Experimental Design and z-Score Results are Useful Tools for Optimizing Instrumental Neutron Activation Analysis Procedures

U. P. M. Santos[1], F. R. Lourenço[2] and E. G. Moreira[1*]

[1]Nuclear and Energy Research Institute (IPEN – CNEN/SP), São Paulo, Brazil, 05508-000
[2]School of Pharmaceutical Sciences, University of São Paulo, São Paulo, Brazil, 05508-000
(* Corresponding Author Email: emoreira@ipen.br)

In this study the optimization of procedures of an Instrumental Neutron Activation Analysis (INAA) method were carried out for the determination of the elements bromine, chlorine, magnesium, manganese, potassium, sodium and vanadium in biological matrix materials using irradiations up to 60 s at a pneumatic station. 2^k experimental designs were applied for assessment of the individual influence of selected variables of the analytical procedure in the mass fraction results. The chosen experimental designs were the 2^3 and the 2^4, depending on radionuclide half-lives. Different certified reference materials and multi-element comparators were analyzed, considering the following variables: irradiation time, sample decay time, sample distance to detector and counting time. Gamma ray spectrometer, comparator concentration, and sample mass were maintained constant in this study. By means of statistical analysis experimental considerations, optimized experimental conditions for the analytical methodwere determined and will be adopted for the validation procedure of INAA methods at the Research Reactor Center of the Nuclear and Energy Research Institute (IPEN – CNEN/SP). Optimized irradiation and measurement conditions were established based on experimental design resultsusing the obtained z-scores for the various elements and experimental conditions.

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