Biogeochemical behavior of 137Cs and 60Co in Tropical soil evaluated by an alternative sequential chemical extraction.

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Body of Abstract: One manner to assess potential mobility of radionuclides in soils is the use of sequential extraction procedures. These procedures intend to provide the radionuclide partitioning in geochemical phases of soil affected by changes in physico-chemical conditions. Sequential techniques are generally laborious and sometimes very specific for elements or materials. Moreover these extractions generally employ strong reagents heated to produces faster reactions against the weaker reagents reacting slowly in nature. In this study an alternative sequential chemical extraction protocol was used to evaluate 137Cs and 60Co potential mobility as a function of some physico-chemical conditions operationally defined: Slightly acidic phase [CH3COOH + CH3COONa 1:1]: elements readily bioavailable; Easily reducible phase [NH2OH.HCl (0.1 M)]: bound to Mn oxides; Oxidizable phase H2O2 (30%) + HNO3; pH2: bound to labile organic matter; Alkaline phase: mainly bound to Fe compounds [NaOH (0.1 M)]; Resistant phase: not potentially available for transfer processes in ecological time [Aqua regia].

The preliminary results of geochemical partition for both elements were coherent with soil to plant transfer factors (TF) data for maize. These results were also coherent with some of soil properties recognized by the specialized literature as related with mechanisms of sorption to Cs (e.g. exchangeable K, organic matter and iron oxides content) and Co (e.g. manganese oxide). The 137Cs distribution in soil showed that Fe oxides are the main sink for this element in all type of soil and after 14 years after contamination the 137Cs was still available for plants in Oxisol. In the Alfisol, 5 years after contamination, the 137Cs and 60Co was not detected as bioavailable (in the slightly acidic phase) neither detectable in maize. The integration of experimental methods results obtained in the laboratory with results obtained in field’s experiment seems to confirm the sensitivity of some Brazilian soil to the 137Cs. These results can be useful for risk assessment studies, to be applied in the case of nuclear accident or contamination scenarios.