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Application of radioanalytical chemistry techniques in radioecological studies of main naturally occurring radionuclides in the coastal marine area near a post-phosphoric acid factory in Gela, Italy

Gela has been identified by the regional legislation as one of the four areas at high risk of environmental crisis in Sicily, where some large industrial complexes, such as phosphate acid factory and petrochemical industries, were located. Although the phosphate acid factory has stopped production since 1990s, the petrochemical industries are still operating. For the purpose of protecting environment and human health, the local government has launched some projects of “national interest for remediation” in the site of phosphate acid factory, including studies on (1) characterization, classification and inventory evaluation of organic and inorganic compound pollutants in environment, (2) radioecological investigation, and (3) environmental quality control and assessment.

The Italian National Institute of Environmental Protection and Research (ISPRA/ISIN) participated in the projects. As a part of the projects, some achievements have been described in this paper, including: (1) development of the suitable radioanalytical chemistry techniques used for determination of ^{210}Po , ^{210}Pb , uranium, and radium isotopes in soil and sediment samples, (2) determination of the activity concentrations of ^{238}U , ^{234}U , ^{235}U , ^{226}Ra , ^{224}Ra , ^{228}Ra , ^{223}Ra , ^{210}Po and ^{210}Pb in soil, marine sediments, phosphogypsum and phosphoric acid, and (3) inventory estimation of the determined naturally occurring radionuclides due to the human activities. In the radioanalytical chemistry techniques for soil/sediment analyses, fusion treatment and reversed phase partition chromatography column with TOPO retained on Microthene as the stationary phase were applied to separation of uranium, Microthene-TOPO column and cation-exchange resin column were used to separation of radium. Wet ashing of samples was used for ^{210}Po and ^{210}Pb determination, where ^{210}Po was separated with autodeposition on a silver disc and ^{210}Pb with PbS precipitation and anion-exchange resin column. All the techniques were shown sensitive and accurate for environmental samples.

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