**Distribution coefficient in soils with natural enrichment of long-lived natural radionuclides (238U and 226Ra)**

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A systematic study has been performed to clarify some hypothesis and assumptions in the use of the distribution coefficient of natural radionuclides (238U and 226Ra) in soils. For that, soils with natural enrichment of these radionuclides were used. The processes involved in the equilibria between solid and liquid fractions of the soils are expected to be different from those corresponding to recently spiked soils.

The soil solution was extracted by centrifugation method. In this sense, a device was designed to maintain a permanent pool of water, which assured zero matric suction at the most external layer of the soil core. In such a way that the centrifugation speed can be related with the effective suction applied to the sample and therefore with the different origins of the soil water with respect to its association with the solid phase.

One of the main factors affecting the soil Kd values is the soil texture. Therefore, the study was performed in three soils with different textural characteristics. However, to eliminate the influence of other soil parameters, the three soils were constructed from a single soil by sieving. The Kd ranges obtained for 226Ra were: loamy coarse sand from 0.86 to 116 L kg-1, loamy fine sand from 0.37 to 42.0 L·kg-1and loam from 5.2 to 182 L kg-1. In the case of 238U were: loamy coarse sand from 0.595 to 3.270 L kg-1, loamy fine sand from 4.020 to 413 L·kg-1and loam from 4.93 to 73 L kg-1.

Firstly, the influence of the parameters used in the method to obtain the soil solution on the Kd value was studied. In this study were included the amount of water added to the soil during the incubation period, the incubation time, and the centrifugation speed. The results pointed out that (in general) the incubation time has not significant influence on the desorption of 238U and 226Ra, in such way that the lower assayed time (24h) is sufficient to achieve the equilibrium between the solid and liquid soil fractions. Only the loamy coarse sand soils showed slower equilibrium process for 238U, requiring times up 7d. The most important factor in the desorption process of uranium was the amount of water added during the incubation period, especially in the soils with coarser grain size. On the other hand, statistically significant influence of centrifugation speed on the radium concentration in solution was observed for soils with smaller grain size.

As a second aim, possible correlations between Kd and chemicals present in soil solution were searched by multivariate regression analyses. Due to the soil samples being constructed from a single soil, the variations observed in the chemicals concentration in the soil solution were small. But even so, the pH showed a clear influence in the sorption-desorption process for both studied radionuclides. Other significant variables were the dissolved organic matter (DOM) and the conductivity (the latter only in the case of radium).