations of model-predicted β from those of the experimental values. This is believed to be due to the fact that the surface properties of the clay and the physiochemical interactions between the clay and binder, which were found to have played vital role during the evaporation process (Nwoye, 2007) were not considered during the model formulation. This necessitated the introduction of correction factor, to bring the model-predicted β value to that of the corresponding experimental value.

Deviation (Dv) (%) of model-predicted β values from the experimental β values is given by

$$Dv = \left(\frac{Pw - Ew}{Ew} \right) \times 100 \qquad (12)$$

Where
Pw = Quantity of water evaporated as predicted by model (g)
Ew = Quantity of water evaporated as obtained from experiment (g) (Nwoye,2007)

Correction factor (Cf) is the negative of the deviation i.e

$$Cf = -Dv \qquad (13)$$

Therefore

$$Cf = -100 \left(\frac{Pw - Ew}{Ew} \right) \qquad (14)$$

Introduction of the value of Cf from equation (14) into the model gives exactly the corresponding experimental value of β (Nwoye, 2007).

5. Results and Discussion

The derived model is equation (11). Computational analysis of the experimental data (Nwoye, 2007) shown in Table 1, gave rise to Table 2

Table 2: Variation of NLogE with Log (A/T)

NLogE	Log (A/T)
1.0314	1.0176
0.9917	0.9912
0.9678	0.9762
0.9488	0.9664
0.9471	0.9429

5.1 Evaporation per unit rise in drying temperature

Water evaporated per unit rise in temperature resulting from drying of the clay at a temperature range 80-95^{0}C was determined following comparison of the evaporation per unit rise in temperature obtained by calculations involving experimental results, and model-predicted results obtained directly from the model.

Evaporation per unit rise in the drying temperature, E_d (g /^{0}C) was calculated from the equation;

$$E_d = E/T \qquad (15)$$

Therefore, a plot of mass of water evaporated E against drying temperature T, as in Fig. 1 using experimental results in Table 1, gives a slope, S at points (9.60, 80) and (8.01, 90) following their substitution into the mathematical expression;

$$S = \Delta E/\Delta T \qquad (16)$$

Equation (16) is detailed as

$$S = E_2 - E_1 / T_2 - T_1 \qquad (17)$$

Where

ΔE = Change in the quantities of water evaporated E_2, E_1 at two drying temperature values T_2, T_1. Considering the points (9.60, 80) and (8.01, 90) for (E_1, T_1) and (E_2, T_2) respectively, and substituting them into equation (17), gives a negative slope: - 0.16 g/^{0}C which is the quantity of water evaporated per unit rise in the drying temperature during the actual experimental drying process. Also similar plot (as in Figure 2) using model-predicted results gives a slope. Considering points (9.3146, 80) and (8.3253, 90) for (E_1, T_1) and (E_2, T_2) respectively and substituting them into equation (17) also gives a negative slope, S as - 0.10 g/^{0}C. This is the model-predicted quantity of water evaporated per unit rise in the drying temperature during the drying of the clay. A comparison of these two quantities of water evaporated per unit rise in the drying temperature shows proximate agreement. This indicates a very high degree of validity for the model as a reliable tool for computational analysis of the quantity of water evaporated as well as the evaporation per unit rise in the drying temperature during drying of Nsu clay at a temperature range 80-95^{0}C.

An ideal comparison of the quantities of water evaporated per unit rise in the drying temperature as obtained from experiment and as predicted by the model for the purpose of testing the validity of the model is achieved by considering the R^2 values. The values of the correlation coefficient, R calculated from the equation;

$$R = \sqrt{R^2} \qquad (18)$$

using the r-squared values (coefficient of determination) from Figures.1 and 2 show a better correlation (0.9984) with model-predicted quantity of water evaporated per unit rise in the drying temperature than that obtained from experiment (0.9419). This suggests that the model predicts more accurate, reliable and ideal quantity of evaporated water than the actual experiment despite its deviations from the experimental values.

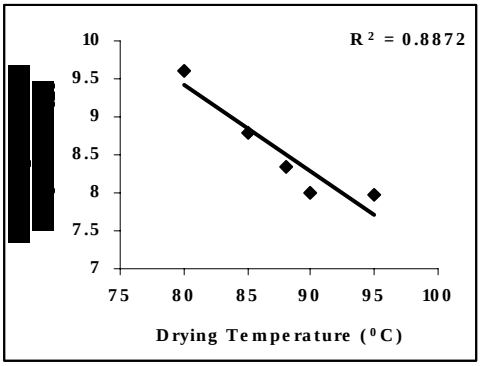

Figure 1. Effect of drying temperature on the quantity of water evaporated (as obtained from the experiment (Nwoye,2007))

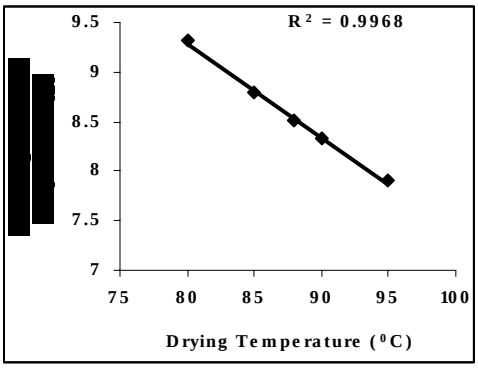

Figure 2. Effect of drying temperature on the quantity of water evaporated (as predicted by model)

Figure 3 shows that the quantities of water evaporated per unit rise in the drying temperature as obtained from the experiment (Nwoye, 2007), designated by the line ExD and as predicted by the model (line MoD) are in very good agreement within the drying temperature range used. Figure 3 shows that above 80^{0}C, both quantities of evaporated water as obtained from experiment (Nwoye,2007) and derived model show proximate agreement; both decreasing with increase in the drying temperature.

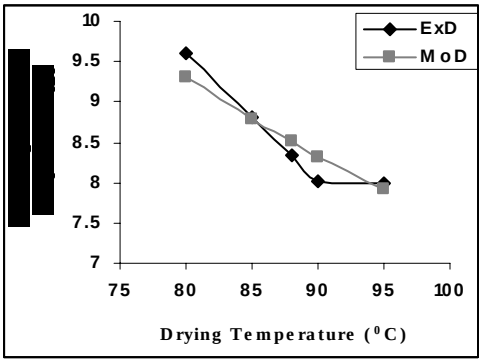

Figure 3 Comparison of the quantity of water evaporated as obtained from the experiment (Nwoye,2007) and as predicted by the model

5.2 Effect of drying temperature on the deviation and correction factor to model-predicted quantity of evaporated water

It was found that the validity of the model is rooted in the expression N Logβ = Log (A/T) where both sides of the expression are correspondingly approximately equal to 1. Table 2 also agrees with equation (7) following the values of N Logβ and Log (A/T) evaluated from Table 1 as a result of corresponding computational analysis.

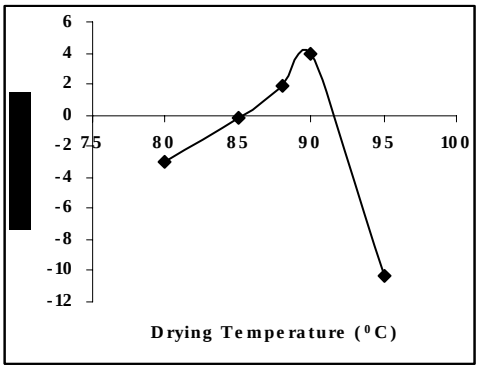

Figure 4. Variation of deviation (from experimental values) of model-predicted quantity of water evaporated with drying temperature

The maximum deviation of the model-predicted quantity of evaporated water from the corresponding experimental value is less than 11% which is quite within the acceptable deviation range of experimental results, hence depicting the usefulness of the model.
Figure 4 show that above 90^0C, the deviation (from experimental values) of the model-predicted quantity of evaporated water increases in magnitude with rise in the drying temperature.

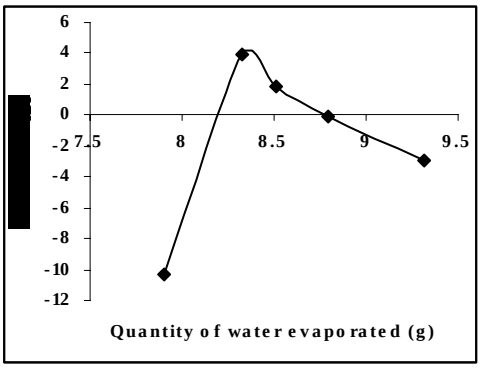

Figure 5. Variation of deviation (from experimental values) with model-predicted quantity of water evaporated

Figure 4 indicates that the highest and least deviations are -10.35 and -0.11% respectively corresponds to the drying temperatures: 95 and 85^0C respectively. Comparison of Figures 4 and 5 shows that these percent deviations also correspond to the model-predicted quantities of evaporated water: 7.9071 and 8.7906 g respectively. Figures 4-6 show that the orientation of the curve of the correction factor against the drying temperature is opposite that of the deviation against drying temperature. This is attributed to the fact that correction factor is the negative of the deviation as shown in equations. (13) and (14). It is believed that the correction factor takes care of the effects of the surface properties of the clay and the physiochemical interaction between the clay and the binder which (affected experimental results) were not considered during the model formulation.

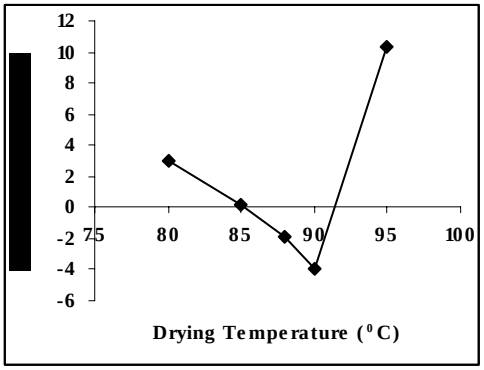

Figure 6. Variation of correction factor (to the model-predicted quantity of water evaporated) with drying temperature

6. Conclusion

The model computes the quantity of water evaporated during oven drying of Nsu (Nigeria) clay at a temperature range 80-95^0C. The validity of the model is rooted in the expression N Logβ = Log (A/T) where both sides of the expression are correspondingly approximately equal to 1. The respective deviation of the model-predicted quantity of evaporated water from the corresponding experimental value is less than 11% which is quite within the acceptable deviation range of experimental results. Water evaporation per unit rise in the drying temperature evaluated from experimental and model-predicted results are -0.16 and 0.10 g/^{0}C respectively, indicating proximate agreement.
Further works should incorporate more process parameters into the model with the aim of reducing the deviations of the model-predicted β values from those of the experimental.

Acknowledgement

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Model for Predictive Analysis of the Concentration of Dissolved Lead In Relation to the Initial and Final Solution pH during Leaching of Galena in Butanoic Acid

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Abstract: A model has been derived for predictive analysis of the concentration of dissolved lead during leaching of galena in butanoic acid solution. The model;

$$Pb = \text{Antilog}\left[\exp\left[(\gamma/\alpha)^{0.7407}\right]\right]$$

shows that the concentration of dissolved lead during the leaching process is dependent on the values of the initial and final leaching solution pH. The validity of the model was found to be rooted in the expression $(LogPb)^N = e^{(\gamma/\alpha)}$ where both sides of the expression were correspondingly approximately almost equal. The maximum deviation of the model-predicted concentrations of dissolved lead from the corresponding experimental values is less than 7% which is quite within the acceptable deviation limit of experimental results. [Academia Arena, 2010;2(6):54-61] (ISSN 1553-992X).

Key words: Model, Lead Dissolution, Solution pH, Butanoic Acid, Galena Leaching.

1. Introduction

Past report (Okoro,2004) shows feasibility studies on the extraction of lead from Ishiagu lead-zinc ore has been carried out with the view to knowing the possibility of extracting lead from Ishiagu galena using different acid types. The results of the investigation reveal that the weight concentration of lead after leaching with dilute nitric acid, sulphuric acid and aqueous solution of both acids are 39.5% w/w, 14.16% w/w and 15.18% w/w respectively. These results indicate that nitric acid gave the best result of recovery (84.2%), with original lead in the ore being 46.9% w/w.

It has been suggested (Onyemaobi, 1990a) that flotation of sphalerite could be carried out using some imported reagents and fuel oil, using a method of recovery called froth flotation. This method was found to utilize the difference between the physico-chemical surface properties of a mineral. This conclusion followed a research carried out by Onyemaobi (1990a) to evaluate the flotation performance of Nigeria's sphalerite from lead-zinc ore with particular reference to the Ishiagu lead-zinc ore. It has been discovered (Onyemaobi and Anyakwo, 1996) that most lead-zinc ores are fine grained and are concentrated mainly by flotation. The flotation results obtained in this work (Ishiagu ore inclusive) are that the factors affecting flotation includes (1) Degree of oxidation (2) Abundance in nature of iron sulphide and nature of a non-sulphide gangue (Onyemaobi and Anyakwo, 1996). Galena was found (Onyemaobi, 1990b) to float in slightly alkaline medium (pH9-10) with short-chain xanthates (potassium ethyl xanthates, isopropyl xanthates). In addition to this, it was discovered that at the critical pH of 10.4 when ethyl xanthate is used, usage of lime would make it behave like a depressant (Onyemaobi, 1990b). Investigation on the role of pH on flotation of sphalerite from Ishiagu lead-zinc ore has been carried out (Agha,1990). The result of the investigation reveals that if there are no activator ions in the medium, sphalerite does not float with xanthate and dithiophosphate collector. Activation and flotation of sphalerite in acid medium (pH4-5) is performed with As, Sb, and Pt ions and in neutral conditions (pH 6.8-7.3) Ce, Pb, Cu, Cd, Ag, Hg, B and Au ions became effective (Agha, 1990).

It has been discovered (Olubambi et al.,2007) that during bioleaching of Ishiagu lead-zinc ore, using mixed cultures of Acidithiobacillus Ferrooxidans, Acidithiobacillus Thiooxidans and Leptospirillum Ferrooxidans, higher silica contents of the ore reduce acidity, iron mobility and oxidation. It was also found (Olubambi et al., 2006) during the leaching of zinc and copper out from their respective sulphide ore that the concentrations of zinc and copper formed reduced as particle size decreased while silica, sulphur, iron and lead contents increased. Also leaching rate of copper was found to be lower than zinc. Results of sedimentation analysis carried out by Nwoye (2009) indicate that the average grain size of Ishiagu galena

concentrate is approximately 100μm. The researcher also found that the mechanism of bioleaching of Ishiagu galena concentrates was indirect mechanism. This was sequel to the dominance of Fe^{3+} ions over H^+ during the leaching process. The best operating conditions for the highest yield of Pb were found to be; leaching temperature of not less than 32^0C, starting pH of leaching solution in the range 1.8 – 2.0, concentration of Fe^{2+} in the starting leaching solution: $2g/dm^3$ (0.007M), grain size of ore to be leached: 0.063μm, mixed culture of Acidithiobacillus Ferrooxidans (ATF), Acidithiobacillus Thiooxidans (ATT) and a newly discovered bacteria (CBT). The microorganisms, Acidithiobacillus Ferrooxidans are able to oxidize ferrous ions and the reduced sulphur compounds (Haver and Wong, 1971) while Acidithiobacillus Thiooxidans are able to oxide only reduced sulphur compound summarized by the reaction (Sklodowska, 1990; Cwalina, 1994).

$$2Fe^{2+} + 2H^+ + 0.5O_2 + \text{bacteria} \rightarrow 2\,Fe^{3+} + H_2O \quad (1)$$

$$S^{2-} \rightarrow S^0 \rightarrow S_2O_3^{2-} \rightarrow S_4O_6^{2-} \rightarrow SO_3^{2-} \rightarrow SO_4^{2} \quad (2)$$

Researchers (Makita et al., 2004) discovered that arsenic can be reduced in a complex galena concentrate by Acidithiobacillus Ferrooxidans. The results of the investigation reveal that arsenopyrite was totally oxidized. The sum of arsenic remaining in solution and removed by sampling represents from 22 to 33% in weight (yield) of the original content in the mineral. The rest of the biooxidized arsenic form amorphous compounds that precipitate galena (PbS) was totally oxidized too, anglesite ($PbSO_4$) formed is virtually insoluble and remains in the solids. The influence of seven factors in a batch process was studied. The maximum rate of arsenic dissolution in the concentrate was found using the following levels of factors; small surface area of particle exposure; low pulp density, injecting air and adding the leaching medium to the system. It was also found that ferric chloride and carbon dioxide decreased the arsenic dissolution rate. Bioleaching kinetic data of arsenic solubilization were used to estimate the dilution rate for a continuous culture. Calculated dilution rates were relatively small ($0.88 - 0.103day^{-1}$) (Makita et al., 2004).

It has been found (Williamson, 2005) that the leaching rates of single sulphide minerals decreased in the order pyrite > sphalerite > galena > chalcopyrite, with the rate of pyrite dissolution being of a similar magnitude to the highest values reported previously (Williamson, 2005). The leaching rates of galena, chalcopyrite and sphalerite increased by factors of 31, 18 and 1.5, respectively, in the presence of pyrite, due to its superior catalytic properties. In the galena + pyrite experiment, the concentration of Fe did not increase appreciably between the first and final sampling times, whilst the Pb concentration did increase significantly. Hence, galvanically promoted dissolution of galena + pyrite decreases the pyrite electrode potential and its dissolution rate. Also in the galena + pyrite experiment, 75% of the total S in solution as measured by ICP –AES was detectable by HPLC, which detects only anionic species; this could be due to the presence of colloidal elemental S (Williamson, 2005). Acid leaching of lead sulphide has been investigated (Prosper, 2005). The results of the investigation indicate that prior to mineral addition, the redox potential of the acid solutions was 360 ± 10mV (SHE). On addition of the mineral powders, the value changed rapidly. In most cases, the redox potential then decreased by a few tens to a hundred or more mV to reach a stable value, except for the single-phase galena + pyrite mixture, for which the redox potential rose continuously throughout the experiment. The ranges of redox potential at pH 2.5 recorded for each single mineral sample are plotted onto the potential pH diagram for the S – H_2O system. Although the pH of the leach solution was kept constant, the generation or consumption of protons could be determined by monitoring the volume of acid needed to maintain a pH of 2.5. Dissolution of oxidation products formed during grinding of galena produced dissolved Pb(II) and sulphur concentrations significantly higher than in the case of sphalerite leaching. However, concentrations of both species decreased over the first hour of the experiment, probably due to restricted solubility of $PbCl_2$ and $PbSO_4$, the latter phase having a particularly low solubility product Ksp ($PbSO_4$) = $10^{-7.86.}$ The equations of the reactions involved are as follows.

$$(1-y)(PbS + 4Cl^- \longrightarrow PbCl^{2-}_4 + S + 2e^-) \quad (3)$$

$$y(PbS + 4Cl^- + 4H_2O \rightarrow PbCl^{2-}_4 + SO^{2-}_4 + 8H^+ + 8e^-) \quad (4)$$

Though the dissolved metal to sulphur ratios were not as high as in the case of sphalerite leaching, they increased from 1.3 (y = 0.7) after 19mins to 2.5 (y = 0.4) after 182min. Based on the XPS data, no significant changes in S speciation occur at the surfaces of these minerals as a result of atmospheric oxidation and acid leaching. Elemental S has been reported (Rawlings, 2005) at the surfaces of both air oxidized and acid-leached galena but no evidence for the presence of elemental S was obtained here possibly due to the sulphur desorption in UHV chamber of the instrument, which had no low – temperature range (Prosper, 2005).

