## X-RAY FLUORESCENCE APPLIED TO ENVIRONMENTAL AND GEOLOGICAL STUDIES AND SPECIAL AND NUCLEAR MATERIALS CHARACTERIZATION

<sup>1</sup>Sato, I.M.; <sup>1</sup>Salvador, V.L.R.; <sup>1</sup>Scapin, M.A.; <sup>1</sup>Flues, M.; <sup>1</sup>Cotrim, M.B.; <sup>1</sup>Martins, E.A.J.; <sup>1</sup>Pires, M.A.F.; <sup>2</sup>Duarte, C.L.; <sup>2</sup>Sampa, M.H.O.; <sup>3</sup>Maihara, V.A.; <sup>4</sup>Oliveira, E.de; <sup>5</sup>Sousa, P.T.de; <sup>6</sup>Zezzel, D.M.

<sup>1</sup>Centro de Química e Meio Ambiente - IPEN/CNEN-SP; <sup>2</sup>Centro de Tecnologia das Radiações - IPEN/CNEN-SP; <sup>3</sup>Centro do Reator de Pesquisas - IPEN/CNEN-SP; <sup>4</sup>Instituto de Química - USP; <sup>5</sup>Universidade Federal do Mato Grosso, UFMT; <sup>6</sup>Centro de Lasers e Aplicações - IPEN/CNEN-SP.

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Introduction X-ray Fluorescence Laboratory has been worked in environmental and geological studies such as monitoring and diagnostics and also has been established analytical methodologies for different matrices (biological, special and nuclear materials). These activities have been supported by financial organisms such as FAPESP, CNPg and IAEA. Graduated (IPN 0014), pos-graduated (TNM 5767) and extension courses in x-ray fluorescence technique have been offered. R&D Activities Toxic metal removal: The removal rate of Ca, Fe, Si, Al, Na, Cu, Mn, Ni, Cr, S, P, Cl, As, Pb, Cd and Hg elements in industrial effluents after electron-beam treatment had determined. Different doses irradiation and addition of scavengers to increase metal removal were established The inorganic and organic compounds removal in used grease oils (industrial and automobile applications) with electron-beam irradiation process has been studied. Soil guality: The highways influence in the soil guality of the Cantareira State Park, SP was outlined. The study involved the total, partial and bioavailable Na, Al, Ca, Mg, K, Si, Ti, Mn, Cr, Ni, Cu, As and Pb determination in the eleven soils collected along the Highway Fernão Dias, Sezefredo Fagundes and Nova Cantareira Roads. The environmental impact of the Thermoeletric Powder Pant operation (Usina Termoéletrica de Figueira, PR) was been studied. The total inorganic content in the soils, coals, ashes and plants samples has been determined by x-ray fluorescence technique. Inorganic elements in diets/foods: The Mn, Na, Mg, P, S, Cl, K, Ca, Fe, Cu, Zn, Sr and Rb content were determined in 30 industrial workers diets by x-ray fluorescence technique to determine the inorganic daily intake. The inorganic and organic compounds determination has been outlined in the common Brazilian beams (Phaseolus vulgaris specimens) by WD-XRFS, NAA and GC/MS techniques. Metal bio-indicator plants: The Na, K, Mg, P, S, Cl, Ca, Fe, Cu, Zn, Sr, Rb, As, Pb and Cd determination in the specimens of plants colleted in Cantareira State Park, SP and Figueira Thermoelectric Power Plant, PR has been outlined by x-ray fluorescence analysis. The metal accumulation capacity will be determined by relation metal content soil/plant. Biomedicine: The Ca/P relation in the -hydroxide-apatite, used for teeth repairing, has been determined by x-ray fluorescence analysis.

The same relation Ca/P in teeth for laser prevention studies also has been carried out. Metal adsorption/retention capacity in soils: The methodology for separation of silts and argil fraction in soil was established. Major and minor elements Ca, K, Mg, Mn, Fe, Cu, Cr, Ni and Zn contents in both phases had determined and its precision and exactness had calculated. Aquamarine characterization: The intensity color influence by Fe<sup>3+</sup>/Fe<sup>2+</sup> relation in the Brazilian aquamarine stones has been outlined by x-ray fluorescence analysis and x-ray diffraction profiles. Thin films: The nominal composition and thickness determination in the AI-Ti and TiO<sub>2</sub> thin films had established using wavelength dispersive x-ray fluorescence spectrometry. Medicinal Plants: The inorganic composition of major, minor and trace elements in the 14 Brazilian herbal plants, in the capsules and "in natura" forms, had determined by x-ray fluorescence technique. Moreover, 10 specimens have been studied for inorganic profile determination, biological specimen identification and active-pharmaco compounds identification. Implementation of Quality System The implementation of quality system for the X-ray Fluorescence Laboratory at Chemical and Environmental Technology Center has been supported by IAEA/ARCAL LXXVI and Brazilian Metrology on Chemistry research projects. Also SGI/IPEN program has been supported the Quality Manual implementation, according to ISO 17025. In the period, the Laboratory had 3 local audits from SGI/IPEN and had participated in the 1 proficiency test from IAEA, 2 international and 1 national interlaboratory programs.