

Natural radionuclides and metals intake into soya, corn and lettuce grown on soil amended with phosphogypsum

B. P. Mazzilli¹, C. H. R. Saueia¹, D.I.T. Fávoro¹, V. M. F. Jacomino²

¹*Laboratório de Radiometria Ambiental
Instituto de Pesquisas Energéticas e Nucleares
Av. Prof. Lineu Prestes, 2242, São Paulo, CEP 05508 000, Brazil*

²*CDTN/CNEN, Caixa Postal 941, CEP 30123-970, Belo Horizonte, Minas Gerais*

Abstract

Phosphogypsum is a TENORM by-product of the phosphate fertilizers industry and is produced by precipitation during wet process of phosphate rocks, thus posing serious problems with its utilization and safe disposal. In Brazil, three main industries are responsible for the production and storage of about 5.5×10^6 tons per year. PG may contain high quantities of P_2O_5 , trace metals and radionuclides of U and Th series. All the countries that produce phosphate fertilizer by wet process are facing the same problem of finding solutions for the safe application of phosphogypsum, in order to minimize the impact caused by the disposal of large amounts of this by-product. Phosphogypsum can be used in agriculture as a soil amendment, however, for its safe application the mobility and intake of natural radionuclides and metals from soil to food crops should be known. The main objective of this study is to evaluate the environmental impact of the use of phosphogypsum as soil amendment and to understand the mechanism of radionuclides and metals transfer in the soil/plant system. To accomplish this task an experiment was carried out in green house, where two major crop groups (soya and corn) and leafy vegetables (lettuce) were grown in two types of soil (clay and sandy) amended with phosphogypsum. The PG used comes from Ultrafertil facility, located in Cubatão, São Paulo state. The radionuclides ^{226}Ra , ^{228}Ra and ^{210}Pb present in crops and lettuce were determined by radiochemical separation followed by gross alpha and beta counting using a gas flow proportional counter. The same radionuclides in soil and PG samples were determined by gamma spectrometry. Po-210 was spontaneously plated on a silver disc and measured by alpha spectrometry. The metals (Ba, Co, Cr, Fe, Hf, Na, Sb, Sc, Ta, Th, U, Zn, Zr and REE) were determined by instrumental neutron activation analysis. The elements Cd, Co, Cr, Cu, Ni, Pb and Se were determined by Atomic Absorption Spectrometry (AAS). The transfer-factors were evaluated for all the metals and radionuclides analyzed.

KEYWORDS: *radionuclide; metal; phosphogypsum; transfer-factor.*

* Presenting author, E-mail: mazzilli@ipen.br