Lead sulphide is rapidly attacked by ferric ion over a wide range of conditions. Soluble lead chlorocomplexes as well as ferric and ferrous chlorocomplexes are formed. It is to be expected after all, that the various metal chlorocomplexes would play an important role in the leaching reaction mechanism.

In addition, it is clear from the result of previous workers that the effect of Fe^{3+}, Cl^- and H^+ are coupled, and that the reaction kinetics and the mechanism of ferric chloride leaching of PbS have not been clearly established (Dutrizac, 1986). Rapid parabolic kinetics were observed in this study under all conditions and it was shown that the parabolic rate constant was directly proportional to the area of galena being leached. In the presence of ferric ion, the rate was insensitive to HCl concentrations < 3.0M, but increased rapidly at higher acidities because of direct acid attack of the sulphide. In the absence of ferric ion, the rate increased steadily with increasing HCl concentrations, and linear kinetics was observed. The galena leaching rate increased as ($FeCl_3$) for $FeCl_3$ concentrations in the range 0.01-0.1M, but decreased slightly with increasing $FeCl_3$ concentrations in the range 0.1M to 2.0M $FeCl_3$. The rate was virtually independent of the concentration of the $FeCl_2$ reaction product. The presence of significant amount of the $PbCl_2$ reaction product, however, caused the galena leaching rate to decrease rapidly. A minimum leaching rate was realized in saturated $PbCl_2$ solutions (Dutrizac, 1986). Studies (Dutrizac, 1986) on the ferric chloride brine leaching of galena concentrate have been carried out. The results of the investigation reveal several advantages of ferric chloride over the reagents as a leaching media which includes that it exhibits substantially faster dissolution rates for most sulphides, it is regenerated easily by chlorination of ferrous chloride leaching by-products, and it has greater potential for the treatment of complex sulfides (Dutrizac, 1986). Further studies (Seon-Hyo et al., 1986) on the ferric chloride brine leaching of galena concentrate have been carried with the view to investigating the thermodynamics and kinetics of the process. Seon–Hyo etal. (1986) discovered that under the leaching condition of their work, the distribution of the various metal chloro complexes is relatively insensitive to the extent of PbS dissolution (Seon–Hyo et al., 1986). Investigations (Dix and Hendrix, 1986) on the Cl_2-O_2 leaching of galena flotation concentrate have been done with the view to evaluating the kinetics of the process. The results of this investigation indicate that the rate of gas transfer can be enhanced by increasing the partial pressure of the gas and by using vigorous agitation to increase the surface area of the liquid-gas interface.

Nwoye (2009a) derived a model for predicting the leaching rate of lead during bioleaching of galena using different strains of bacteria such as ATF, ATT and the newly discovered bacteria (CBT and CTT). The model;

$$Ø = e^{-(\Upsilon + \ln\Upsilon)} \qquad (5)$$

referred to as pH-model, calculates the leaching rate when the pH of the leaching solution is known at any instant during the leaching process.

Where

γ = pH of the leaching solution at any instant during the leaching process.

Ø= Leaching rate of lead from galena (g/dm^3hr^{-1})

On multiplying both sides of the model by leaching time t, the model then calculates the concentration of Pb leached out as $\Theta = e^{-(\Upsilon + \ln\Upsilon)}t$.

Nwoye (2009a) also derived a model (known as ΔG – model) for predicting the leaching rate of lead relative to the bacterial leaching index and the free energy change associated with the bioleaching process involved. The model;

$$Ø = 10^{(\Delta G/C)} \qquad (6)$$

calculates the leaching rate when the values of the free energy change ΔG, associated with the leaching reaction as well as bacterial leaching index C, are known. This model indicates that the value of the leaching rate and concentration of leached Pb depends largely on the nature and leaching ability of bacteria or bacteria consortium used. It was observed that the greater the value of C, the higher the bacterial leaching ability and tendency. It was also found that the bacterial leaching index of bacillus spp is within the range 2-2.2 while mixed cultures of bacillus spp gave greater value (close to 3) of C than the case of single bacillus spp (Nwoye, 2009a). Based on the fore going, given the values of the leaching rate and the associated free energy change, the specie of the bacteria used can be identified by calculating the value of C, just by re-arranging the model as C = ΔG/log Ø. It was observed that pseudomonas spp. of bacteria have a value of C, less than 1. This value was found to be associated with very poor yield of Pb and leaching rate. Furthermore, on multiplying both sides of the model by the leaching time t, the model then calculates the concentration of leached Pb as $\Theta = (10^{(\Delta G/C)})\,t$.

Nwoye (2009a) further derived a more comprehensive and precision-enhanced model by jointly associating the pH-model and ΔG-model. The resultant model;

$$\Delta G = \text{Log}\left[\, e^{-(\Upsilon+\text{In}\Upsilon)}\right]^{C} \qquad (7)$$

not only calculates both the leaching rate and concentration of leached Pb (though indirectly), but also calculates directly the free energy change associated with the leaching process as well as the bacterial leaching index, as the case may be providing that two of the process parameters are known. The pH of the leaching solution during the leaching process can also be calculated using this model.

It has been found (Nwoye,2009a; Pinches, 1975) that the final pH of the leaching solution depend on the leaching time, initial pH for the leaching solution and

the leaching temperature.
Nwoye (2009b) derived a model for predicting the initial solution pH at pre-assumed final pH and concentration of dissolved zinc, during leaching of galena in butanoic acid solution. The model;

$$\alpha = \left(\frac{1.4\gamma}{\ln[(Zn)^{1/3}]} \right) \quad (8)$$

shows that the initial pH of the leaching is dependent on the values of the pre-assumed final solution pH and concentration of dissolved zinc. The validity of the model was rooted in the expression $e^{N(\gamma/\alpha)} = \sqrt[3]{Zn}$ where both sides of the expression were approximately equal to 4. The respective deviation of the model-predicted initial solution pH value from that of the corresponding experimental value was less than 2% which is quite within the acceptable deviation limit of experimental results.
The aim of this work is to derive a model for predictive analysis of the concentration of dissolved lead in relation to the initial and final solution pH during leaching of Ishiagu (Nigeria) galena in butanoic acid.

2. Model

During the leaching process, the ore was assumed to be stationary in the reaction vessel and contains the un-leached lead and zinc as part of reaction remnants. The ore was attacked by hydrogen ions from butanoic acid within the liquid phase, and in the presence of oxygen.

2.1 Model Formulation

Results from experimental work (Nwoye, 2008) carried out at SynchroWell Research Laboratory, Enugu were used for the model derivation. These results are as presented in Table 1.
Computational analysis of these experimental results (Nwoye, 2008) shown in Table 1, resulted to Table 2 which indicate that;

$$(\text{Log Pb})^{N} = e^{(\gamma/\alpha)} \quad \text{(approximately)} \quad (9)$$

Introducing the value of N into equation (9)

$$(\text{Log Pb})^{1.35} = e^{(\gamma/\alpha)} \quad (10)$$

Multiplying the indices of both sides of equation (10) by 1/1.35

$$\text{Log Pb} = \left[e^{(\gamma/\alpha)}\right]^{0.7407} \quad (11)$$

$$\text{Pb} = \text{Antilog}\left[\left[e^{(\gamma/\alpha)} \right]^{0.7407}\right] \quad (12)$$

Where

N = 1.35 (Dissolution coefficient of lead in butanoic acid) determined in the experiment (Nwoye, 2008).
α = Initial pH of the butanoic acid leaching solution just before the leaching process started.
γ = Final pH of the butanoic acid leaching solution at time t.
Pb = Concentration of dissolved lead during the leaching process (mg/kg)
Equation (12) is the derived model**.**

Table1: Variation of the initial and final pH of the butanoic acid leaching solution with the concentration of dissolved lead. (Nwoye, 2008)

(γ)	(α)	Pb (mg/kg)
3.98	3.80	140.22
4.25	4.08	138.42
4.33	4.24	136.22
4.41	4.36	136.02
4.50	4.46	135.86
4.61	4.55	135.04
4.63	4.60	133.96
4.72	4.67	133.34
4.84	4.81	132.82
4.86	4.83	132.60

3. Boundary and Initial Condition

Iron oxide ore was placed in cylindrical flask 30cm high containing leaching solution of hydrogen peroxide. The leaching solution is non flowing (stationary). Before the start of the leaching process, the flask was assumed to be initially free of attached bacteria and other micro organism. Initially, the effect of oxygen on the process was assumed to be atmospheric. In all cases, weight of iron oxide ore used was 5g. The initial and final pH range of leaching solutions; 3.80 - 4.83 and 3.98 – 4.86 respectively as well as leaching time of 2 hrs (120 minutes) were used for all samples. A constant leaching temperature of 25^{o}C was used. Butanoic acid concentration at 0.23 mol/litre and average ore grain size;150μm were also used. Details of the experimental technique are as presented in the report (Nwoye, 2008).
The leaching process boundary conditions include: atmospheric levels of oxygen (considering that the cylinder was open at the top) at both the top and bottom of the ore particles in the gas and liquid phases respectively. A zero gradient was assumed for the liquid scalar at the bottom of the particles and for the gas phase at the top of the particles. The sides of the particles were assumed to be symmetries.

4. Model Validation

The formulated model was validated by calculating the deviation of the model-predicted initial pH from the

corresponding experimental pH values.

The deviation recorded is believed to be due to the fact that the surface properties of the ore and the physiochemical interactions between the ore and leaching solution which were found to play vital roles during the leaching process (Nwoye, 2008) were not considered during the model formulation. It is expected that introduction of correction factor to the predicted initial pH, gives exactly the experimental initial pH values.

Deviation (Dn) (%) of model-predicted initial pH values from those of the experiment is given by

$$Dn = \left(\frac{P_I - E_I}{E_I} \right) \times 100 \qquad (13)$$

Where

P_I = Predicted initial pH values

E_I = Experimental initial pH values

Since correction factor (Cr) is the negative of the deviation,

$$Cr = - Dn \qquad (14)$$

Substituting equation (13) into equation (14) for Dn,

$$Cr = -100 \left(\frac{P_I - E_I}{E_I} \right) \qquad (15)$$

It was observed that addition of the corresponding values of Cr from equation (15) to the model-predicted initial pH gave exactly the corresponding experimental initial pH values (Nwoye, 2008).

5. Results and Discussion

Computational analysis of these experimental results (Nwoye,2008) shown in Table 1, resulted to Table 2.

Table 2: Variation of $e^{(\gamma/\alpha)}$ with $(LogPb)^{1.35}$

(γ/α)	$e^{(\gamma/\alpha)}$	LogPb	$(LogPb)^{1.35}$
1.0474	2.8502	2.1468	2.8049
1.0417	2.8340	2.1412	2.7950
1.0212	2.7765	2.1342	2.7827
1.0115	2.7497	2.1336	2.7817
1.0090	2.7429	2.1331	2.7808
1.0132	2.7544	2.1305	2.7762
1.0065	2.7360	2.1270	2.7700
1.0107	2.7475	2.1250	2.7665
1.0062	2.7352	2.1233	2.7635
1.0062	2.7352	2.1225	2.7621

The derived model is equation (12). An ideal comparison of the concentrations of dissolved Pb as obtained from experiment and as predicted by the model for the purpose of testing the validity of the model is achieved by considering the R^2 values (coefficient of determination). The values of the correlation coefficient, R calculated from the equation;

$$R = \sqrt{R^2} \qquad (16)$$

using the r-squared values (coefficient of determination) from Figures 1-4 show close correlations between the concentrations of dissolved Pb obtained from experiment (Nwoye,2008): (0.9876) & (0.9821) and derived model: (0.9129) & (0.8749) relative to initial & final solution pH respectively.

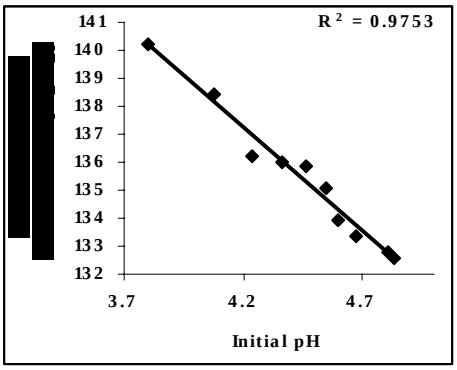

Figure 1: Effect of initial solution pH on the concentration of lead dissolved (as obtained from experiment (Nwoye, 2008))

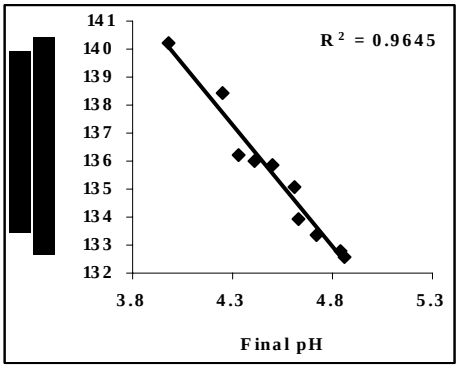

Figure 2: Effect of final solution pH on the concentration of lead dissolved (as obtained from experiment (Nwoye,2008))

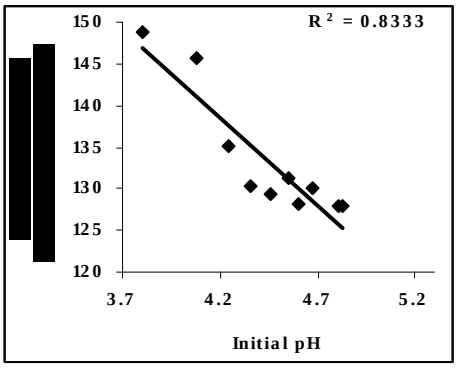

Figure 3: Effect of initial solution pH on the concentration of lead dissolved (as predicted by derived model)

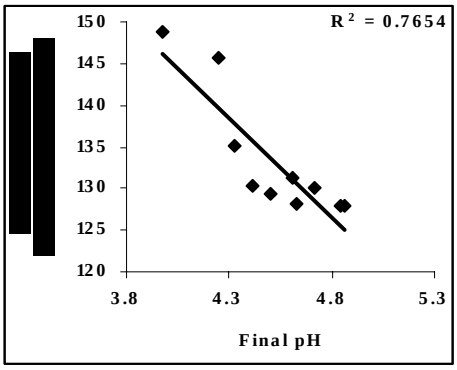

Figure 4: Effect of final solution pH on the concentration of lead dissolved (as predicted by derived model)

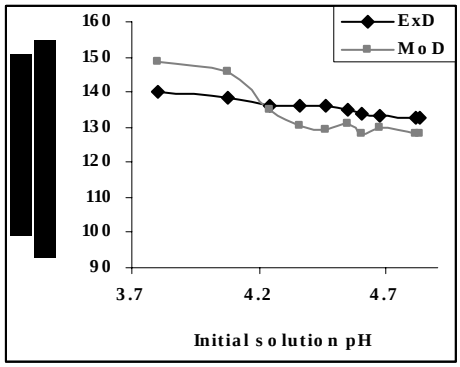

Figure 5: Comparison of the concentrations of dissolved lead (relative to the initial solution pH) as obtained from experiment (Nwoye,2008) and derived model.

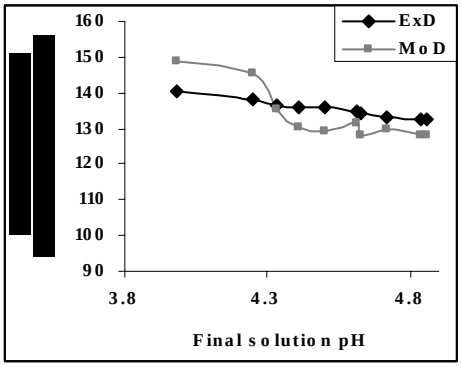

Figure 6: Comparison of the concentrations of dissolved lead (relative to the final solution pH) as obtained from experiment (Nwoye, 2008) and derived model.

Figures 5 and 6 also shows very close alignment of the curves from model-predicted values of the concentration of dissolved Pb (MoD) and that from the corresponding experimental values (ExD). The degree of alignment of these curves is indicative of the proximate agreement between both experimental and model-predicted concentration of dissolved Pb. The validity of the model is believed to be rooted on expression $(\text{Log Pb})^N = e^{(\gamma/\alpha)}$ where both sides of the equation are correspondingly approximately almost equal. Table 2 also agrees with equation (9) following the values of $(\text{Log Pb})^N$ and $e^{(\gamma/\alpha)}$ evaluated following statistical and computational analysis carried out on the experimental results in Table1.

