e a outra com a coincidência entre o detetor de Raio-x e os demais detetores.

Da análise, em andamento, destes dados, já foi possível colocar no esquema de decaimento algumas transições γ que seguem o decaimento da fonte de ^{152}Eu, não posicionadas anteriormente como 212 e 237 keV (posicionadas, entre os níveis de 1023 e 810 keV e 1530 e 1293 keV do ^{152}Sm, respectivamente). Foi confirmada a linha de 563 keV, não observada anteriormente. Também confirmou-se nível de 1314 keV do ^{152}Gd. Este estudo sugere a existencia de dois novos níveis, no esquema do ^{152}Sm, de 1776 e 1779 keV.

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The Concentration of Uranium in São Paulo Citizens' Diet: Results

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Man can interact with the natural radiation either externally or internally. In the last case through the ingestion or inhalation of radioactivity materials or products. The study of this interactions can be important for biological protection questions and the interaction with internal organs can be verified through the metabolism for each isotope. The ways the uranium enter the human body and it's metabolism are the subject of many interesting studies [3,4,5]. In this work we will evaluate the concentration of uranium in São Paulo citizens diet using the fission method. Some samples of aliments were irradiated with neutrons in the IEAR-1 reactor and the traces left on the Makrofol E detector by the uranium fission fragments were counted using an optical microscope. We present there preliminary results which show that rice and lettuce are the aliments with higher concentration. The fission method is useful because the detectors used have important caracteristics. They have high sensibility, are easy to handle and facilitate the counting of the traces, they resist great dose ranges, there are detectors of different sensibility for the various particles, and their cost is low. Besides this qualities the method is worthy because it allows the measurement of small quantities of uranium [1] which is a very important caracteristic because we expect a concentration of ppb (part per billion) of uranium. The technique of the register of fission fragments traces is based on the fact that charged particles produce permanent damage in solid materials. This damages are identified as traces that after an ampliation (by the development) can be counted, for example in an optical microscope. To determinate the concentration of the uranium in the diet we count the number of traces left on the detector used. The number of traces (T) is proportional to the number of fissions (N_f)

$$T = KN_f$$

where K is a proportional constant due to the efficiency of the detection, development and counting. We assume that the fission suffered by the uranium of the samples is due to thermal neutron, so that we can express the number of fissions as

$$N_f = \frac{r m_U N_0}{M_{235}} \sigma_f^{235} \phi t$$

Dealing with equations (1) and (2) we obtain

$$T = \frac{K \sigma_f N_0 \phi t V}{M_U} C$$

where C is the concentration of uranium and V is the volume of the drip. The term σ_f is the effective fission cross section to the natural uranium (σ_f=4 barns) and can be related with the ^{235}U by

$$\sigma_f = r \sigma_f^{235} \frac{M_U}{M_{235}}$$

To determinate the concentration of uranium in one sample we compare it to a known one of the standard sample

$$C_s = \frac{T_s}{T_{st}} C_{st}$$

where C_s is the unknown sample's concentration, T_s and T_{st} are the number of traces in the sample and in the standard, respectively, and C_{st} is the concentration in the standard sample. With data from Ministério da Agricultura some aliments were chosen as the basic São Paulo citizens' diet such as rice, bovine meet, lettuce, tomato and salt. The aliments were weighted and then incinerated at almost 500 Celsius degree, except for the salt that did not passed through the process of incineration. The ashes of the aliments were then diluted in nitric acid 2% and the solutions were evaporated in a metal plate. The resting material were again diluted in nitric acid 2%. For each aliment we obtained 10 ml of solution and dripped a volume of $5\mu l$ in the Makrofol E detector. Some standard samples were made with uranium with a known a concentration. This samples have been dried by a infrared light and covered by another Makrofol E detector. After this process the samples were irradiated in the IEAR-1 reactor with neutrons. To make the traces visible the Makrofol E detectors were developed in a solution of 15% of KOH, 45% of water and 40% of ethilic alcohol at 70 celsius degree for 7 minutes. They were washed with water and dried at room temperature. To count the traces left on the Makrofol E by the fission fragments an optical microscope was used. With the number of trace we can determinate the relative concentration (table ??) of uranium for each aliment. This relative concentration was calculated normalizing to 1 the concentration of the aliment with the highest number of traces, that is in our case the lettuce, taking on account the mass concentration of the aliments on the nitric acid solution. To obtain the absolute concentration of uranium in the aliments we need the number of traces in the standard sample and make use of equation (5). This measurements will be done in the next irradiation period. We can conclude that the relative concentration of uranium is higher in the lettuce and rice folowed by the tomato and the salt. This results are in accord with our expectations, but the rice is a new element that was not found in other studies.

Aliments	Concentration (arbitrary units)
lettuce	1,00
rice	0,55
tomato	0,37
salt	0,29
meet	0,11

Table 1: The aliments of the diet and their concentration of uranium

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