4. International symposium on radiopharmaceutical chemistry
Jülich, FR Germany 23 - 27 Aug 1982
CEA-CONF-- 6328

CAPILLARY GAS CHROMATOGRAPHIC SEPARATION OF ISOTOPIC METHANES : A METHOD SUITABLE FOR ISOLATION OF ^{11}C METHANE

G. Berger, C. Prenant, J. Sastre, D. Comar.
Service Hospitalier Frédéric Joliot, CEA Département de Biologie, 91406 Orsay, France.

Very high specific radioactivity is imperative when ^{11}C radiopharmaceuticals are highly toxic or when they are used for "in vivo" observation of specific receptor binding.

Strict precautions concerning pollution by atmospheric $^{12}CO_2$ at the target, gas and reagent levels have allowed a specific radioactivity for various compounds of at best 1-2 Ci/µmole at the time of use.

This order of magnitude is a limit which could not be surpassed in our laboratory during three years of routine work. It is the reason why isotopic separation of labelling agents has been undertaken.

Preliminary experiments have been performed with methanol, methyl iodide, acetone, hydrogen cyanide and methane labelled with deuterium or carbon thirteen. Chromatography (HPLC and capillary GC) has been chosen for its performance, rapidity and its ability to be automatized.

Concerning the first four compounds, it has not been possible to separate ^{13}C derivatives from ^{12}C ones, neither by capillary GC with different liquid phases (CP index ranging from 10 to 100) and highly efficient columns (N^{th} up to 600 000), nor by HPLC with normal, reverse and ion exchange phases. Nethertheless, deuterated methanol and acetone are well separated from corresponding light derivatives.

On the other hand, in the case of methane, the ^{13}C-^{12}C separation has been performed by capillary GC, at low temperature, on treated soft glass.
The original method (1) which was developped for the separation of deuterated compounds gave a poor resolution for $^{13}CH_4$ - $^{12}CH_4$ and was too slow for our purpose (5 hours). It has been modified as follows : A 100 meter soft glass capillary tube pretreated with 25 % NH_4OH at 180°C for 15 hours (2), was eluted at a pressure of 1 bar with 10 % Nitrogen in Helium at - 206 ± 1°C (obtained by adiabatic evaporation of liquid nitrogen).

With these conditions the retention time is about 1 hour and the respective resolution values are :

$^{13}CH_4$ - $^{12}CH_4$: 0,71
$^{12}CH_3D$- $^{12}CH_4$: 3,5
$^{12}CD_3H$- $^{12}CH_4$: 7,1
$^{12}CD_4$ - $^{12}CH_4$: 7,8

These results are encouraging and it now seems possible to obtain ^{11}C methane without carrier. The next step will be to try to transform the non reactive methane into methyl iodide or formaldehyde without isotopic dilution for further use in labelling radiopharmaceuticals.

1) F. Bruner, G.P. Cartoni, M. Possanzini
Anal. Chem., 41 : 1122 (1969).

2) W. Leipnitz, M. Mohnke
Chem. Techn., 14 : 753 (1962).