Table 3: Variation model-predicted concentrations of dissolved lead its associated deviation and correction factors

Pb (mg/kg)	Dv (%)	Cv (%)
148.71	+6.05	-6.05
145.61	+5.19	-5.19
135.08	-0.84	+0.84
130.42	-4.12	+4.12
129.26	-4.86	+4.86
131.22	-2.83	+2.83
128.09	-4.38	+4.38
130.04	-2.47	+2.47
127.96	-3.66	+3.66
127.96	-3.50	+3.50

Table 3 shows insignificant positive and negative deviations of the mode-predicted concentrations of dissolved Pb from the corresponding experimental values. Table 3 also shows that the maximum deviations (from experimental values) of the model-predicted concentration of dissolved Pb are less than 7% which is quite within the acceptable deviation limit of experimental results. The least and highest magnitude of deviation of the model-predicted concentration of dissolved Pb (from the corresponding experimental values) are -0.84% and 6.05% which correspond to initial solution pH 4.24 and 3.8 as well as final solution pH 4.33 and 3.98 respectively. Table 3 indicates that the correction factor to model-predicted concentration of dissolved Pb is opposite that of the deviation values. This is because correction factor is the negative of the deviation as shown in equations (14) and (15). It is believed that the correction factor takes care of the effects of the surface properties of the ore and the physiochemical interaction between the ore and the leaching solution which (affected experimental results) were not considered during the model formulation. Based on the foregoing, Table 3 indicates that a correction factor of 0.84 and -6.05% make up for the least and highest deviation of -0.84 and 6.05% resulting from application of initial solution pH 4.24 and 3.8 respectively. It is pertinent to state that the actual deviations are just the modulus of the values. The role of the sign attached to the values is just to show when the deviation is surplus or deficit.

6. Conclusion

The model predicts the concentration of dissolved lead during leaching of Ishiagu (Nigeria) galena in butanoic acid solution. This prediction could be done during the leaching process providing the initial and expectant final pH of the leaching solution are known. The validity of the model is believed to be rooted in the expression (Log Pb)^{N} = e $^{(\gamma/\alpha)}$ where both sides of the expression are correspondingly approximately almost equal. The maximum deviation of the model-predicted concentration of dissolved Pb from that of the corresponding experimental value is less than 7% which is quite within the acceptable deviation limit of experimental results.

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Standardization of Sterilization Protocol for Micropropagation of *Aconitum heterophyllum*- An Endangered Medicinal Herb

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Abstract: A protocol has been standardized for sterilization of nodal segments and seeds of *Aconitum heterophyllum* for its micropropagation intended for its mass propagation and conservation. Three sterilizing agents *viz.*, $HgCl_2$, NaOCl and H_2O_2 were tested for sterilization by varying their concentration and time of exposure. 100% healthy shoots were obtained when explants were sterilized with 0.1% $HgCl_2$ for 5 minutes, inoculated on MS basal media with appropriate hormones and observing them for 30 days, while at 7.5% concentration of H_2O_2, 5 minutes exposure provided 90% of aseptic seed germination. Results showed that out of three sterilizing agents $HgCl_2$ was significantly reducing the contamination of explants and H_2O_2 of seeds in *in-vitro*, which shows that requirement of sterilization, may vary with the type tissue used for micropropagation. [Academia Arena, 2010;2(6):62-66] (ISSN 1553-992X).

Keywords: *Aconitum heterophyllum*, sterilization, micropropagation, conservation, contamination

1. Introduction

In-vitro propagation comprises of various stages: selection of explants; aseptic culture establishment; multiplication of propagules; rooting and acclimatization of plantlets. But the most important and challenging step is sterilization of explant for aseptic culture establishment. Sterilization is the process of making explants contamination free before establishment of culture. Explant contamination depends on the several plant and environmental related factors such as species, age, explant source and prevailing weather condition. In fact according to losses due to contamination under *in-vitro* conditions average between 3-15% at every subculture in the majority of commercial and scientific plant tissue culture laboratories (Leifert *et al.*, 1989), the majority of which is caused by fungal, yeast and bacterial contaminant (Leifert *et al.*, 1994). Consequently leading to the waste of time, effort and material which if not mitigated can have serious economic problems. *Aconitum heterophyllum* Wall is an important and endangered medicinal plant belonging to the family Ranunculacea. Conservation through vegetative propagation is slow and time consuming but tissue culture offers an alternative tool for rapid multiplication and conservation of disease free propagules in a short period, which will further enable uninterrupted supply of raw material, *Aconitum heterophyllum* for drug preparation. As *Aconitum heterophyllum* is an endangered medicinal herb optimum conditions like type of sterilizing agent, its concentration and time of exposure to that sterilizing agent are mandatory for asepsis of *Aconitum heterophyllum*. These sterilants are toxic to the plant tissue, hence the type, concentration, time of exposure and removal of traces of sterilizing agent becomes important in standardizing sterilization protocol.

Therefore, the present study has been done to standardize the sterilization method for explant and seeds of *Aconitum heterophyllum* for *in-vitro* propagation intended for its conservation using different types of sterilizing agents by varying their concentration and duration of exposure.

2. Materials and Methods

2.1 Sample Collection

The plants and seeds of *Aconitum heterophyllum* were procured from Forest Nursery, Deoban, Chakrata, Uttarakhand. Seed samples were sent to NBPGR, Pusa Campus, New Delhi, for its germplasm conservation and the Accession No. IC-567646 was obtained. Seeds were washed and air dried at room temperature and sealed in sample bag till further use. Potted plants procured from the nursery were maintained in the polyhouse till further use. All the glassware and instruments to be used were thoroughly cleaned and autoclaved at 15 psi for 40 minutes after drying them at 90ºC in oven.

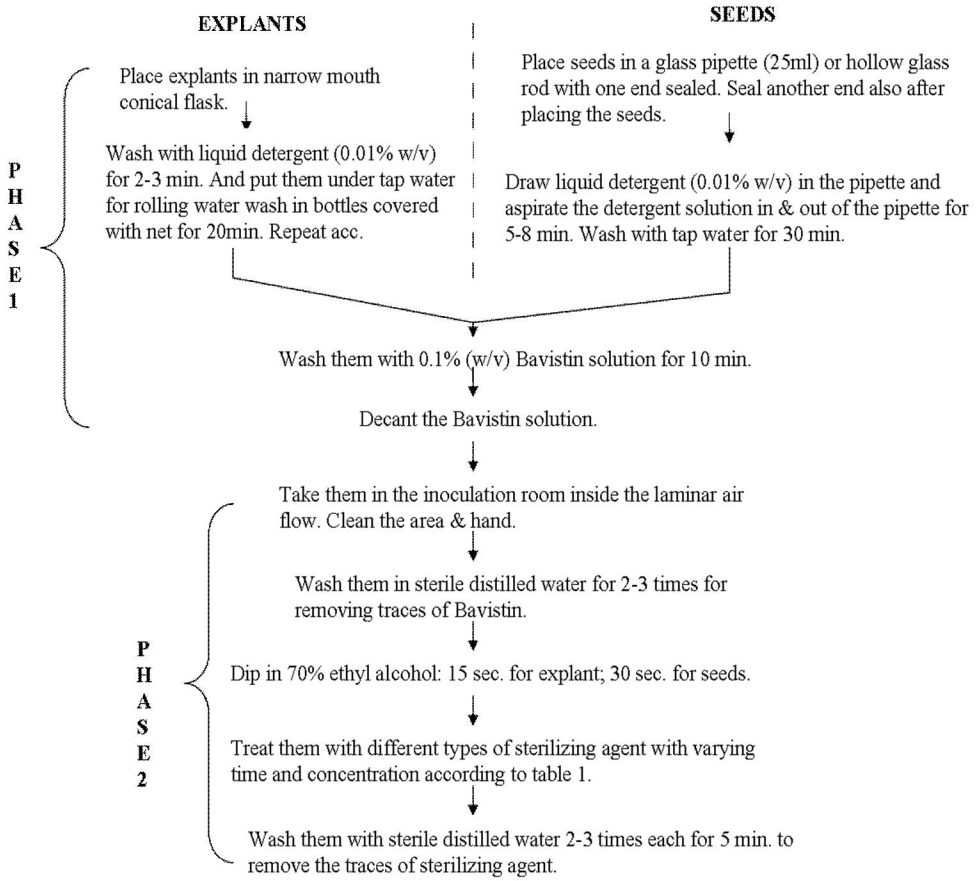

Figure 1. Procedure of sterilization of explants and seeds of *Aconitum heterophyllum*

2.2 Explant Sterilization

Nodal segments of *Aconitum heterophyllum* were excised from the pot grown plants. These nodal segments were trimmed to approx 2 cm. in size and large fleshy leaves were removed. All the brown skins were cleaned thoroughly. Procedure of sterilization (Figure 1.) for *Aconitum heterophyllum* had been divided into two phases: Phase I (outside Laminar Air Flow) and Phase II (inside Laminar Air Flow). Three different kinds of sterilizing agents' *viz.*, Mercuric Chloride ($HgCl_2$), Sodium Hypochlorite (NaOCl) and Hydrogen Peroxide (H_2O_2) are tested for explant sterilization by varying their concentration and time of exposure (Table 1).

***2.3* Seed Sterilization**

Seeds of *Aconitum heterophyllum* were subjected to float test for determining the viability. Seeds of *Aconitum heterophyllum* are small in size; this makes its washing and sterilization little bit uneasy. As these seeds run out from the flask while washing, using glass pipette (20-25ml) or hollow glass rod with one end sealed can avoid this situation. Process of seed sterilization has been shown through a flow chart (Figure 1). Table 1 shows the concentration and time of exposure to different sterilizing agents used for decontaminating the seeds.

Table 1. Types of sterilizing agents used in a different concentration with varying time of exposure for sterilizing explants and seeds of *Aconitum heterophyllum.*

STERILIZING AGENT	CONC. (%)	TIME OF EXPOSURE (minutes)
Mercuric Chloride ($HgCl_2$ w/v)	**0.05**	**2, 5, 8.**
	0.1	**2, 5, 8.**
	0.15	**2, 5, 8.**
Sodium Hypochlorite (NaOCl w/v)	0.5	2, 5, 8.
	1.0	2, 5, 8.
	1.5	2, 5, 8.
Hydrogen Peroxide (H_2O_2 v/v)	**5.0**	**2, 5, 8.**
	7.5	**2, 5, 8.**
	10	**2, 5, 8.**

2.4 Inoculation

Murashige and Skoog basal medium supplemented with appropriate cytokinins and auxins were used for inoculation. Medium was checked for the contamination before inoculation. Sterilized explants were trimmed suitably to remove sterilizing agent affected parts/brown parts. Explants and seeds were then inoculated on the appropriate medium and labeled properly. Regular and proper record for contamination, browning and growth/bud break/germination (seeds) were taken for 30 days.

3. Statistical Analysis

Statistical analysis was done to find out the effect of different sterilizing agents its concentration and time of exposure on the asepsis of the said plant species. For each experiment, ten nodal segments and 20 seeds each in three replicates were used. The mean infected plant, healthy plant and dead plant percentage and mean germination percentage and their standard error was calculated. Data collected was subjected to two-way ANOVA (SPSS 15.0) to find out the significance level of effect of varying concentrations and time of exposure of different sterilizing agent on growth and asepsis of plants of *Aconitum heterophyllum.*

4. Results

4.1 Explant Sterilization

After observing the inoculated explants for 30 days for growth and contamination, it was found that increasing time and concentration significantly reduced contamination but showed adverse effect on explants (Figure 2). Among all the three sterilizing agents *viz.*, $HgCl_2$, NaOCl and H_2O_2, treatment with 0.1% (w/v) $HgCl_2$ for 5 min. gave the 100% healthy shoots ($p<1.0\%$). Increasing concentration and time of exposure to $HgCl_2$ provided more population of dead shoots.

NaOCl being mild sterilizing agents provided more percentage of infection. Increasing concentration and time of sterilization with NaOCl, showed almost negligible reduction in contamination. Same was the case with H_2O_2 where infected explants were more even on increasing concentration up to 10% and time to 8 minutes.

4.2 Seed Sterilization

In-vitro propagation through seeds also provides a useful technique for conservation as *in-vitro* condition make the seeds of *Aconitum heterophyllum* to germinate dormant seeds. So sterilization of seeds before inoculation in the media is obligatory.100% seed viability was obtained. Various sterilizing agent with different concentration and time of exposure (Table 1) were tested, out of which 7.5% (v/v) H_2O_2 for 5 min. gave the maximum (90%, $p<1\%$) germinated and healthy seedlings while less germination and more percentage of contamination was observed with NaOCl, while

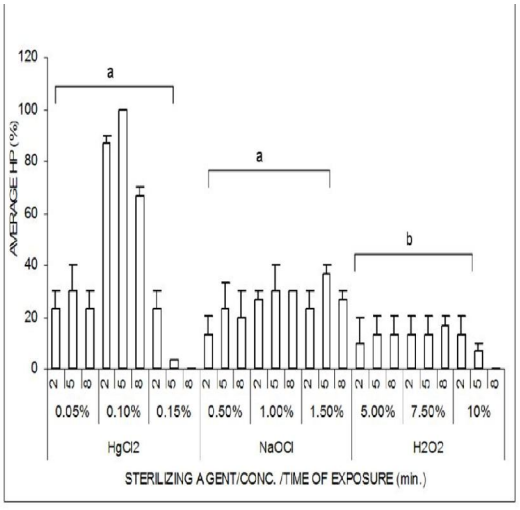

Figure 2. Percentage of Healthy Plants (HP) obtained after sterilization of explants of *Aconitum heterophyllum.* (a= significant at p<1%, b= interaction b/w concentration & time non significant)

$HgCl_2$ showed adverse effect on germination. Here also increasing time and concentration significantly reduced the contamination, but on the other hand it also effected the germination of seeds (Figure 3).

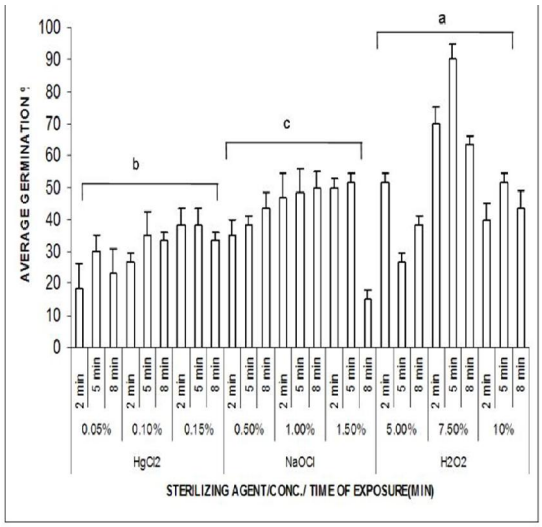

Figure 3. Average % of aseptic seed germinated after sterilization of seeds of *Aconitum heterophyllum*. (a= significant at p<1%, b= interaction b/w concentration & time non significant & c= time variation and interaction b/w concentration & time non significant)

5. Discussion

Tissue culture provides a best tool for large scale production of propagules especially in case of endangered medicinal herb. *Aconitum heterophyllum* has been declared as an endangered medicinal herb of Uttarakhand by the CAMP Workshop, 1998 (Dhar *et al.,* 2002). *Aconitum heterophyllum* is reputed for its various medicinal and pharmaceutical properties. Due to its high demand in the local, national and international drug manufacturers, illegal, unscientific and indiscriminate extraction of *Aconitum heterophyllum* Wall from its wild habitat has increased. Micropropagation provides a best tool for large scale production of propagules and its conservation especially in case of endangered medicinal herb, where explant material is available in a very small quantity. Viability of seeds, age of explant and the tissue source from which the explant is excised are very important for high frequency of regeneration. The most important treatment prior to culture initiation is perhaps surface sterilization of plants. Since *in-vitro* propagation provide suitable environment for growth of fungus and bacteria, unsuccessful sterilization hinders the progress of micropropagation studies. Many of the organisms that are residents on mammalian skin can survive in *in-vitro* cultures and therefore faulty aseptic techniques can also result in contamination. Therefore, reduction of contamination requires efficient aseptic techniques in tandem with effective sterilization methods (Falkiner, 1990).

Sterilization of a material (explant/seeds) before subjecting them for *in-vitro* propagation is essential for the production of 'clean' *in-vitro* plantlets that ensures the reduction of the contaminants as well as high survival rate of explants.

Requirements may differ for different parts of plants depending on their morphological characters like softness /hardness of the tissue etc. Therefore, in the present study, three sterilizing agents in different concentration with varying time of exposure were tested for sterilization of explants as well as for seeds of *Aconitum heterophyllum.*

In case of nodal segments taken as explant, 100% healthy plants were obtained with 0.1% (w/v) $HgCl_2$ at 5 minutes showing significant reduction in both the bacterial as well as fungal contamination, while other two sterilizing agent did not give acceptable sterilization percentage even on increasing time and concentration. The results are very much in conformity with other previous studies on various medicinal plants medicinal plants *viz., Podophyllum hexandrum, Asparagus densiflorous, Balanites aegyptiaca* (L) Del., *Cinnamomum camphora and C. verum, Plumbago zeylanica* Linn., *Basilium polystachyon* etc. (Sultan *et al.*, 2006; Dasgupta *et al.,* 2007; Gour *et al.,* 2007; Soulange *et al.,* 2007; Sivanesan, 2007; Amutha *et al.,* 2008). Same concentration of $HgCl_2$ was effective in case of *Inula racemosa* Hook.f. (Jabeen *et al.,* 2007) and *Picrorhiza kurroa* (Sood & Chauhan, 2009) but the time of exposure was comparatively less, 2 min. and 30 sec respectively.

90% of aseptic seed germination was obtained when sterilized for 5 minutes with 7.5% (v/v) H_2O_2. The other two sterilizing agents NaOCl and $HgCl_2$ did not give acceptable sterilization even on increasing concentration. The statistical interaction between time and concentration with $HgCl_2$ was found to be significant, while it was insignificant in case of NaOCl. This difference shows that time and concentration of sterilizing agent may vary with the type of tissue used for sterilization. As compare to the hilum/radicle of the seeds, the nodal explants are more open to the external environmental elements, so it requires comparatively strong sterilizing agent which is observed in the present study.

The detailed review of the earlier studies reveal that there is only scanty published data on sterilization of *Aconitum heterophyllum*, as sterilization is the initial and vital step of micropropagation, minute error can lead to loss of whole culture with waste of time and labor. So, much attention is needed while sterilizing specially when dealing with such a valuable and endangered medicinal herb.

