

Correlation between gamma attenuation and self-attenuation using environmental samples and point geometry radioactive source

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It is usual in the laboratories routines when a sample is prepared for gamma spectrometry, they been dried by heating in a stove with fixed temperature and time until the sample weight stop varying [1, 2, 3]. This study's aim is to verify the maximum level of humidity acceptable for gamma spectrometry of environmental samples. However, in this first stage, the goal is to verify the feasibility of use for a Cesium 137 point source, since its gamma energy (662 keV) can show no significant difference in the spectra with the variation of humidity of the samples. Starting from a sample of beach sand, which was dried and sealed since 2014, five smaller samples were made with 250,01± 0,01g of sand, from those one sample was kept dried and the other four were moistened with different distilled water quantities, between 25ml and 100ml, varying each 25ml. Also was made an additional sample with only 250ml distilled water. Using a scintillating detector of Sodium Iodine, doped with Thallium, ORTEC, model 905-4, calibrated with a Cesium-137 punctiform source, certified from IRD (Instituto de Radiologia e Dosimetria) at 23/06/2016 with 40,237kBq. On the day of the counts, the source has 37,276kBq of activity, this can be easily calculated by obeying the radioactive decay law. Each sample was counted for 30 minutes, or 1800s, five times, with the source above the sample and both centralized in the detector axis. When one overlapped the curves of the Cs-137 photopeaks obtained from each sample spectra, shown in the Figure 1 graphic, it can be noted that the chosen source proved to be viable, once the samples showed visible differences on their photopeaks. It also can be noted that the dried sample has the smallest photopeak, which means, has a larger attenuation compared with the wet samples, however, among the latter, the higher the humidity, the greater the attenuation.

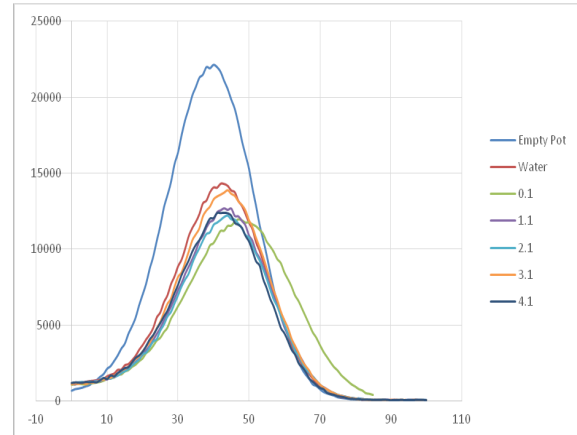


Figure 1. Graphic with the overlapping photopeaks of Cs-137 for each sample

The Table 1 shows the relation of the samples with their respective counting median and error. When looking at these data it is noticeable, considering the samples with sand, that the dried sand has more counting than the wet samples, contrary to what is shown in Figure 1, but also, as higher the humidity, the lower is the number of counting.

Table 1 - Counting median and its respective errors for each sample.

Sample	Centroid	Error
Empty Pot	662317	814
Water	404038	636
0.1 (0ml)	364833	604
1.1 (50ml)	349453	591
2.1 (100ml)	312529	559
3.1 (25ml)	362187	602
4.1 (75ml)	315151	561

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