

X-RAY FLUORESCENCE MICROANALYSIS OF BIOMEDICAL AND ENVIRONMENTAL SAMPLES

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A feasibility study of microanalysis of biological materials by micro X-ray fluorescence spectrometry (MXRF) was completed. The research covered the following topics:

1. Analysis of thin tissue samples
2. Analysis of dried residue of human body fluid
3. Improvement of a fundamental parameters approach to analysis of organic samples

Literature studies indicated that abnormalities in elemental concentration appear in tissue samples from selected parts of the human central nervous system (CNS) and cerebrospinal fluid for patients affected by neurodegenerative diseases. The main goal of this research was topographic and quantitative evaluation of selected elements in tissue samples from the CNS. Particle-induced X-ray emission¹ (PIXE) was used for a preliminary study of the major and trace elements in pelletized samples of white and grey brain matter from a control group. MXRF spectrometry utilizing capillary optics with an effective micro-beam diameter of about 300 micrometers was applied to study the quantitative elemental distribution in thin, lyophilized tissue samples. Variations of P, Cl, K, Ca and Fe concentrations with micro-beam position were detected. The results were compared to microscopic observations and morphometrical analyses.

The same MXRF technique was applied for analysis of dried cerebrospinal fluid on a thin film sample support. An examination of the quantification procedure was done. The distribution of selected elements in the residue created during the drying process was studied. Spots having crystal structure were discovered.

The MXRF analysis of organic samples² was improved in several ways. Spectral interference between scattered Mo L lines originating from the X-ray tube anode and P, Cl and S K-L_{2,3} lines were eliminated. Concentrations of analytes were calculated using a fundamental parameters approach³. A computer program code written in C++ language was developed and tested.

¹ M. Boruchowska et al., *PIXE analysis of human brain tissue, X-Ray Spectrom.*, in press.

² J. Sieber, et al., *Advances in X-Ray Analysis*, Vol. 43. pp. 540-546, 2000.

³ M. Lankosz and P. Pella, *X-Ray Spectrometry*, Vol. 24, No. 6, pp. 320-326, 1995.