PRODUCTION OF HYDROGEN BY RADIOLYSIS OF WATER CATALYZED BY PRESENCE OF ARGILLITE, BENTONITE AND NANOPARTICLES OF TiO_2

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Long term disposal of high-level and long-lived nuclear waste has been extensively investigated for many years. Hydrogen will be generated by corrosion and radiolysis of waste packages with high level radioactive waste in presence of water. Several authors systematically studied the radiolytic decomposition of water and the results obtained were published in an important number of revue papers and books [1-4]. These studies basically address the kinetic and thermodynamic parameters which quantify radiolytic yields and reaction rates of radiolysis products. Several studies of the water radiolysis in presence of clay and oxide have been reported [5-6]. The yield of H_2 was found to be greater for the radiolysis studies of water adsorbed on different surface than for bulk water. The present work quantifies the radiolytic production of hydrogen in the presence the argillite sample K-119 , nanoparticles of TiO_2 with specific surface area of 253 m^2/g, and bentonite FoCa7 [7] using ^{60}Co source. The dose rate was 112, 400 and 1144 Gy/h as determined using the Fricke's dosimetry. The $G(H_2)$ radiolytic yield, calculated for the argillite sample K119 containing 3% water is 32.3 10^{-7} $mol \cdot j^{-1}$which is 100 times higher than that obtained from argillite water sample of to that 3.2 10^{-8} $mol \cdot j^{-1}$. This augmentation in yield appears to be due to electron and (•OH) radical interaction with the argillite sample K119. The $G(H_2)$-values for hydrogen gaz production from titanium oxide anatase-type with specific surface aire of 253 m^2/g dispersed in water are is 0.43 10^{-7} mol/j. This value two times higher than that obtained from γ-radiolysis of deaerated, aerated water. The radiolytic yield for hydrogen, calculated for solid FoCa7-clay containing 11% water is 5.22 10^{-9} $mol \cdot j^{-1}$ which is much lower than the $G(H_2)$ value of 3.6 10^{-7} $mol \cdot j^{-1}$obtained with the same material dispersed in water. The latter yield is similar to the one found in experiments studying the radiolysis of water confined in nanoscale pores of well-characterised porous silica glasses and mesoporous molecular sieves (MCM-41) reported by P. Rotureauet al [8].

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