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Implementation of the k₀-standardization method for analysis of geological samples at the Neutron Activation Analysis Laboratory, São Paulo, Brazil

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The Neutron Activation Analysis Laboratory (LAN-IPEN) has been analysing geological samples for many years with INAA comparative method, for geochemical and environmental studies. This study presents the results obtained in the implementation of the k₀ standardization method at LAN-IPEN, for geological samples analysis, by using the program k₀-IAEA, provided by The International Atomic Energy Agency (IAEA). The efficiency curve of the gamma-ray spectrometer used was determined by measuring calibrated radioactive sources at the commonly used counting geometries. The thermal to epi-thermal flux ratio f and the shape factor α of the epi-thermal flux distribution of the IEA-R1 nuclear reactor of IPEN were determined for the pneumatic irradiation facility and some selected irradiation positions, for short and long irradiation, respectively. To obtain these factors, the “bare triple-monitor” method with ¹⁹⁷Au-⁹⁶Zr-⁹⁴Zr was used. The Certified Nuclear Reference Material IRMM-530R Al-0,1% Au alloy, high purity zirconium, Ni and Lu comparators were irradiated. In order to validate the methodology, the geological reference materials basalts JB-1 (GSJ) and BE-N (IWG-GIT), andesite AGV-1 (USGS), granite GS-N (IWG-GIT), SOIL-7 (IAEA) and sediment Buffalo River Sediment (NIST-BRS-8704), which represent different geological matrices, were analysed. The concentration results obtained agreed with certified, reference and recommended values, with relative errors less than 10% for most elements. These results indicate excellent possibilities of using this parametric method at the LAN-IPEN for geochemical and environmental studies.

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