Rate of propagation of *Aconitum heterophyllum* is far less as compared to its exploitation. Results of the study reveal that the protocol developed for the sterilization of *Aconitum heterophyllum* has the

potential to be reproduced and utilized for the large scale multiplication of disease free plants of *Aconitum heterophyllum* for its uninterrupted supply to herbal drug industries and simultaneously conserving this medicinal herb, an indigenous endangered medicinal plant.

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Effect of Melting Temperature of Pb-Sb-Cu Alloy on Its Electrical Resistivity and Power Dissipation Capacity

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Abstract: The effect of melting temperature of sand cast Pb-Sb-Cu alloy (designated for production of battery heads and plates) on its electrical resistivity and power dissipation capacity was studied following determination of the electrical properties of the alloys (cast using three different techniques; Technique A, Technique B, Technique C and cooled in the furnace) and then heating of the alloy until melting occurred. Technique A, involves simultaneous addition of Cu powder and pouring of the molten Pb-Sb into the mould. Techniques B, involves addition of Cu powder intermittently as pouring of Pb-Sb into the mould was going on and Technique C involves pouring a stirred mixture of heated Pb-Sb alloy and powdered Cu into the mould. The results of the investigation indicate that the current flow, power dissipation and electrical conductivity increases with increase in the melting temperature of the Pb-Sb-Cu alloy. It was also found that the electrical resistance and resistivity of the alloy decrease with increase in the melting temperature. This is sequel to the fact that the minimum additional energy (energy gap) which a bonding electron must acquire to leave the bond in the valence band and move into the conduction band hence becoming free to conduct electricity, decreases with decrease in the electrical resistance, resistivity and with increasing temperature. Increased copper addition (up to a maximum of 8.26%) to the base alloy (Pb-Sb) was discovered to have increased correspondingly the current flow, power dissipation, electrical conductivity and decreased correspondingly the electrical resistance and resistivity of Pb-Sb-Cu alloy so produced. This is attributed to the increased melting temperature of the alloy as a result of increased impurity atoms in the alloys in the form of copper. [Academia Arena, 2010;2(6):67-71] (ISSN 1553-992X).

Keywords: Effect, Melting Temperature, Electrical Resistivity, Power Dissipation, Pb-Sb-Cu Alloy.

1. Introduction

It has been reported (Geiss and Peretti, 1962) that addition of indium to Pb-Sb alloy increases the corrosion resistance of the alloy. Indium is added to the Pb-Sb alloy by ionic exchange through electrolytic process where indium is the anode and Pb-Sb, the cathode.

Several studies (Ezenwa, 1987; Weaver, 1935) have been carried out on lead-antimony alloy by addition of Sn to improve its mechanical properties and corrosion resistance. Results of the investigation indicate that addition of Sn to the Pb-Sb matrix increases both the tensile strength, hardness and corrosion resistance of the alloy. This makes Pb-Sb-Sn alloy suitable for coating tanks and pipes.

Arsenic addition to Pb-Sb-Sn alloy has been found (Sodacha and Kerr, 1972) to increase the corrosion resistance of the alloy due to its ability to reduce oxidation during service by formation of oxide film on the matrix

Several research works (Blumenthal, 1944. Rollason and Hysel, 1940; Nwoye, 2000) have been carried out to improve the electrical conductivity of Pb-Sb alloy used as wet cell battery heads.

Blumenthal, (1944) discovered that addition of cadmium enhances the electrical conductivity of Pb-Sb alloy tremendously. It was however, stated that the alloy cannot find application in battery heads and plates because Cd is very radioactive and causes a volatile and explosive reaction when in contact with sulphuric acid for a long time.

Rollason and Hysel, (1940) reported that addition of silver to Pb-Sb alloy increases very significantly the electrical conductivity of the alloy. It was however, stated that this increase does not give a stable value due to impurities in the Ag. It was stated that these impurities are Au, As, Sn, Cu and S. He further posited that these impurities create an unstable electrical field in the alloy of Pb-Sb-Ag. It is believed that this short coming has made the use of this alloy for battery heads and plates impossible since it obscures the precise electromotive force of the electrolyte in the battery.

Nwoye (2000) found that addition of copper powder by dispersion to Pb-Sb alloy improves the electrical conductivity of alloy greatly. It is believed that this breakthrough was possible because Cu used, had high purity level (99.8%).

It has been reported (Ijomah, 1992) that the higher the temperature applied to metals and alloys, the greater the bonds broken, and the higher the level of conductivity attained. The same report indicates that the resistivity of engineering materials such as metals and alloys is dependent on the temperature at which the material is

exposed. The report (Ijomah, 1992) concluded that increase in temperature of materials reduces its resistivity.

Ijomah (1992) reported that the energy gap; minimum additional energy which a bonding electron must acquire to leave the bond and, hence become free to conduct electricity decreases with increasing temperature and impurity content. The report also revealed that the resistivity increases with increase in the energy gap.

The aim of this research work is to study the effect of melting temperature of Pb-Sb-Cu alloy (designated for production of battery heads and plates) on its electrical resistivity and power dissipation capacity. In this work, copper powder was added to the Pb-Sb melt by dispersion.

2. Materials and methods

ALLOY PREPARATION:

The materials used are antimonial lead scraps and electrolytic copper powder of grain size < 425μm. They antimonial lead collected were melted together in order to obtain a fairly uniform composition of lead antimonial alloy, in case of any variation in antimony content. The melting operation was carried out at the forge, followed by casting of the alloys in sand mould and cutting to various sizes for use in the actual alloying. They melting crucible was of 260mm long, 200mm wide mild steel of about 100mm breadth with handle for carriage.

MOULD PREPARATION:

The preparation of the mould was done by first sieving the sand for aeration and mixing 6% moisture to give good green strength. The mould box of dimension 300mm wide, 100mm breadth and 500mm long was made from cast metal frame. A long hollow cylindrical pipe of 85mm long and 9mm diameter was used as the pattern for the cast. The mould was allowed to dry.

CASTING TECHNIQUES:

A weighed quantity of lead antimony alloy (500g) was placed on the crucible and then placed inside the furnace. Techniques A, B and C were used to produce the first, second and third batch of the Pb-Sb-Cu alloys respectively. Technique A involved simultaneous addition of Cu powder and pouring of the molten Pb-Sb into the mould. Technique B involved addition of Cu powder intermittently as pouring of Pb-Sb into the mould was going on while Technique C involved pouring a stirred mixture of Cu powder and Pb-Sb alloy heated to 420^0C, into the mould. The Control alloys were cast by just pouring only the molten Pb-Sb into the mould (Conventional Technique).

CAST ALLOYS COOLING:

Cast alloys from each of the techniques were cooled in the furnace.

HEAT TREATMENT:

They cast alloys were cut to lengths:0.075m before being heat treated at a temperature of 180^0C to relieve stresses incurred during solidification of the alloys. The heat treatment was also carried out to homogenize the microstructure of the alloys prior to the impact testing process.

ELECTRICAL MEASUREMENTS:

Following the heat treatment process, electric current, I flowing through the alloy measured and other electrical properties associated with current flow calculated using appropriate equations. The electromotive force from the dry battery equals 2.9V, being voltage supply to the alloys. Current was allowed to flow through the alloys for five minutes, and the power dissipated during the process calculated for all alloys produced using three techniques. This is to ascertain the power dissipating capacity of the alloys. The tested specimen were thereafter melted and their temperatures recorded correspondingly against their respective values of electric current, resistance, resistivity, conductivity and power dissipation.

CALCULATION OF ELECTRICAL PARAMETERS

According to Ohm's law

$$R = V/I \quad \text{(Okeke,1987)} \qquad (1)$$

Where

R = Resistance of the alloy (Ω)

V = Voltage supply to the alloy (V)

I = Current flowing through the alloy (A)

The resistance of the alloy was calculated using equation (1). Also, the resistivity of the alloy was calculated using the equation;

$$\rho = RA/L \text{ (Okeke,1987)} \qquad (2)$$

Where

ρ = Resistivity of the alloy (Ωm)

L= Length of the alloy material (m)

A = Cross sectional area of the alloy (m^2)

The cross sectional area of the alloy material was calculated using the equation;

$$A = \Pi D^2/4 \qquad (3)$$

Where

Π = 22/7 Substituting these values into

D = 0.9cm; (Diameter of cross- section of the sample)

Substituting these values into equation (3)

$$A = 6.364 \times 10^{-5}\ m^2$$

Also, the conductivity of the alloy was calculated as the reciprocal of the resistivity;

$$\alpha = (\rho)^{-1} \text{ (Okeke,1987)} \quad (4)$$

$$\alpha = (RA/L)^{-1} \quad (5)$$

Where

α = Conductivity of the alloy $(\Omega m)^{-1}$

Power dissipated as current flow through the alloy was calculated using the equation;

$$P = IVt \quad \text{(Okeke,1987)} \quad (6)$$

Where

P = Power dissipated by the alloy (W)

t = Time elapse within which power was dissipated (s)

3. Results and discussion

Results of chemical analysis carried out on the materials used (as shown in Table 1) indicate that antimonial lead contains about 3.3% Cu in addition to Pb and Sb present. The percentage composition of the powdered Cu used is as received.

Table 1: Chemical composition of materials used

Material	Pb (%)	Sb (%)	Cu (%)
Antimonial Lead	92	4.7	3.3
Copper powder	-	-	99.80

Effect of melting temperature of Pb-Sb-Cu alloy on its electrical current flow ability

Results of measurement (Figure 1) of the current flowing through the Pb-Sb-Cu alloys (for all techniques used) and the melting temperature of the alloy show that current flow through these alloys increases with increase in the melting temperature of the alloys.

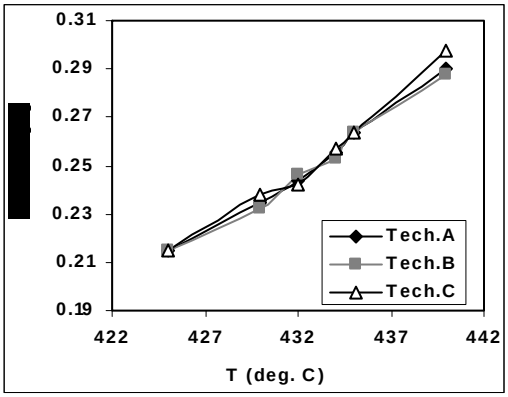

Figure 1: Effect of melting temperature of Pb-Sb-Cu alloy on the electrical current flow through it.

Considering Figure 1, Figure 2 and Table 3, it is believed that current flows through the Pb-Sb-Cu alloys increases with increase in the melting temperature of the alloys (up to 440^0C) as a result of increased Cu addition and distribution (up to 8.26%) within the Pb-Sb matrix. This implies that increased melting temperature of the alloy is as a result of increased Cu addition and distribution within the base alloy (Figure 6). Moreso, increasing the temperature of metals and alloys reduces their respective resistivities (Ijomah, 1992). Therefore, substituting eqn. (1) into eqn. (2) gives $\rho = V A/L I$ which shows an inverse relationship between current I, and resistivity, ρ. This indicates that decrease in the resistivity of the alloys result to increase in the current flowing through the alloy. This is sequel to the fact that increase in the temperature of metals and alloys excites the electron and increases the number bonds broken resulting to increased flow of electron (through increased vibrational motion) into the conduction band (Ijomah, 1992). Furthermore Cu added to the base alloy (Pb-Sb) behaves like impurity atoms which have been reported (Ijomah, 1992) to reduce the electrical resistivity of the alloys involved. It is therefore expected that increased Cu addition into the base alloy will also result to much reduction in the resistivity of the alloy and hence much increase in the current flow.

Effect of melting temperature of Pb-Sb-Cu alloy on its electrical resistance

Figure 2 shows that the electrical resistance of the alloy decreases with increase in the melting temperature of the alloy. This is because increase in the melting temperature of the alloy decreases its electrical resistivity. This agrees with past findings (Ijomah, 1992).

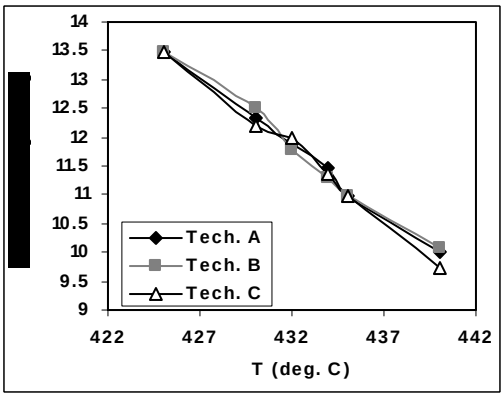

Figure 2: Effect of melting temperature of Pb-Sb-Cu alloy on its electrical resistance

Equation (2) shows a direct relationship between resistance R, and resistivity ρ. This indicates that decrease in the resistivity of the alloy decreases the resistance. Table 3 indicates that increase in Cu addition to the base alloy decrease its resistance. This is because increased Cu addition to the base alloy increases its melting temperature (as in Figure 6) which invariably decreases the resistivty. This decrease in the resistivity in turn results to decrease in the resistance.

Effect of melting temperature of Pb-Sb-Cu alloy on its electrical resistivity

Figure 3 shows that the resistivity of Pb-Sb-Cu alloy decreases with increase in the melting temperature of the alloy. This is in agreement with report by Ijomah (1992). Comparison of Figure 6 and Table 3 shows that increase in the melting temperature of the alloy resulted from increase in the Cu added to the base alloy as impurity atoms. Table 3 shows that increased addition of the impurity atoms (Cu) to the alloy reduced its resistivity in agreement with past findings (Ijomah,1992).

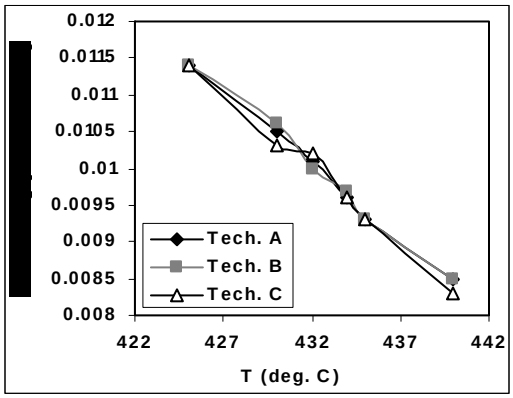

Figure 3: Effect of melting temperature of Pb-Sb-Cu alloy on its electrical resistivity

Effect of melting temperature of Pb-Sb-Cu alloy on its electrical conductivity

Figure 4 shows that the electrical conductivity of the Pb-Sb-Cu alloy increases with the melting temperature of the alloy. Equations (4) and (5) show an inverse relationship between conductivity α and resistivty ρ. This implies that the electrical conductivity of the Pb-Sb-Cu alloy increases with decrease in the resistivity of the alloy.

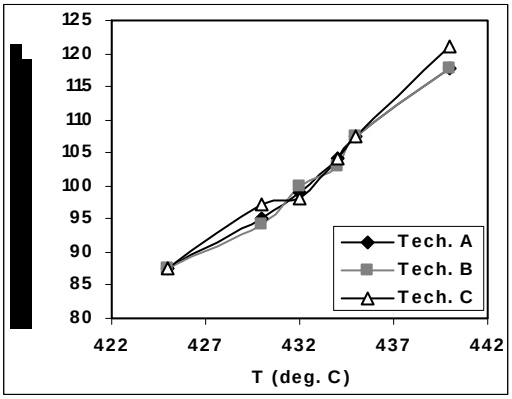

Figure 4: Effect of melting temperature of Pb-Sb-Cu alloy on its electrical conductivity

Figure 3 shows that the resistivity of the alloy decreases with increase in the melting temperature, implying increase in conductivity as the melting temperature increases (eqns.(4), (5) and Table 3). This is in accordance with past report (Ijomah, 1992). A comparison of Figure 6 and Table 3 indicates that decrease in the resistivity of the alloy as a result of increase in the melting temperature resulted from increased Cu addition (which acts as impurity atoms) to the base alloy. This agrees with report by Ijomah, (1992).

Effect of melting temperature of Pb-Sb-Cu alloy on power dissipation through it.

Equation (6) shows a direct relationship between electrical current and power dissipated by Pb-Sb-Cu alloy. This indicates that increase in the current flowing through the alloy results to increase in the power dissipated by the alloy following such current flow.

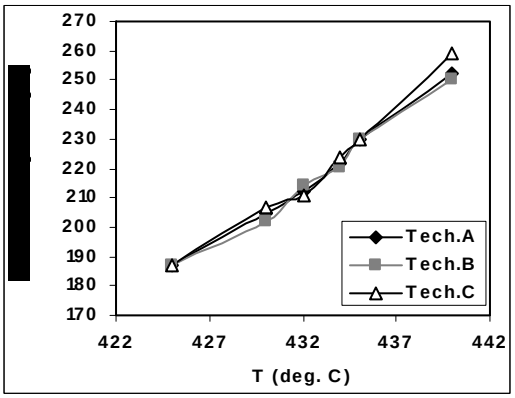

Figure 5: Effect of melting temperature of Pb-Sb- Cu alloy on power dissipation through it.

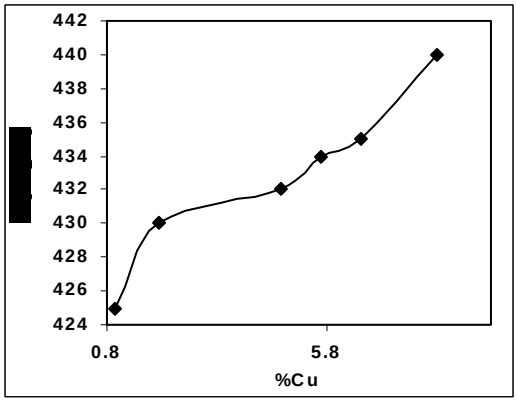

Figure 6: Effect of copper addition (to Pb-Sb matrix) on the melting temperature of Pb-Sb- Cu alloy system.

Comparison of the relationship between Figures 1 and 5 agrees with equation (6). Equation (6) indicates that if the current flowing through the alloy increases with increase in the melting temperature of the alloy, then the power dissipated during the flow of the current is also

expected to increase with the melting temperature (as shown in Figure 5). Comparison of Figure 6 and Table 3 shows that increase in Cu addition to the base alloy increases the melting temperature of the alloy hence resulting to the decrease in the resistance and resistivity of the alloy. This condition favours increased flow of current which invariably increases power dissipation.

