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# The k<sub>0</sub>-based NAA at BARC: Developments, QA/QC and applications

The k0-based Neutron Activation Analysis (k0-NAA) was adapted in Bhabha Atomic Research Centre (BARC) in the year 1994 and since then it is being used in our R&D activities. The present article gives an account of developments and applications of k0-based NAA as well as internal monostandard NAA (IM-NAA) using research reactors at BARC. Irradiation sites were characterized by cadmium ratio methods by determining sub-cadmium-to-epithermal neutron flux ratio (f) and epithermal neutron flux shape factor (alpha). The k0-factors for a large number of short, medium and long-lived nuclides with respect to gold (197Au) were determined. Several (certified/standard) reference materials obtained from IAEA and NIST were analyzed for evaluating accuracy of the method. Recently, synthetic multielement standards (SMELS I, II and III) were analyzed as part of QA/QC of IM-NAA. The detection efficiency, which is an important input parameter in k0-method, was measured using multi ⍰-ray standard sources in k0-NAA studies and in the case of IM-NAA , insitu relative detection efficiency was obtained using gamma-rays from the sample itself. The later approach could help us in analyzing samples of non-standard shapes and sizes. Most of our work, except for short-lived nuclides, was carried out by irradiating samples in the swimming pool type Apsara reactor. The measurement of gamma-rays of activation products was carried out using a 40 % relative efficiency HPGe-detector coupled to MCA and peak areas were determined using the peak-fit software PHAST. Developed k0-methods were applied for composition analysis of samples in the field of geology, biology, environmental science, archaeology, material science and nuclear technology. Important contributions were made by determining composition of alloys like zircaloys and stainless steels and impurities in 1S-aluminium without using a standard. We have been contributing towards the development of large sample NAA (LSNAA), under an IAEA CRP, using low flux and highly thermalized irradiation positions at research reactors. Large samples of pottery, coal, uranium ore, rocks and stainless steels were analyzed using thermal column irradiation facility at Apsara reactor. We are also exploring the possibility of using LSNAA method in the graphite reflector position of the critical facility (CF) at BARC and the standardization of the methodology is in progress. Some details and salient results will be presented in this paper.

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