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NEUTRON ACTIVATION ANALYSIS OF BIOLOGICAL SAMPLES AT THE RADIOCHEMISTRY DIVISION OF IPEN-CNEN/SP

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Determination of trace elements in biological samples has attracted much attention lately, accompanying the development of increasingly sensitive analytical techniques as well as due to improvements in knowledge on the role of trace elements in living organisms.

At the Radiochemistry Division of IPEN-CNEN/SP, neutron activation analysis (NAA) is being extensively applied to study biological samples. Recent studies have been performed in collaboration with other research institutions, universities and medical clinics.

Determination of trace elements in extracts from Brazilian medicinal plants has been carried out to study their role in relation to medicinal effects or their toxicity (1).

Human head hair has been analyzed with the aim of using the concentrations of trace elements as an indication of nutritional or health status of human subjects.

Mercury has been determined in head hair from Brazilian populational groups in order to detect contamination due to the comsuption of fish (2).

Human lungs from smokers and non-smokers collected in autopsies have been analyzed so as to obtain normal levels of elements in hilum limph nodes and lung tissues as well as to know whether there is any correlation between trace elements in these tissues and smoking habit of the subjects (3).

Analysis of Brazilian snake venoms from the species Bothrops and Crotalus has been carried out, to study the role of metals in their toxic action and in the biochemical characterization of snake species for further contribution to antivenim serum production (4).

Toxic and other elements were analyzed in Brazilian foodstuffs, such as bread, milk powder and rice (5,6) as well as in gelatine samples (7). NAA was also applied to analyze five varieties of corn obtained as a result of studies developed to increase nutritional value of the protein contained in this foodstuff (8).

To validate our analytical procedures biological reference materials provided by NIST, IAEA, NIES, IUPAC and SHINR have been analyzed. The reference material has been chosen, when possible, to be sufficiently similar to the matrix and to have an elemental concentration of the same order of magnitude as the one to be analyzed.

Irradiations of biological samples and synthetic standards have been performed in the IAEA-R1 nuclear reactor using neutron fluxes from 10^{11} to 10^{13} $n.cm^{-2}.s^{-1}$. Adequate conditions for irradiation, decay and counting have been chosen based on half-life of the nuclide of interest. Ge(Li) or hyperpure Ge detector have been used for gamma ray measurements.

Elements such as Al, As, Br, Ca, Cl, Co, Cs, Fe, K, Mg, Mn, Na, Rb, S, Sb, Sc, Se, V and Zn have been determined by instrumental method of neutron activation analysis (INAA). However some elements of great biological interest such as As, Cr, Cd, Hg, Sb and Se could not be determined by INAA due to interference of predominant radionuclides such as Na-24, P-32, Br-82 and K-42 in the gamma ray spectra. In these cases, radiochemical separation techniques have been used for the isolation of the elements of interest(5-7,9). (Work supported by FAPESP and CNPq from Brazil and IAEA).

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