Effect of copper addition (to Pb-Sb alloy) on the current flow, resistance, resistivity, conductivity and power dissipation through the Pb-Sb-Cu alloy.

Table 3 shows that increased addition of Cu (up to a maximum of 8.26%) to the primary alloying material (Pb-Sb alloy) to form Pb-Sb-Cu alloy increased correspondingly the current flow, power dissipated and electrical conductivity but decreased correspondingly the electrical resistance and resistivity. Comparison of Tables 2 and 3 show that addition of Cu to the Pb-Sb matrix (control) greatly improved the current flow, power dissipated and conductivity of the base alloy and also reduced greatly the resistance and resistivity of the alloy.

Table 2: Electrical properties of Pb-Sb alloy cooled in furnace (Alloy control of melting temperature 425^0C)

I (A)	R (Ω)	ρ(Ωm)	α $(\Omega m)^{-1}$	P (W)
0.212	13.68	0.0116	86.21	184.45

Table 3: Effect of copper addition (to Pb-Sb alloy) on the current flow, resistance, resistivity, conductivity and power dissipated through the Pb-Sb-Cu alloy formed.

%Cu	I (A)	R (Ω)	ρ(Ωm)	α$(\Omega m)^{-1}$	P(W)
0.99	0.215	13.49	0.0114	87.70	187.05
1.96	0.238	12.19	0.0103	97.09	207.06
4.76	0.242	11.98	0.0102	98.04	210.54
5.66	0.257	11.37	0.0096	104.17	223.59
6.54	0.264	10.98	0.0093	107.53	229.68
8.26	0.298	9.73	0.0083	121.10	259.26

Conclusion

The current flow, power dissipation and electrical conductivity of Pb-Sb-Cu alloy increased with increase in the melting temperature of the alloy, while the electrical resistance and resistivity of the alloy decreases with increase in the melting temperature. Increased Cu addition (up to a maximum of 8.26%) to the base alloy (Pb-Sb alloy) increased correspondingly the current flow, power dissipated, conductivity but decreased correspondingly the resistance and resistivity of Pb-Sb-Cu alloy so produced.

Acknowledgement

It is the intention of the author to publish this work culled from his M. Eng. Thesis in honour of Prof. Sylvanus I. Okeke of Nnamdi Azikiwe University, Awka as a memorial research piece credited to his numerous publications in recognition and appreciation of his unequalled supervisory role during this research work.

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Evaluation Of The Distrbutive Trade Channels For Selected Food Staples In Imo State, Nigeria.

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ABSTRACT: This study analyzed the efficiency of the distributive trade channels for Cassava, Maize and Yam in Imo State, Nigeria. It aimed specifically to identify the types of markets for these staples, the category of channel members, their relative efficiency and the factors influencing their relative efficiency. Survey conducted, following the use of the multistage sampling technique, identified a decentralized market for cassava and maize with the dominance of "freelance" retailers followed by the wholesalers and, then, the cooperative retailers ,in that order, as the channel members. The centralized market type was identified for yam, with a predominant north – south flow. Despite the relatively small volume of trade executed by the cooperative retailers, they were found to be relatively more efficient in the channel management of these staples. The factors that influenced the efficiencies of the channel members were the volume of sales and the volume of losses incurred by each category in transaction, cost of capital, type of channel member, cost of transportation and storage. It was recommended, among others that, for these staples, renewed emphasis should be placed on the activities of such group-based channels as the cooperative retailers in order to reduce the level of losses occurring along the channels as well as reverse the trend towards food insecurity staring the economy in the face. [Academia Arena, 2010;2(6):72-79] (ISSN 1553-992X).

KEY WORDS: Evaluation; Efficiency; Distributive Trade Channels; Selected Food Staples; Imo State; Nigeria.

INTRODUCTION

The failure to produce desired levels of farm output in our national economy had been blamed on factors suggested in Ohale(1991); Nweke(1994;1996); Nweke and Spencer R, (1995); Onyemelukwe et al (1977).In these studies sufficient consideration was not given to the channel of distribution, defined in Davis (1971) as "the route taken by a product as it moves from the producer to the ultimate consumers, a combination of transportation, storage and organization of firm or person who plays a part in the transfer of goods (or services) from producer to consumer', and in Olayide (1989) as "the combination of institutions/middlemen through which a seller markets his products to the ultimate buyer". Different types of middlemen had been identified in a typical distributive channel Baker (1981); Davis (1979). Huge losses were reported along the distributive trade channels, estimated in .Osuji (1986) to be over 15% for cassava, 10% for yams, 17% for cowpeas and 9% for sorghum, arising from the operations of the various categories of middlemen in the distributive trade in their bid to create form, time, place and possession utilities. The losses portend food insecurity for consumers who rely on these staples as major sources of calorie in-take in the state .The losses were said to impede the realization of the national policy objectives enunciated in CBN {2004} as well as the achievement of such welfare status envisioned in Christiansen et.al {2003}.The wastage has been on increase despite the measures put in place to check them. The performance of the various categories of middlemen involved in channel management of these staples has not been satisfactorily assessed to establish their relative operational efficiency, particularly the extent to which they account for these losses as they undertake their distributive trade functions. Studies reported in Jones (1968); Anthonio (1967); Morgan (1965); Okereke and Anthonio (1988), tended to ignore the structural analysis of the market, leaving an information vacuum on the channel that is relatively efficient in its distributive functions and the influence of factors identified in Stanton (1981) on these channels. It is not known if all categories of middlemen differ in their marketing efficiency as well as their gross margins from operations. This information will aid in determining the member that should be encouraged to dominate the distributive trade channel for these staples. The general objective of the study was, therefore, to access thee performance of the existing distributive channels for the selected food staples in the study area. The specific objectives were to identify the types of markets for maize, cassava, and yam in the study area; the channel members in the distributive trade for these selected staples; estimate the marketing functions/dysfunctions undertaken by these channel members; the relative efficiency of these channel members and the influencing factors. It was hypothesized that there was no significant difference in the relative efficiency of identified channel members in the performance of their marketing functions; that their

efficiency was not significantly influenced by all the estimated variables, including their sales volume, volume of losses sustained in transaction, the cost of capital used in production, transportation cost, wages, stall rent and association dues, category of middlemanship.

METHOD OF STUDY.

The study was conducted in Imo State, Nigeria, using the multistage sampling technique. The state was first stratified into Owerri, Orlu and Okigwe Agricultural Zones, in line with the zoning pattern of the Agricultural Development Programme in the area. Two zones, namely, Owerri and Orlu were chosen through simple random sampling. This gave a total of six Local Government Council Areas. A list of the markets in each Local Government Council Area was compiled and two markets were chosen from each Local Government Council Area through simple random sampling, giving a total of twelve markets. From a list of marketers involved in the distributive trade for these staples, complied with the assistance of the trade union officials in each of the markets, ten marketers were chosen through simple random sampling. This gave a total of One Hundred and twenty marketers from who data were collected, using structured questionnaire. The market and the market conducts of these participants in each market for cassava, yam and Maize were observed twice in a week for three months. Twenty farmers engaged in Yam, Cassava and Maize production were chosen from each Local Government Council Area through simple random sampling. This gave a total of One Hundred and Twenty farmers and a set of questionnaire were administered on them to obtain confirmatory information on the range of transactions that transpired between them and the various categories of middlemen in the distributive trade for these staples. Data were collected on types of middlemen, prices of the food staples under study, distance covered to make purchases, sales, losses, storage and transportation costs, wages, stall rent and association dues paid by channel members. Data collection lasted from August 2009 to February 2010. Data were analyzed using the multiple regression technique, tables and percentages to estimate marketing margins. The percentage marketing margins were specified as:

$$\% GM = \frac{Y - X}{Y} \times 100 \quad (1)$$

$$\% NM = \frac{Y - X - TV}{Y} \times 100 \quad (2)$$

Where,
% GM = Percentage Gross Margin;
Y = Sales Price;
X = Purchase Price
TVC = Total Variable Costs;
% GM = Percentage Gross Margin;
% NM = Percentage Net Margin

The multiple regression model to estimate and compare the marketing margins of the types of channel members as well as the influencing factors was specified implicitly as

$$Y = f(X_1, X_2, X_3, X_4, X_5, D_2, D_3, ei) \quad (2)$$

The explicit function was specified as:

$$Yi = \alpha_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 D_2 + \alpha_6 D_3 + Ui \quad (3)$$

Where,
Y = Gross Marketing margins (%).
X_1 = Sales volume (Kg);
X_2 = Losses incurred in transaction (Kg)
X_3 = Cost of capital used (interest on loans and depreciation charges on fixed assets).
X_4 = wages, stall rent and association dues (N).
X_5 = = Transportation and storage costs (N).
D = Types of channel member, Dummy, D_2 & D_3 (with D_2 =1 for cooperative retailers and zero otherwise; D_3 = 1for wholesalers and zero otherwise). Gujarati (1995).
Following Gujarati (1995), the "freelance" retailers were, in this study, treated as the base category.
Four functional forms of the model were specified and the form that gave the best fit based on economic, statistical and econometric criteria was chosen for further analysis.

RESULTS AND DISCUSSION

Types of Markets and Categories of Members Identified along the Distributive Trade Channels for the Food Staples.

The market type identified for cassava and maize was different from that identified for yam.

The decentralized markets were identified for cassava and maize.This agrees with the position expressed in Olukosi and Isitor (2005) that marketing channels for agricultural products in Nigeria are mainly decentralized. The distribution channel was dominated by the independent "freelance" retailers, with characteristics similar to those explained in Allen (1979). Along with the independent "freelance" retailers were wholesalers and a few cooperative retail societies who operated under binding agreements. Similar cooperative retail societies and their performances were identified in Baker (1981), and were defined as "voluntary, non-profit-making organizations which are controlled by committees elected by customers who are members of the societies". About 85% of the purchases were made directly from farmers at the farm-gate by the independent "freelance" retailers, while about 5% of the purchases were made by the Cooperative retailers. The wholesalers made about 10% of the purchases directly from the farmers. The most common form of organizational flow was, therefore, from the farmers to the farm-gate retailers to the consumers. The centralized market type was identified for yam, with a predominant north – south flow, in line with the observation of Anthonio (1967) that a North-South trade flow exists in Yam marketing in Southeastern Nigeria. The products were brought together in large central and terminal points having a longer distribution chain than was the case for the cassava and maize distribution chain. About 65% of the purchases were made by brokers who then sold to the wholesalers. The most common organizational flow was from the producer to brokers to wholesalers to consumers. A few independent "freelance" (30%) and cooperative retailers (5%) were also identified in the yam distribution trade.

The Marketing Functions and Dysfunctions of the Channel Members.

The marketing functions and dysfunctions performed by these channel members in the distributive trade functions for the selected staples are as shown in Table 1.The Table shows that 38.5%, 4.4% and 39.9% of cassava, yam and maize respectively, purchased by all classes of middlemen in the distributive trade were lost along the chain. This means that more cassava than maize was lost by the channel members in the performance of the marketing functions in the study area. These estimated losses confirm the findings of Coursey and Booth (1977) that staggering amount of wastages occur along the distributive channels for major food staples. The estimated losses in calories arising from a staple like Yam, was put at about 5.7million Kcal/ha and protein content of 107Kg/ha (Coursey and Booth (1977). For cassava, the wholesalers sustained the highest percentage loss (62.6%) followed by the independent "freelance" retailers and, then, the cooperative retailers. About equal percentage losses were sustained in the yam trade by the wholesalers (4.5%) and the "freelance" retailers (4.6%), while the cooperative retailers sustained the lowest percentage loss.

Table 1: Distribution of Marketing Functions and Dysfunctions of the Channel Members.

Marketing functions and dysfunctions		Total for all middlemen		Wholesalers		Cooperative retailers		"Freelance" retailers.
(A) CASSAVA	(Kg)	Qty(kg)	%	Qty(kg)	%	Qty(kg)	%	Qty(kg)
Purchases (kg)	65,000	-	18,000	-	14,000	-	33,000	-
Processed	18,000	27.7	4,000	22.2	5,700	40.7	8,300	25.2
storage	10,000	15.4	2523	14.0	5,600	40.0	2477	7.5
sales	12,000	18.5	205	1.1	3,000	21.4	8795	26.7
losses	25,000	38.5	11,272	62.6	300	2.1	13,423	40.7
(B) YAM								
Purchases	68,000	-	10871	-	17339	-	39790	-
processed	-	-	-	-	-	-	-	-
storage	5000	7.4	600	5.5	2354	13.6	2046	5.1
Sales	60,000	88.2	9782	90.0	14290	82.4	35928	90.3
losses	3000	4.4	489	4.5	695	4.0	1816	4.6
(C) MAIZE								
Purchases	25800	-	10,000	-	95896	-	152104	-
processed	56,000	21.7	3,000	30.0	39573	41.3	13427	8.8
storage	13,000	5.0	1897	19.0	9785	10.2	1318	0.9
Sales	86,000	33.3	3864	38.6	33237	34.7	48899	32.1

losses	103000	39.9	1239	12.4	13301	13.9	88460	58.2

Source: Field Survey Data 2010.

For maize, the highest percentage loss was sustained by the independent "freelance" retailers (58.2%) followed by the wholesalers (13.9%).The cooperative retailers , again, sustained the lowest percentage loss (12.4%).The result shows that the cooperative retailers were more efficient in the handling of these food staples. It suggests that the independent "freelance" retailers and the wholesalers are responsible for the greater part of these losses and shortages in the study area. In terms of utilities created along the channel, the table shows that the cooperative retailers created the highest place utilities (38.6%) and time utility (34.7%) along the trade channel. They were followed by the wholesalers and, then, the independent "freelance" retailers. This means that, in addition to higher level of efficiency, the cooperative retailers also excelled in the creation of place and time utilities along the distributive chain. The wholesalers, however, created the highest volume of possession utility for all food staples in the study area.

The Estimated Costs Incurred by Channel Members in the Distributive Trade.

The estimated costs incurred by channel members in the performance of their distributive trade are as shown in the Table 2.

TABLE 2: Summary Costs incurred by the Channel Members in the Study Area.

Item of cost	Amount for wholesalers (₦)	Amount for "freelance" retailers (₦)	Amount for Cooperative retailers (₦)	Total amount for all middlemen (₦)
Variable costs				
Transportation	4691.00	566.52	286.97	2551.49
Labour	1138.24	283.26	143.49	1564.99
Total variable costs	2836240(68.90%)	849780(20.64%)	430460(10.46%)	4116480
Fixed costs			-	
Marketing levy	27.57	22.67	23.84	74.08
Interest on loan	48.52	-	13.54	62.06
Insurance	92.60	-	14.56	107.16
Stall rent	45.73	-	21.65	67.38
Depreciation allowance	69.50	11.87	13.56	94.93
Average fixed costs	283920(86.78%)	34540(11.17%)	8715(2.66%)	327175
Average total costs	3120.16	884.32	517.61	4522.09

Source: Field Survey Data, 2010.

Table 2 shows that total variable costs had the greatest influence on the performance of all classes of middlemen in the distributive trade for these food staples. This is so because ₦2836240 (68.90%), ₦ 849780(20.64%) and ₦ 430460(10.46%) of the total variable costs were spent by the wholesalers, independent "freelance" retailers and the cooperative retailers respectively to meet operating expenses. The average fixed cost accounted for the balance of ₦ 283920 (86.78%); ₦ 34540(11.17%) and ₦ 8715 (2.66%) for each of the categories respectively. The figures show that, for all categories of middlemen, the total variable cost was highest among the wholesalers (₦ 2836240 or 68.90%) followed by the "freelance" retailers (₦ 849780 or 20.64%) and, then the cooperative retailers (₦ 430460 or10.46%). The average fixed costs also followed the same trend, that is, 283920(86.78%) for the wholesalers, ₦ 34540(11.17%) for the "freelance" retailers and ₦8715 (2.66%) for the cooperative retailers. This means that, given the price elasticity of demand for these commodities, consumers are likely to pay lower prices if the cooperative retailers are allowed to dominate the distributive trade channel for these food staples in the area. This will, however, depend on the extent to which these societies are able to address the numerous problems that militate against the operations of most other cooperative societies. These problems were identified in Osuntogun (1972); maunder (1973); Ijere91977); (Igbozuruike (1980) and Olufokunibi (1981), Okereke (1982); and include unprofitable scale of operation, defective management, shortage of skilled manpower, storage and service inputs. The results also suggest that, for the wholesalers and the "freelance" retailers to remain in the business and make useful contributions in the distributive trade, they must earn higher marketing margins to cover their high operating and fixed expenses .They

must also explore cost-saving devices in their operations to avoid rendering marketing functions at higher costs to consumers.

The Estimated Revenue of Channel Members from the Selected Food Staples.
The Average Total Revenue (ATR) of the different channel members in the distributive trade for these food staples are as shown in Table 3.

Table 3 Distribution of the Earnings of Channel Members from Selected Food Staples.

Staple food crop	Average Total Revenue to all middlemen ₦	Average for cooperative retailers ₦	Average for "freelance" retailers ₦	Average for wholesalers ₦
Yam	1895000	1231750 (65%)	473750 (25%)	189500 (10%)
Cassava	1621000	875340 (54%)	680820 (42%))	64840 (4%)
Maize	3572000	1500240 (42%)	1357360 (38%)	714400 (20%)
Total	7088000	3607330	2511930	968740

Source: Field Survey Data, 2010.

