Development of methodology for drying environmental radioactive samples

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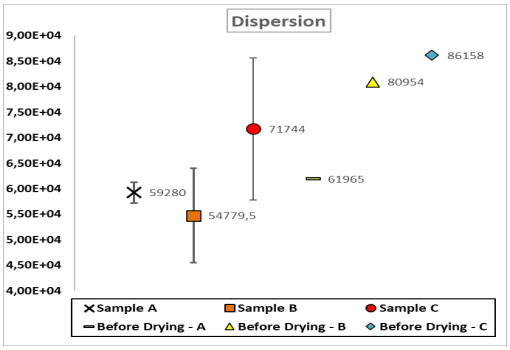
In the Gamma Spectrometry technique of environmental samples, a commonly used practice is drying, which aims to mitigate the self-attenuation caused by the water naturally contained in the sample, in order to search the spectrometry of a comparable matrix, in line with the reproducibility of the results generated [1, 2]. The experiments were carried out using an analog oven, varying the temperature by 5 ºC per sample, allowing the study of radionuclide loss during the exposure of the analyzed object to the drying temperature of samples. The objective is to acquire the gamma spectrum of sand samples from Areia Preta – Guarapari/ES beach before and after exposing the sample to different temperatures, using a High Purity Germanium detector (HPGe), based on the hypothesis that there may be leakage of radionuclides in the drying process, and thus verify if the current drying methodology influences on the levels of ^{228}Ra, ^{226}Ra e ^{40}K of the analyzed sample. The samples, previously moistened equally with distilled and deionized water, were then submitted to the process of drying, which consisted of 1 hour in the analog oven and 20 minutes in a glass desiccator with silica, after that they were weighed, repeating the process until the initial mass of 300 g was reached for each sample. The Gamma Spectrometry was then performed to compare the photopeak count of the 911 KeV energy, regarding the ^{228}Ac, before and after the procedures, knowing that no gas comes before the ^{228}Ac in the decay chain of ^{232}Th, hence there are no leaks in this chain when the recipients are opened for handling. When performing a Student's T test of n 3 and a 95% confidence level in the counts performed for the same photopeak, we obtain the data presented in Figure 1.

Confidence level of 95% - Sample A	After drying	*In natura*
Upper limit	61318,11	61965
Lower limit	57242,56	
Confidence level of 95% - Sample B	**After drying**	***In natura***
Upper limit	79205,96	80954
Lower limit	60692,04	
Confidence level of 95% - Sample C	**After drying**	***In natura***
Upper limit	85657,45	86158
Lower limit	57831,89	

Figure 1. Student's T tests performed for the 911 KeV photopeak, regarding the ^{228}Ac in the samples

With the data contained in Figure 1, we also obtain Table 1, which illustrates the count of the photopeaks and their respective confidence intervals.

Table 1 - Dispersion of the photopeaks counts



From the results obtained, it is possible to verify the variation of counts, which may be an indication of change in the natural state of the sample. The proposal aims to maintain the experiment by submitting more samples to thermal stress, adding the time of 40 days between analyses to achieve a secular balance between the stages of acquisition of the gamma spectrum. Thus, the present study generated data that justify the continuation of the experiments that will give greater reliability in results obtained by gamma spectrometry of dried samples in ovens.

References

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