Table 3 shows that ₦ 1231750 (65%) of the average total revenue from Yam that accrued to all classes of middlemen went to the cooperative retailers, followed by the "freelance" retailers with ₦ 473750 (25%) and then the wholesalers with ₦ 189500 (10%). From cassava, the table shows that the cooperative retailers earned ₦ 875340 (54%) of the average total earnings followed by the "freelance" retailers and then the wholesalers. The table again, shows that, from maize, the average earnings of these categories were 42%, 38% and 20 % respectively of the average total earnings. This suggests that the distributive trade for these staples was more rewarding to the cooperative retailers followed by the independent "freelance" retailers and, then, the wholesalers. This underlines the relative merit in promoting the activities of group-oriented economic units such as co-operative societies in the distributive trade for these food staples. Baker (1981), however, observed that cooperative societies as retail outlets had failed to exploit fully the economies of scale open to it and had consistently lost ground to other categories of retail outlet. This category of middlemen will enhance its operational performance if it specializes in yam trade which has a clear advantage over all staples in terms of earnings. This will enable them utilize resources spent in the distributive trade for maize and cassava to enhance its performance. In the same vein, the "freelance" retailers will enhance their operational performance if they specialize in cassava trade while the wholesalers should devote more of their resources in maize trade

The Relative Percentage Gross and Net Margins of the Channel Members.
The summary marketing margins estimated from the activities of the different categories of channel members in the distributive trade for the selected staples are as shown in Table 4
Table 4 shows that the percentage gross margins were 21.38, 66.17 and 55.56 for the cooperative retailers, independent "freelance" retailers and wholesalers respectively. These compare favourably with the percentage gross margins for other food crops in the country, reported in Adekanya (1982) and Barua et al (1993). The results mean that, for every hundred Naira paid by the consumers for these food staples, ₦ 21.38, ₦ 66.17 and ₦ 55.56 went to cover marketing costs and profits for the Cooperative retailers, "freelance" retailers and wholesalers respectively. The farmers received an average of ₦ 78.62, ₦ 33.83 and ₦ 44.44 from the transactions associated with the cooperative retailers, "freelance" retailers and wholesalers respectively.

Table 4: Estimated Relative Marketing Margins of the Channel Members.

variable	Cooperative retailers (₦)	"freelance retailers (₦)	Wholesalers (₦)	Total for all middlemen(₦)
Gross earnings from sales	3607330	2511930	968740	7088000
Purchase cost	2836240	849790	430460	4116490
Gross marketing margins	771090	1662140	538280	2971510

Percentage gross margins	21.38%	66.17%	55.56%	41.92%
Farmers share of gross margins	78620	33830	44440	-
Total variable costs	80490	10050	38340	128880
Net marketing margins	690600	1652090	499940	2842630
Percentage Net Margin	19.14%	65.77%	51.61	

Source: Field Survey Data, 2010.

These marketing margins, being the difference in the price paid for a commodity at different stages of the marketing system, reflecting time, place, form and possession utilities, Olukosi and Isitor (2005), established the channel category that would perform the necessary functions at the lowest cost consistent with the demands of efficiency. This suggests that the operations of the cooperative retailers, with higher marketing margins, were more benefial to farmers than those of the independent retailers and the wholesalers. This emphasizes the need for stepping up the operations of group-oriented actors, such as the co-operative societies, which were acclaimed in Milton 91980): idonije (1982) Adeyemi (1987): Pandey (1992); to be veritable tools for the enhancement of the welfare status of the people.

Result of the Multiple Regression Analysis.

The estimated double-log functions for the marketing margins and their influencing factors were found as follows:

$$\text{LnY} = 0.469 + \underset{(0.0435)}{0.271\text{LnX}_1}{}^{*} + \underset{(0.1148)}{0.342\text{LnX}_2}{}^{*} + \underset{(0.1126)}{0.321\text{X}_3}{}^{*} + \underset{(0.1474)}{0.229\text{LnX}_4} + \underset{(0.2122)}{1.048\text{LnX}_5}{}^{*} + \underset{(0.0922)}{0.884\text{LnD}_2}{}^{*} + \underset{(0.2230)}{0.4815\text{LnD}_3}{}^{*}$$

R^2 =0.8229; Adjusted R^2 =0.8135; F-ratio = 87.3567; n = 120. *Significant at 5% probability level. Figures in parenthesis are standard errors of estimates.

The estimated function in (3) above shows that about 82% of the variations in marketing margins of cooperative retailers and wholesalers in the distributive trade were explained by the variables included in the model. This suggests a good regression fit. The function also shows that, except for wages, stall rent and association dues(X_4) which were not significant, all the other variables were significant, at 5% level of probability, in influencing the gross marketing margins earned by these channel members. This means that Sales volume(X_1), losses incurred in transaction (X_2), cost of capital(X_3), transportation and storage costs (X_5) and type of channel member(X_6) were the factors that influenced the gross marketing margins earned in the distributive trade for these selected staples. Since the wages, stall rent and association dues paid by the members did not significantly influence their earnings performance, the null hypothesis that their efficiency was not significantly influenced by all the estimated variables was, therefore, accepted. Of particular interest is the dummy coefficients (D_2 & D_3) which were statistically significant, suggesting that the type of channel member influenced the level of marketing margins earned in the distributive trade for these staples. Such dummy coefficients, referred to as the differential intercept coefficients (Gujarati, 1995) "tells by how much the value of the intercept term of the category that receives the value of 1 differs from the intercept coefficient of the base category" (Gujarati, 1995).In this particular study, the variable indicates by how much the intercept term for the cooperative retailers' as well as that of the wholesalers differ from that of the 'freelance retailers (the base category). It measures the relative efficiency of the three categories of channel members in the distributive trade. This means that, from the composite function in (3) above, the relative efficiency of the "freelance" retailers is:

E ($Yi/ D_2 =0; D_3 = 0$) =

$$\text{LnY} = 0.469 + \underset{(0.0435)}{0.271\text{X}_1}{}^{*} + \underset{(0.1148)}{0.342\text{X}_2}{}^{*} + \underset{(0.1126)}{0.321\text{X}_3}{}^{*} + \underset{(0.2122)}{1.048\text{X}_4}{}^{*} + \underset{(0.1474)}{0.229\text{X}_5} \quad (4)$$

R^2 =0.8111; Adjusted R^2 = 0.8011; F-ratio = 83.46 * significant at 5% probability level. Figures in parentheses are standard errors of estimates.

That of the Cooperative retailers is:

E ($Yi/D_2 =1; D_3 =0$) =

$LnY = 1.353 + 0.271X_1* + 0.342X_2* + 0.321X_3* + 1.048X_4* + 0.229X_5$ (5)
(0.0435) (0.1148) (0.1126) (0.2122) (0.1474)
$R^2 = 0.8095$; Adjusted $R^2 = 0.7994$; F-ratio = 79.353; * Significant at 5% probability level. Figures in parentheses are standard errors of estimates.
That of the wholesalers is:
E ($Yi/D_2 = 0$; $D_3 = 1$) =
$LnY = 0.9505 + 0.271X_1* + 0.342X_2* + 0.321X_3* + 1.048X_4* + 0.229X_5$ (6)
(0.0435) (0.1148) (0.1126) (0.2122) (0.1474)
$R^2 = 0.8054$; Adjusted $R^2 = 0.7951$; F-ratio = 77.94; *Significant at 5% probability level. Figures in parentheses are standard errors of estimates.

The intercepts of the functions indicate that the descending order of economic efficiency of the three categories of middlemen in the distributive trade for these staples is the cooperative retailers followed by the wholesalers and, then, the "freelance" retailers. This finding is consistent with the position of Baker (1981) that cooperative retail societies, taken together, have a turnover greater than the next four largest type of retail outlet covered by his study. Since, in the view of Davis (1971, it is essential that the producer chooses the most suitable channel (or channels) of distribution to ensure that the right goods in the right quantities are in the right place(s) at the right time in order to achieve the objectives of distribution, the cooperative retail trade for these staples presents itself as the best channel for the enhancement of the gains from the production and distribution of these staples in the study are. These go to support the numerous cases been made for the promotion of cooperative activities for rapid economic development.

Summary.

The study was designed to access the performance of the distributive channels for some selected food staples in Imo State, Nigeria. The specific objectives were to identify the types of markets for maize, cassava, and yam in the study area; the channel members in the distributive trade for these selected staples; estimate the marketing functions/dysfunctions undertaken by these channel members; the relative efficiency of these channel members and the influencing factors. The multistage and simple random sampling techniques were adopted to select One Hundred and Twenty marketers involved in the distributive trade for these staples, and data related to the specific objectives were collected from them. Data were analyzed using the multiple regression technique, tables and percentages to estimate marketing margins as the index of relative efficiency. Results showed that decentralized markets existed for cassava and maize; that the distribution channel was dominated by independent "freelance" retailers who made the greater bulk of purchases directly from farmers at the farm-gate along with a few cooperative retailers who operated under binding agreements. A few wholesalers identified along the channel also made direct purchases from the farmers. The most common form of organizational flow was, therefore, from the farmers to the farm-gate retailers to the consumers. The centralized market type was identified for yam, with a predominant north – south flow. The most common organizational flow was from the producer to brokers to wholesalers to consumers. A few independent "freelance" and cooperative retailers were also identified in the yam distribution trade. The independent "freelance" retailers and the wholesalers were shown to be responsible for the greater part of the losses and shortages being experienced in the area. In terms of utilities created along the channel, the cooperative retailers created the highest place and time utilities along the trade channel, followed by the wholesalers and, then, the independent "freelance" retailers. The wholesalers created the highest volume of possession utility for all food staples. The result showed that the cooperative retailers were more economically efficient than the wholesalers in the distributive trade for these staples. He wholesalers were more economically efficient than the "freelance" retailers.

Conclusion.

The result shows that the various categories of channel members identified in the distributive trade differed in their marketing efficiency as well as the gross margins earned from their operations. The cooperative retailers were more economically efficient and more beneficial than the wholesalers and the "freelance" retailers in the distributive trade for Cassava, Maize and yam in the study area. The efficiencies of these members were influenced by their sales volume, volume of losses sustained in transaction, the cost of capital used in production, transportation cost, wages, stall rent and association dues as well as the category of middlemanship. They were not influenced by the wages, stall rent and association dues paid by the members.

Recommendations.

It is recommended that: (1)Efforts be intensified in the promotion of such Group-oriented activities as co-operative societies in the distributive trade for these

food staples (2).The cooperative retail societies and the independent "freelance" retailers should specialize in maize trade in order to utilize resources spent in the distributive trade for yam and cassava to enhance its operational performance.
(3) Accessible and motorable roads between the rural and urban areas should be provided to lower transportation cost and enhance the marketing margins that are being earned by the channel members in the retail trade for these staples.

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In vitro Antimicrobial activity of water extract of *Moringa oleifera* leaf stalk on bacteria normally implicated in eye diseases

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Abstract: The *in vitro* antibacterial activity of the water extract of *Moringa oleifera* leaf stalk extract was conducted. Paper disc diffusion method was used to assess the effect of the extract on *Pseudomonas aerogenosa, Staphylococcus albus, Staphylococcus aureus, Escherichia coli, Staphylococcus pyogenus* and *Enterobacter aerogenes*. At dilution of 1000mg/ml, 700mg/ml, 400mg/ml and 200mg/ml only mild activity against *Escherichia coli* and *Enterobacter aerogenes* was noticed. *Pseudomonas aerogenosa, Staphylococcus albus, Staphylococcus aureus* and*, Staphylococcus pyogenus* was resistant at these concentrations. The highest activity was produced by *Escherichia coli* at 1000mg/l which comparably is less than that of the standard drug tetracycline (250mg/ml). in conclusion, this study has shown that the water extract of *Moringa oleifera* posses some degree of antimicrobial activity especially at high dose. [Academia Arena, 2010;2(6):80-82] (ISSN 1553-992X).

Keywords: *In vitro;* Antimicrobial activity; *Moringa oleifera;* diseases

Introduction

Moringa oleifera also known as Drumstick (India), Nebedy (Senegal), Benzolive tree (Haiti), Marum (Thailand) and Malunggay (Philippine) (EL-Awady, 2003). In Nigeria, it is called Zogale, Zogale gandi and Bagaruwar makka (Hausa), Ewe igbale and Idagbo monoye (Yoruba), Ikwa oyibo (Igbo) and Kabi (Kilba).

Moringa oleifera is a well documented world renowned plant herb for its extraordinary nutritional and medicinal properties. It is a natural antihelmintic, antibiotic, detoxifier, outstanding immune builder and is used in many countries to treat malnutrition and malaria. It is also used in water purification and therefore helps in reducing the incidence of water borne diseases (Marcu, 2004).

Eye infections may be caused by bacteria, fungi, Chlamydia or virus with bacteria being the most common. This seriously affects the activity of the affected subject and may a times lead to vision impairement or blindness.

Kilba people of Adamawa state, Nigeria use the fluid from the stalk of *Moringa oleifera* in treating eye infections.

This study is therefore designed to investigate the invitro activity of *Moringa oleifera* leaf stalk extract on bacterial organisms normally implicated in eye diseases.

Methodology

The leave stalks of *moringa oleifera* were collected from Hong, Adamawa state, Nigeria and identify by the department of biological sciences, University of Maiduguri. The stalk was air dried and pounded into a coarse powder using laboratory pestle and mortar. To 100g of the powder leaf stalk was added 1.5 litres of distilled water and was thoroughly mixed and allowed to stand for one hour before filtering with the aid of whatman filter paper number 1. The filterate was dried in hot air oven (45^{o}C). The extraction yielded 24.891% w/w of water extract.

Laboratory isolates of the pure cultures of *Pseudomonas aerogenosa, Staphylococcus albus, Staphylococcus aureus, Escherichia coli, Staphylococcus pyogenus* and *Enterobacter aerogenes* were obtained from the Department of Veterinary Medicine Research Laboratory, University of Maiduguri, Nigeria. The isolates were propagated on nutrient agar plate (Oxoid, 40, England) according to the manufacturer's specification. The stock cultures were stored at 4^{o}C on nutrient agar. They were then subcultured in

nutrient broth (Oxoid, 40, England) at 37°C for 8 hours prior to antimicrobial testing.

Extract concentrations were prepared by dissolving known weight of the stock solutions of crude aqueous extract in known volume of distilled water to give 200mg/ml, 400mg/ml, 700mg/ml and 1000mg/ml of the crude extract. 250mg/ml of the standard antibacterial agent (tetracycline, cipla ltd, Mumbai, India) was similarly constituted.

Disc diffusion method as described by National Committee of Clinical Laboratory Standard (1993a) was used to determine the antimicrobial activity of *Moringa oleifera*. Disc containing different concentrations of dissolved extract (200mg/ml, 400mg/ml, 700mg/ml and 1000mg/ml) were prepared with sterilized filter paper (Whatman no.1, 6 mm in diameters) soaked in different beakers. The disc was dried at 50°C.

Overnight cultures of each bacterial isolates was diluted with sterile normal saline to give an inoculums size of 1,000,000 cfu/ml. the inocula were spread on the surface of the dried nutrient agar plate with cotton wool swabs which have been dipped in the diluted suspensions of the organisms. The plates were incubated at 35°C for 30 minutes before the discs were applied aseptically. The treated plates were incubated at 37°C for 48 hours. The same procedure was carried out using tetracycline as control. The zone of inhibition above 6mm diameter of each isolate was used as a measure of susceptibility to the extract and was compared to that of the standard drug.

Results

The results of the antimicrobial test using water extract of *Moringa oleifera* leaf stalk and tetracycline are presented in Table 1.

The water extract inhibited the growth of *Escherichia coli* and *Enterobacter aerogenes*. The zone of inhibition of *Escherichia coli* were 7mm, for 200mg/ml, 400mg/ml, 700mg/ml and 10mm for 1000mg/ml of the extract as against 12mm produced by the standard drug, tetracycline (250mg/ml).

The extract did not produce any effect against *Pseudomonas aerogenosa, Staphylococcus albus, Staphylococcus aureus* and *Staphylococcus pyogenus*. However, the standard drug tetracycline (250mg/l), produced zones of inhibition 17mm, 17mm, 25mm and 15mm for *Staphylococcus aureus, Staphylococcus albus, Staphylococcus pyogenus* and *Pseudomonas aerogenosa* respectively.

Table 1. *In vitro* antibacterial effect of *Moringa oleifera* leaf stalk at various concentrations on bacterial organism

Extract/ Antibiotic	*Escherichia coli*	*Enterobacter aerogenes*	*Staphylococcus albus*	*Staphylococcus aureus*	*Staphylococcus pyogenus*	*Pseudomonas aerogenosa*
Extract: 1000mg/ml	10mm	7mm	R	R	R	R
Extract: 700mg/ml	7mm	7mm	R	R	R	R
Extract: 400mg/ml	7mm	7mm	R	R	R	R
Extract: 200mg/ml	7mm	7mm	R	R	R	R
Tetracycline: 250mg/ml	12mm	16mm	17mm	17mm	25mm	15mm

Key: R-Resistant

Conclusion

The result of this study showed that *Moringa oleifera* leaf stalk water extract had no antibacterial activity against *Staphylococcus aureus, Staphylococcus albus, Staphylococcus pyogenus* and *Pseudomonas aerogenosa* and only a mild activity against *Escherichia coli* and *Enterobacter aerogene*. It has been reported that crushed seed extract of *Moringa oleifera* had bactericidal activity against *Staphylococcus pyogenus* and *Pseudomonas aerogenosa* (Suarez *et al.,* 2005). Harvey (2005), also reported that Pterygospermin, a bactericidal and fungicidal compound contained in an aqueous extract made from seed of *Moringa oleifera* was effective against *Staphylococcus aureus* as the antibiotic neomycin. However, this does not in any way indicate that the results of these studies are

scientifically divergent, as plants have different organic compounds stored in them but their concentration in different parts of the plant may not be the same. Harbone (1982), has documented that active principles are stored in different plants and released in varying combination and strength. Miller (1973) has also documented that fats occur in all proportion of plant, but in general, the major accumulations are found in tissues of fruits and seeds. The phytochemistry of *Moringa oleifera* shows that several organic compounds found in the pods and leaves differ despite their closeness (Duke, 1983).

With these, it can be deduced that the active antibiotic principle, Pterygospermin has a very low concentration in the leaf stalk of *Moringa oleifera* and that was why the activity against the test micro-organisms differed from other works.

Suggestion and conclusion

This result showed that *Moringa oleifera* leaf stalk water extract had antimicrobial effect not up to the extent claimed by its traditional users. However, attempts should be made to conduct *in vivo* studies with the extract so as to confirm the present *in vitro* findings as the diameter of the zone of inhibition is not only affected by sensitivity of the micro-organisms alone but concentration of the extract in the discs is used and it's rate of diffusion in the media as well. This will aid in giving a clear evidence for condemning its traditional usage or supporting it to some extent.

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In-vitro antibacterial activity of *Allium humile*

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Abstract: This review aims to obtain the preliminary information regarding the inhibitory effects of the extracts of *Allium humile* on the test strains *B. subtilis, S. aureus, E. coli* and *P. aerugenosa.* The anti-bacterial activities of five solvent extracts viz. n-Hexane, Chloroform, Ethyl acetate, Methanol and Aqueous fractions of *Allium humile* were evaluated using disc diffusion technique. The extracts and fractions demonstrated significant anti-bacterial activity. Extract from Chloroform was the most potent against all the test organisms with the largest diameter of zone of inhibition. n-Hexane also showed considerable zone of inhibition. Ethyl acetate, Methanol and Aqueous fractions also exhibit slight inhibitory effects on both the gram-positive and gram negative test strains. [Academia Arena, 2010;2(6):83-86] (ISSN 1553-992X).

Keywords: *Allium humile*, Antibacterial, Zone of inhibition, chloroform extract, Inhibitory effect

Introduction :

Infectious diseases accounts for high proportion of health problems in the developing countries including India (Davies et al., 1994). Microorganisms have developed resistance to many antibiotics and as a result, immense clinical problem in the treatment of infectious diseases has been created. The resistance of the organisms increased due to indiscriminate use of commercial antimicrobial drugs commonly used for the treatment of infectious disease. This situation forced the researchers to search for new other antimicrobial substance from various sources including medicinal plants (Bauer et al., 1996). Many of the plant materials used in traditional medicine are readily available in rural areas at relatively cheaper than modern medicine (Mann et al., 2008). Plants generally produce many secondary metabolites which constitute an important source of microbicides, pesticides and many pharmaceutical drugs. Although chemical drugs are popular, however, herbal medicine continued to be practiced due to richness of certain plants in varieties of secondary metabolites such as alkaloids, flavonoids, tannins, terpenoids which have been reported to have antibacterial activities (Lewis and Ausubel, 2006, Cowan, 1999).

Medicinal plants represent a rich source of antimicrobial agents. Plants are used medicinally in different countries and are a source of many potent and powerful drugs (Srivastava et al., 2006). A wide range of medicinal plant parts is used for extract as raw drugs and they possess varied medicinal properties. The different parts used include roots, stem, flower, fruit, twigs exudates and modified plant organs. While some of these raw drugs are colleted in smaller quantities by the local communities and folk reveals for local used, many other raw drugs are collected in larger quantities and traded in the market as the raw material for many herbal industries (Uniyal et al., 1996).

Considering the vast potentialities of plants as a source for anti-microbial drugs with reference to antibacterial agent, a systematic investigation was undertaken to screen the Allium humile for its antibacterial activity. Allium sp. has been used for centuries as remedies for human diseases because they contain components of therapeutic values. Allium humile is a perennial bulb having white flowers and belongs to Alliaceae family and grows naturally on slopes at high elevations in India. It is mainly found at the height of 1500-3000 meters of Alpine Himalayas of Uttarakhand, India, near moist rock, dry rock and steep slope with a strong preference of sunny site. Edible plant part used includes flowers, leaves, root and bulb. The leaf and bulb parts of this plant are used locally in the alleviation of inflammation and painful conditions (Farooquee et al, 2004). Leaves and inflorescences are also used as seasoning agents. Although no specific mention of medicinal uses has been for this species, member of this genus are in general very healthy additions to the diet. In this study, we investigated the antibacterial activity of petroleum ether, ethyl acetate, chloroform, methanol and aqueous extracts of A. humile against a panel of Gram positive and Gram negative bacteria. As per our knowledge, the antibacterial activities of this plant have been reported for the first time.

Materials and Methods:

Plant material:

Fresh disease free leaves and seeds of the plant were collected from Deovan, Chakrota, Uttarakhand, India, from an altitude of 1575 meter. Leaves were 4-7cm long, 4-5 mm wide. The leaves were washed

thoroughly several times with running water and once with sterile distilled water. The leaf material was then air-dried on a sterile blotter under shade. A voucher specimen and seed of the plant has been deposited in the herbarium of National Bureau of Plant Genetic Resources (NBPGR), Pusa, Delhi, India. The National Identity number of Allium humile is IC 567643.

Preparation of Extracts:

Solvent Extracts:

The thoroughly washed, shade dried sample (45 days) was subjected to the soxhlet extractor. The solvents employed for the fulfillment of this research were n-Hexane (68^0C), Chloroform (61.2˚C), Ethyl acetate (76˚C), Methanol (64.6˚C) and aqueous (100˚C). The extracts were separated by running a soxhlet assembly where solvents were applied as per their polarity at their boiling point. All the extracts were concentrated using Rotary flash Evaporator and preserved at 4˚C in air-tight bottles until further use. All the extracts were then subjected to anti-bacterial activity assay.

Microbial Cultures:

Four different bacterial strains were employed for the successful accomplishment of the study viz. Bacillus subtilis (MTCC 441), Staphylococcus aureus (MTCC 96), E. coli (MTCC 739) and Pseudomonas aeruginosa (MTCC 429). These strains were tested for their degree of resistance towards the different extracts of the plant sample. The strains were collected from Institute of Microbial Technology, Chandigarh, India. All the test strains were maintained on Nutrient Agar slopes (Hi-Media) and were subjected to anti-bacterial activity assay.

Anti-bacterial Assay:

Antimicrobial activity was carried out using disc-diffusion method (Bauer et al., 1996). The extracts were dissolved in DMSO (1% v/v) to yield the final concentration of 100 mg/mL. Sterile discs (Himedia, India) were impregnated with the prepared extracts. For the preparation of the inoculation, the tested bacteria were cultured in nutrient broth at 37°C for 24 h and 0.5 of the McFarland unit, which was used (Barry and Thornsberry, 1985). One hundred microliters of prepared culture were spread on the surface of nutrient agar (Hi-Media) for bacterial pathogens. The plates were kept at ambient temperature for 30 min to enable diffusion of extracts and then incubated at 37°C for 24 h. Discs impregnated with only solvents were used as negative controls and antibiotic discs of streptomycin (10 µg/disc) (Hi-Media, India) for bacteria was used as positive controls. The antibacterial activity was evaluated by measuring the diameter of inhibition zone. Each experiment was repeated at least three times and mean of the diameter of inhibition zones was calculated.

Phytochemical Screening

The n-Hexane, Chloroform, Ethyl acetate, Methanol and Aqueous extracts of A. humile were subjected to qualitative chemical tests for the indentification of various plant constituents like tannins, polyphenols, flavonoids, alkaloids, steroids and saponins. Two milliliters of each extract was measured into a test tube for each of the tests and concentrated by evaporating extractant in a water bath.

Results

Extract Yield

Percentage extraction for the different solvents used was 54% (water), 46% (hexane), 40% (ethyl acetate), 34% (methanol) and 24% (chloroform). Water is a universal solvent and is generally used in traditional settings to prepare the plant decoctions for health remedies. All the extracts were acidic in nature (pH values ranging between 5.0-5.5). The acidity combined with bioactive components might enhance the antimicrobial activity of the extracts against the bacteria.

Anti-bacterial Assay

The different extracts and fractions of *Allium humile* demonstrated significant anti-bacterial activity. Chloroform was the most potent against most of the test organisms with largest diameter of zone of inhibition i.e. 18mm against B. subtilis. n-Hexane also showed considerable zone of inhibition viz. 13mm against E.coli and P.aeruginosa. The plant extracts and their antimicrobial activity on the given bacterial strains are shown in (Figure 1).

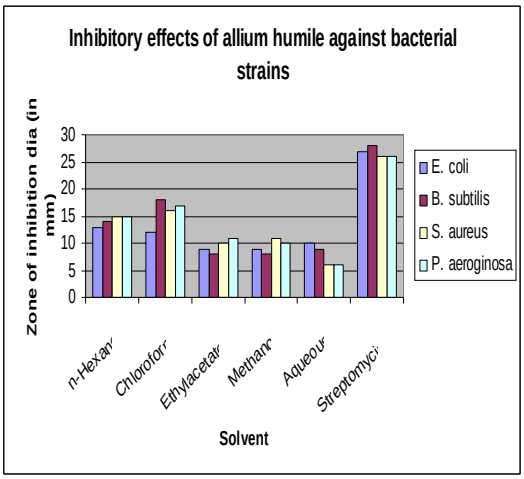

Figure 1: Graphical representation of inhibitory effect of different extract of *Allium humile* against test bacterial strains

In vitro antimicrobial study indicated maximum range (61-65%) for chloroform extract of the four test strains, while the minimum range of inhibitory activity (23-28%) was exhibited by different extract in different solvent systems (aqueous for Staphylococcus aureus and Pseudomonas aeruginosa, ethyl acetate for Bacillus subtilis, methanol for Bacillus subtilis). However, no extract (of all the solvents used) showed any antibacterial activity against M. luteus (Table 1).

Phytochemical Screening

Qualitative phytochemical investigation revealed that the extracts contained some phytoconstituents. Saponins, tannins, alkaloids and flavonoids are present in the acetone extracts; tannins, alkaloids and flavonoids are found in the methanol extracts; alkaloids and flavonoids in water; and hexane extracts and saponins and tannins in dichloromethane extracts (Table 2). These bioactive components including thiocynate, nitrate, chloride and sulphates, beside other water soluble components which are naturally occurring in most plant materials, are known to be bactericidal, pesticidal or fungicidal in nature thus conferring the anti-microbial property to plants.

Table 1: Zone of inhibition diameter (in mm) of different extracts of *Allium humile*

	Extracts of *Allium humile*					
Test pathogens	**Methanol**	**n-Hexane**	**Chloroform**	**Aqueous**	**Ethyl Acetate**	**Streptomycin**
E. coli	9	13	12	10	9	27
B. subtilis	8	14	18	9	8	28
S. aureus	11	15	16	6	10	26
P. aeruginosa	10	15	17	6	11	26
Micrococcus luteus.	-	-	-	-	-	23

Table 2. Phytochemical analysis of different extract of *Allium humile*

		Extracts of *Allium humile*				
Tests		**Methanol**	**n-Hexane**	**Chloroform**	**Aqueous**	**Ethyl Acetate**
1.	**Steroids**					
i. a	Salkowski test	(+)	(+)	(-)	(-)	(-)
ii.	Gilberman-Buchard's test	(+)	(+)	(-)	(-)	(-)
2.	**Alkaloids**					
i.	Wagner's test	(-)	(-)	(+)	(+)	(+)
ii.	Hager's test	(-)	(-)	(+)	(+)	(+)
3.	**Phenolic and Flavonoid compounds**					
i.	Vanilin-HCL test	(-)	(-)	(+)	(-)	(+)
ii.	Ferric chloride test	(+)	(+)	(+)	(-)	(-)
iii.	Zinc hydrochloric acid reduction test	(-)	(-)	(-)	(-)	(-)
4.	**Tannins**	(-)	(-)	(+)	(+)	(+)
5.	**Saponins**	(-)	(-)	(+)	(+)	(+)

Discussion

The higher resistance of Gram-negative bacteria to plant extracts has previously been documented and related to thick murein layer in their outer membrane, which prevents the entry of inhibitor substances into the cell (Martin, 1995; Brantner et al., 1996; Palombo and Semple, 2001; Tortora et al., 2001; Matu and van Staden, 2003). Similarly, our results indicated that the antibacterial activities of the extracts were more pronounced on Gram positive than on Gram-negative bacteria. The chloroform extract of leaf of Allium humile has shown the maximum antibacterial activity regardless of the solvent system. It also showed maximum inhibitory activity against all the test bacterial strains except E.coli against which the n-hexane extract had shown highest activity. The antimicrobial activity exhibited by various extracts of leaf was, however, less than the standard drugs used.

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The effect of aqueous leaves extract of henna (*Lawsonia inermis*) in carbon tetrachloride induced hepato-toxicity in swiss albino mice

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ABSTRACT: The hepato-protective effect of aqueous leave extract of *Lawsonia inermis* on Carbon tetrachloride induced liver damage in swiss albino mice was investigated by measuring the serum of Alanine aminotransferase (ALAT) and Aspartate aminotransferase (ASAT). Groups A and F were administered carbon tetrachloride and distilled water respectively. Groups B and C were administered the extract at 100mg/kg and 150mg/kg body weight respectively for seven days prior to carbon tetrachloride treatment, while groups D and E were administered extract alone at 100mg/kg and 150 mg/kg body weight respectively. The extract significantly ($P \leq 0.05$) decreased the serum levels of ASAT and ALAT, even though not dose dependant. The results suggest that aqueous leave extracts of *Lawsonia inermis* has hepato-protective effects at appropriate dosage. [Academia Arena, 2010;2(6):87-89] (ISSN 1553-992X).

KEYWORDS: Hepato-protective, *Lawsonia inermis*, Carbon tetrachloride, Alanine aminotransferase (ALAT), Aspartate aminotransferase (ASAT).

INTRODUCTION

Many higher plants produce important organic compounds such as resins, tannins, flavonoids, pesticides and other pharmacological compounds; however, most of the plants have not been scientifically evaluated for their toxicity, efficiency and constitute as well. Henna (Lawsonia inermis) is extensively grown in the Middle East and Africa . It has an astringent taste and tea like odor. When the dried leaves are soaked in water and applied to the skin, hair or nails, auburn to red color develops, hence it is worldwide recognized as cosmetic agent used for ornamental values.

Carbon tetrachloride also known as tetra chloromethane is known to have hepatotoxic effects. Carbon tetrachloride is a synthetic chemical compound formally widely used in fire extinguishers but largely abandoned now due to its toxicity. At room temperature and pressure it is a colorless liquid with a "sweet" smell that can be detected at low levels. Exposure to higher concerntration of this compound can affect the central nervous system including the brain. When exposed, the liver is inflamed and hepatocytes will be destroyed (5). The objective of this study therefore is to evaluate the hepato-protective effect of L. inermis in carbon tetrachloride induced liver damage.

MATERIALS AND METHODS

PLANT COLLECTION

Fresh leaves of Lawsonia inermis were obtained from Gashua town of Barde Local Government Area of Yobe state Nigeria. The plant was identified by a toxonomist in the department of Biological Sciences, University of Maiduguri, Nigeria.

EXPERIMENTAL ANIMALS

Thirty Swiss Albino mice weighing between 20-40g were used. They were kept in plastic cages in the laboratory for one week before the commencement of the experiment to acclimatize. They were fed commercial chick mash (Vital feeds Nig. Ltd) and given water ad libitum.

PREPARATION OF PLANT AQUEOUS EXTRACT

The leaves of Lawsonia inermis (Henna) were washed with distilled water. The leaves were sun dried

and grounded into powder using pestle and mortar. Fifty (50) grams of the powdered leaves were mixed with five hundred Milles (500 ml) of water in a flat bottom flask and boiled for 30 minutes. It was allowed to cool and then filtered using a Whatman no.1 filter paper size 0.1µm (micrometer). The filterate was stored at 4oC. The plant aqueous extract was prepared according to the method of Mittal and Aguwa, (3).

EXTRACT ADMINISTRATION

The mice were divided into six (6) groups of five mice each.

Group A mice were administrated Carbon tetrachloride at a dose rate of 4mg/kg body weight subcutaneously.

Group B mice were administered the extract at dose rate of 100mg/kg body weight orally daily for seven consecutive days, and 24 hours after the last dose of extract. Carbon tetrachloride was administered subcutaneously at dose rate of 4mg/kg.

Group C mice were administered the extract at dose rate of 150mg/kg body weight orally daily for seven consecutive days, and 24 hours after the last dose of extract. Carbon tetrachloride was administered subcutaneously at the dose rate of 4mg/kg.

Group D mice were administered the extract alone at dose rate of 100mg/kg body weight orally daily for seven consecutive days.

Group E mice were administered the extract alone at dose rate of 150mg/kg body weight orally daily for seven consecutive days.

COLLECTION OF BLOOD AND LIVER SAMPLES

All the mice from each group were sacrificed 24 hours after administration of carbon tetrachloride and the blood collected in a plane sample bottle via the jugular vein. The blood was allowed to clot and centrifuge at 1500rpm and the serum collected for determination of Alanine aminotransferase and Aspartate aminotransferase concentration.

DETERMINATION ALANINE AMINOTRANSFERASE (ALAT) AND ASPARTATE AMINOTRANSFERASE (ASAT)

The in vitro determination of Alanine aminotransferase and Aspartate aminotransferase was carried out by the method described by Reitman and Frankel, (6) and Schmidt and Schmidt, (19).

STATISTICAL ANALYSIS

The Graphpad Instat 3.0 computer software (2) was used to analyse the data generated. A significant level of $P \leq 0.05$ was considered.

RESULTS

The result of the experiment showing the effect of aqueous leaves extract of Henna (Lawsonia inermis) on carbon tetrachloride induced liver damage is presented in table 1.

All the mice administered the extract showed a significant ($P \leq 0.05$) decrease in both ALAT and ASAT level when compared with group treated with carbon tetrachloride (4mg/kg body weight) alone. However those treated with the extract alone showed higher decreased level of the enzymes then those administered the extract after CCl4 treatment.

The groups treated with 100mg/kg body weight and 150mg/kg body weight of the extract alone recorded significant decrease in the level of ALAT only when compared with the group given distilled water alone. However, the group treated with carbon tetrachloride (4 mg/kg body weight) alone and those treated with 100 mg/kg body weight and 150mg/kg body weight of the extract before carbon tetrachloride administration recorded a significant increase in both ALAT and ASAT level when compared with group treated with distilled water alone.

DISCUSSION AND CONCLUSSION

The result of the study showed that the aqueous leave extract of Lawsonia inermis administered at the dosage used for the experiment suppressed the activity of the liver enzymes in treated animals compared with the control and the group treated with carbon tetrachloride alone.

The extract was found to contain flavonoids, tannins, coumarin, mannitol (8). Flavonoids are reported to exhibit antioxidant activity (4) and are effective scavengers of superoxide anions (7). Beneficial effect of flavonoids has been described for successful treatment of many health conditions, including cancer and liver diseases. They can also bind to enzymes and DNA to chelate heavy metals . The extract may have exhibited hepato-protective activity due to its antioxidant property attributable to the flavonoids, since antioxidants are found to protect liver cells against damaging effects of the reactive oxygen species such as singlet oxygen, superoxide, peroxynitrite, peroxyl and hydroxyl radicals (1).

Antioxidants prevent the oxidative stress which comes up as a result of reactive oxygen that is known for their cellular damaging effect (1).

In conclusion, the aqueous extract of L. inermis has been observed to suppress the liver enzymes therefore has possible hepato-protective activity in the mice because of the presence of flavonoids.

TABLE 1. THE EFFECT OF AQUEOUS LEAVES EXTRACT OF HENNA (*LAWSONIA INERMIS*) ON LIVER ENZYMES OF SWISS ALBINO MICE TREATED WITH CARBON TETRACHLORIDE.

GROUP	LIVER ENZYMES	
	ALANINE AMINOTRANSFERASE (ALAT)	ASPARTATE AMINOTRANSFERASE (ALAT)
A (CCl_4 4mg/kg)	130.2 ± 6.87	217.8 ± 10.66
B (100mg/kg of extract and 4mg/kg of CCl_4)	101.8 ± 17.12*	185.4 ± 9.55*
C (150mg/kg of extract and 4mg/kg of CCl_4)	106.8 ± 10.28*	187.0 ± 9.72*
D (100mg/kg of extract alone)	18.8 ± 3.49 * [a]	90.8 ± 9.91*
E (150mg/kg of extract alone)	13.4 ± 2.97* [a]	65.2 ± 5.63*
F (distilled water)	22.2 ± 3.11 [a]	113.5 ± 11.12

[a] Significant ($P \leq 0.05$) decrease compared with distilled water

* Significant ($P \leq 0.05$) decrease compared with carbon tetrachloride

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Factors Influencing the Use of Fertilizer in Arable Crop Production Among Smallholder Farmers In Owerri Agricultural Zone of Imo State

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Abstract: The study evaluated the factors influencing the use of fertilizer in arable crop production among smallholder farmers in Owerri Agricultural Zone of Imo State. The objectives determined factors influencing the use of fertilizer in arable crop production among smallholder farmers, and determined socio-economic characteristics of smallholder arable crop production farmers in the study area. A multistage random sampling technique was adopted in selecting six Local Government Areas (LGAs), two community from each selected LGA, two villages from each selected communities and five farmers from each selected village. Data were collected with the aid of a well-structured questionnaire from one hundred and twelve farmers. Data were analyzed using frequency distribution, and logistic regression analysis. Results of the analysis showed that output of crop, level of education, farm size and price of fertilizer were important factors influencing farmers' use of fertilizer in arable crop production while gender, age and household size were not. The result further showed that the average age of the farmers were 54.3years, 52.7% of them were males. The farmers spent about 8.5years in school and 20.6 years was their average farming experience. They have an average farm size of 1.3ha and household size of 7persons. The number of extension contact per month was twice. [Academia Arena 2010;2(6):90-96]. (ISSN 1553-992X).

Key words: Fertilizer use, arable crops , smallholder farmers, Nigeria

1. Introduction

Agriculture in Nigeria as in most other developing countries is dominated by smallscale farm producers (Oladeebo, 2004). Smallholder farmers constitute about 80% of the farming population in Nigeria (Awoke and Okorji, 2004). These smallholder farmers although individually look insignificant but collectively form an important foundation upon which the Nigerian agriculture rests. Smallholder farmers are farmers whose production capacity falls between 0.1 and 4.99 hectares holding (Federal Office of Statistics, 1999). According to Awoke and Okorji (2004), smallholder farmers are those farmers who produce on small scale, not involved in commercial agriculture but produce on subsistence level, and cultivate less than five hectares of land annually on the average. A smallholder farmer has among his objectives satisfying household food needs and a little surplus for the market. The smallholder farmers in Owerri agricultural zone are mostly arable crop producers. Production of arable crops in the zone by smallholder farmers is achieved through two main intercrops namely yam, maize, cassava, egusi (melon) intercrop and cassava, maize, egusi (melon) intercrop (Imo ADP, 2000).

One major problem facing agriculture in Nigeria today is that the fertility status of most Nigerian soils is generally low and the problem is how to improve the fertility and hence the productivity of the soil for increased agricultural production (Azagaku and Anzaku 2002). It is only through the use of inputs as soil amendments in the form of mineral fertilizer or organic manure that the productivity of the soil can be improved. Therefore it is necessary to determine the factors influencing the use of fertilizer in arable crop production among smallholder farmers in Owerri Agricultural Zone of Imo State. This study estimated the determinants of fertilizer use in arable crop production among smallholder farmers and determined the socio-economic characteristics of smallholder arable crop production farmers in the study area.

2. Materials and Methods

This study was carried out in Owerri Agricultural Zone of Imo State. Imo State is located in the southeast Zone of Nigeria and lies between latitude 5^0 10^I N and 6^0 35^I N and longitude 6^0 35^I E and 7^0 28^I E (Ministry of lands Survey and Urban planning Owerri, 1992). Owerri Agricultural Zone is

one of the three Agricultural Zones in Imo State. It is located at the southwestern part of Imo State. It is bounded on the East by Abia State, on the west by Anambra and Rivers State, on the North by Isu and Isiala Mbano Local Government Areas of Imo State and on the South by Abia and Rivers States (Imo ADP, 2000). It comprises eleven local Government Areas, namely; Aboh Mbaise, Ahiazu Mbaise, Ezinihitte Mbaise, Ikeduru, Mbaitoli, Ngor-okpuala, Ohaji/Egbema, Oguta, Owerri Municipal, Owerri North and Owerri West. There are two main seasons in the zone –dry and rainy seasons. The annual rainfall is between 2000mm and 2500mm while the mean annual temperature is between 26^0C – 28^0C with a relative humidity of about 98% during the wet season (Imo ADP, 1990). The zone is richly endowed with fertile land suitable for the growth of arable crops like yam, cassava, maize, melon, rice, etc. It has other favourable conditions for arable crop production. Arable crops intercrop is the main cropping system practiced in the zone. The farmers in the zone are mainly smallholder farmers (Imo ADP, 2000). All these necessitated the choice of the zone as the study area.

Owerri Agricultural Zone was chosen purposively for the study because of proximity, accessibility and cost, as well as the existence of arable crop farming among the smallholder farmers in the area who use fertilizer in their arable crop production . Multi-stage random sampling technique was adopted in selecting the respondents for the study. Six out of the eleven LGAs (Local Government Areas) were randomly selected. The second stage of the selection involved the random selection of two communities from each of the chosen six LGAs making a total of twelve communities. Another stage involved a random selection of two villages from each of the twelve selected communities making a total of twenty-four (24) villages.

A random selection of five smallholder farmers was done from each village making a total of one hundred and twenty respondents for the study. These farmers were selected from the list of households who are into smallholder arable crop production in the villages and this list was collected from the village heads and Agricultural Development Programme (ADP) Extension Agents. These Farmers are those that are into Cassava, Maize, Egusi (Melon) intercrop. This is because from the survey carried out, majority of the farmers are into (CME) intercrop in the zone with the reason that there are problems of sourcing for staking sticks, high cost of seed yam and high labour demand in yam production. However, only 112 of the respondents returned valid and usable data for further analysis in the study.

Data were collected from both primary and secondary sources. Information on the socio-economic status of farmers, cost of inputs, input and output quantities, income from output etc. were collected.

Frequencies, percentages and means were used to achieve the socio-economic characteristics of the respondents while multivariate logistic regression analysis was used to determine the factors influencing the use of fertilizer by the farmers. The logistic regression model which derives its name from the logistic probability function (Gujarati, 1998) expresses the quantitative dependent variable, which in this study is dichotomous both qualitative and quantitative. Therefore, coefficient of multiple determination will not be used in deciding the level of significance rather X^2 – Chi squared was used. (Fox, 1984; Ohajianya et al, 2007).

The model employed in the analysis is specified as follows:

$L_n Y = L_n (P/1-P)$

$L_n (P/1-P) = b_0 + b_1 X_1 + b_2 X_2 + \ldots\ldots b_9 X_9 + e$

Where Y = use of fertilizer and its non-use dummy (use of fertilizer (1) and zero for non-use)

P = Probability of use of fertilizer

L_n = Natural logarithm function

b_0 = Constant

b_1 - b_9 = Logistic regression coefficients

X_1 = Output of the farm in naira (₦

X_2 = Gender (male (1) and female(zero)

X_3 = Age of the farmer (years)

X_4 = Level of education (years)

X_5 = Number of persons in the household

X_6 = Farm size (hectares)

X_7 = Farming experience (years)

X_8 = Extn contact (No of visits per mth)

X_9 = Price of fertilizer (N)

e = Stochastic error term.

3. Results and Discussion

3.1 Socio-Economic Characteristics of Smallholder Arable Crop Production Farmers

The socio-economic characteristics of smallholder arable crop production farmers like age, gender, education, household size, farming experience, farm size, extension contact etc were discussed in this section.

Table 1 shows the percentage age distribution of smallholder arable crop farmers in the study area.

Table 1: Percentage Age Distribution of Smallholder Arable Crop Production Farmers

Age (years)	Frequency	Percentage (%)
30 – 39	3	2.7
40 –49	32	28.6
50-59	47	42.0
60-69	23	20.5
70 - 79	7	6.2
Total	**112**	**100**

Mean Age = 54.3
Source: Field Data, 2008

The result of the analysis shows that most (73%) of the farmers fell below the age of 60years, while 26.7% of the respondents were aged 60years and above. The mean age of the respondents was 54.3years. This means that the, smallholder arable crop production farmers studied are relatively old. This goes to buttress the fact that agriculture is seen as an occupation for the aged while the young look for white-coller jobs in the urban areas. Younger farmers are more adventurous while according to Onuoha and Nnadi (1999), older farmers are so conservative that they treat any new thing with skepticism and indifference. The resultant effect according to Orebiyi, et al (2002) is that, there will be a decrease in agricultural productivity in the long run when the ageing farmers can no longer perform.

Table 2 Indicates the percentage distribution of the respondents according to gender.

Table 2: Percentage Distribution of Farmers by Gender

Gender	Frequency	Percentage (%)
Male	59	52.7
Female	53	47.3
Total	112	100

Source: Field Data, 2008

Table 2 shows that 52.7% of the respondents were men while 47.3% were women. This suggests that men are more involved in arable crop production farming than women. Since farming is a laborious activity, the finding is in line with the findings of Obasi (2007) who indicated that women are more involved in the less laborious activities. Orebiyi, et al (2002) also observed that male farmers are expected to have a better and higher productive efficiency than their female counterparts who are more likely to have divided interest and attention because of domestic factors confronting them daily.

Table 3: Percentage Distribution of Respondents by Level of Education

No of years at school	Frequency	Percentage (%)
No formal education	**7**	**6.2**
1-6	28	25.0
7.12	44	39.3
13 - 17	33	29.5
Total	**112**	**100**

Mean level of education = 8.5 years
Source: Field Data, 2008

Table 3 shows that 6.2%, 25%, 39.3% and 29.5% of the farmer had no formal education, spent 1-6years, 7-12years and 13years and above in school respectively. Thus on the average, farmers in the study area spent 8.5years in school, indicating that majority of the respondents attempted at least secondary school education. The need for education in agriculture cannot be overstressed since the level of education of a farmer not only increases his productivity but also enhances his ability to understand and evaluate new production techniques.

Table 4 shows the percentage distribution of the respondents by household size

Table 4: Percentage Distribution of Respondents by Household Size

Household size	Frequency	Percentage (%)
1-5	33	29.5
6-10	72	64.3
11 -15	7	6.2
Total	**112**	**100**

Mean Household Size = 7
Source: Field Data, 2008

Table 4 shows that 29.5%, 64.3% and 6.2% of the respondents have household size of 1-5 persons, 6 -10persons and 11 persons and above respectively. The mean household size stood at approximately 7 persons per household during the study. Having large household size as in this case is sometimes advantageous because labour may be easy to get (Obinne, 1989).

Table 4.5 shows the percentage distribution of the respondent's farming experience.

Table 5: Percentage Distribution of Farmers by Years of Farming Experience

Farming experience	Frequency	Percentage (%)
1-5	2	1.8
6-10	13	11.6
11-15	24	21.4
16-20	18	16.1
21-25	13	11.6
26-30	13	11.6
31 – 35	29	25.9
Total	**112**	**100**

Mean years of farming experience = 20.6
Source: Field Data, 2008.

Table 5 shows that 1.8%, 11.6%, 21.4% and 16.1% of the respondents had years of farming experience of 1-5years, 6-10years, 11-15years and 16-20years respectively. Also the table shows that 11.6%, 11.6% and 25.9% of the respondents had years of farming experience range of 21-25years, 26-30years and 31years and above respectively. The mean years of farming experience was 20.6years. This suggests that the farmers have the necessary experience in arable crop production. The higher the farming experience the more the farmer would have gained more knowledge and technical ideas on how to tackle farm production problems and the higher would be his output and income (Nwaru et al, 2004).

Table 6 shows the percentage distribution of the respondents according to farm size.

Table 6: Percentage Distribution of farmers by farm size

Farm size (Ha)	Frequency	Percentage (%)
0.1 –0.9	40	35.71
1 – 1.9	47	41.96
2-2.9	21	18.75
3 –3.9	2	1.79
4- 4.9	2	1.79
Total	**112**	**100**

Mean farm size = 1.39
Source: Field Data, 2008

Table 6 shows that 35.71%, 41.96%, 18.75%, 1.79% and 1.79% of the respondents have farm sizes ranging from 0.1-0.9ha, 1-1.9ha, 2-2.9ha, 3-3.9ha, and 4-4.9ha respectively. The mean farm

size was 1.39hectares. This compares favourably with the findings of 1.30ha and 1.37ha in Okigwe and Orlu zones of Imo State respectively by Obasi (2007). The implication of this farm size is that as population increases farm size reduces due to partitioning in the inheritance process or due to land reform process. And this invariably will lead to more intensive land use systems. This is so because population growth forces farmers to shorten fallow periods, increase investment on land, manage soil fertility through the addition of manure etc. (Obasi, 2007).

Table 7 indicates the percentage distribution of the respondents by number of extension contacts visit per month.

Table 7: Percentage Distribution of Respondent by No of Extension Contacts Per Month

Extension contact (No. of visits per month)	Frequency	Percentage (%)
0	30	26.8
1	7	6.2
2	75	67
Total	**112**	**100**

Mean No of extension contact = 2times per month
Source: Field Data, 2008

Table 7 shows that 26.8%, and 67% of the respondents indicated that extension agents visited them not and twice respectively in a month. On the average, extension agents visited the farmers 2times in a month. The 2 times visit in a month certified the conditions for a farmer to adopt innovations. Since according to Onuoha and Nnadi (1999), an extension officer should visit the farmer regularly or fortnightly to know his problems on the innovations transferred and on other farm activities so as to help him find solutions to them.

3.2 Factors Influencing the Use of Fertilizer Among the Smallholder Farmers in the Study Area.

The results of the estimation of the factors influencing the use of fertilizer are presented in Table 8.

Table 8: Estimates of the Influences of Selected Variables on the Probability of Use of Fertilizer in Arable Crop Production in Owerri Agricultural Zone of Imo State.

Explanatory Variables and Important Statistics	Logit Regression Coefficient	T-Ratios
Output (x_1)	0.0814	3.7685**
Gender (x_2)	- 0.0829	-1.1627
Age (x_3)	- 0.0592	-1.4334
Education level (x_4)	0.0794	3.8544**
Household size (x_5)	-0.0603	-1.1732
Farm size (x6)	0.0981	3.1242**
Farming experience (x_7)	0.0884	3.8603**
Extension contact (x_8)	0.0592	2.8325**
Price of fertilizer (x_9)	-0.0824	-2.5912**
Constant	-22.0691	-6.3576**
Chi-square	72.4936	
Sample size	112	

** Significant at 1% level
Source: Field data, 2008.

To determine the factors influencing the use of fertilizer among the smallholder farmers in the Owerri Agricultural Zone of Imo State, tests were first conducted to check the presence of any multicolinearity between the independent / explanatory variables. Tests revealed no such presence of multicolinearity. Consequently, all the explanatory variables were entered and the equation fitting the logit regression model was estimated. The variables relating to output of crop (x_1), level of education (X_4), farm size (x_6), farming experience (x_7), extension contact (x_8) and price of fertilizer (x_9) were found to be significant at 1%, implying that these variables are the important factors influencing farmers' use of fertilizer in arable crop production in the study area.

The coefficient for gender (X_2), age (X_3) and household size (X_5) were found not to be significant at the 5% level of significance, indicating that these variables are not important factors influencing farmers' use of fertilizer in arable crops production in the study area. The coefficient of output of arable crops was positive and significant, implying that increases in the output of arable crops produced with fertilizer would lead to increases in the use of fertilizer in arable crops production. This finding is similar to those of Ohajianya et al, (2007) in their study on comparative analysis of organic and inorganic fertilizer use in cassava production in Imo State. The coefficient of level of education was positive and significant, suggesting that farmers with higher education use fertilizer more than farmers with low education. This could be attributed to the fact that higher education enables the farmer to know the benefits of the use of improved inputs such as fertilizer in crop production. This result is similar to those of Cooke (1982) and Asomonye (1991). The coefficient of farm size was positive and significant, indicating that farmers with larger farm size use more fertilizer than farmers with small farm size. The coefficient of farming experience was positive and significant, indicating that the more experienced farmers use more fertilizers in crops production. Coefficient of extension contact was positive and significant, implying that farmers who are in contact with extension agents use more fertilizer than farmers that do not have extension contacts. The coefficient of fertilizer price was negative and significant, implying that farmers use more fertilizer when the price is low than when its price is high. It also means that the farmers respond positively to the dynamics of the market forces.

The findings on farm size and extension contact disagreed with the finding of Ohajianya et al (2007) but are similar with those of Likita (2005) and Dittoh (1991), while the results on farming experience and price of fertilizer are similar with those of Ohajianya et al, (2007), and Udoh and Akintola (2001).

4. Conclusion and Recommendations

The result of the study indicated that output of crop, level of education, farm size, farming experience, extension contact and price of fertilizer were important factors influencing farmers use of fertilizer in arable crop production in the study area. Extension work and training of staff should be given a pride of place by the different arable crop production implementing agencies. The level of arable crops output will increase tremendously if the extension workers are active in their routine farm visits, interpretation and demonstration of research findings. With adequate training, they are better armed with facts and more current on details of new findings that will help improve their farm output.

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