MASS SPECTROMETRY CHARACTERIZATION OF ENVIRONMENTAL CONTAMINANTS

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Keywords: mass spectrometry, pesticides, VOCs, nuclear fuel, GC/MS, LC/MS/MS.

The scope of this research is to characterize chemically, contaminants and constituents on environmental samples using mass spectrometry techniques. Besides research, training human being skillful on mass spectrometer is a task to be achieving for the Brazilian market on analytical chemistry. One PhD student works on organochloraides and organophosphates in soil research, three masters students works are going in mass spectrometry techniques, and two undergraduate scientific studies students are working in this area.

The proliferation on hybrids analytical techniques develops parallels analytical techniques, such as Gas Chromatography, Liquid Chromatography and Infrared absorption techniques that are explored in this research as well.

The following list shows each research work done and ongoing in the laboratory this year of 2004.

1) Cypermethrin Residues Determination in the Milk of a Lactating Dairy Cow by Gas Chromatographylon Trap Mass Spectrometry.
2) Biogenic VOC emissions from forested Amazonian landscapes.
3) Identification of therpenes in the fruits oil of Campomanesia Adamiantum Myrtaceae-Gabiroba.
4) Diesel emission significantly influence composition and mutagenicity of ambient particles: a case study in São Paulo, Brazil.
5) Characterization of caramel corants used in the food industry by GC/ITMS.
6) Identification of degradating products from polymers via thermogravimetry / gas chromatography / mass spectrometry sharing TGA-GC/MS.
7) Hydrogen characterization from methanol cracking for fuel cells.
8) Hydrogen characterization from melting silicium oxides.
9) Quality control in the carbon analysis for the nuclear materials.
10) Optimization in the analysis of UF_6 by mass spectrometry.
11) Rapid method to determination of mycotoxins compounds in food samples using LC-APCI/MS/MS in simultaneous positive and negative íon mode.
12) Direct and sensitive analysis of pesticides in juices by mass spectrometry-LC/MS/MS.

NEW TECHNOLOGIES OF TREATMENT / RECOVERY / IMMOBILIZATION OF INDUSTRIAL WASTES

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Molten Salt Pyrolysis. Three main thermal treatments could be used to recovery energy or higher value products from wastes: incineration, gasification and pyrolysis. The operational conditions and by-products are the main difference among these methods. The incineration burns completely the material, releasing energy. Nevertheless, gasification and pyrolysis could be used to transform the waste in valuable products, such as fuels or chemicals. In the pyrolysis the material is heated in the absence of oxygen. The organic material is submitted to a thermal cracking generating a volatile fraction and a solid residue. The volatile fraction can be cooled and partially condensed. The condensed (liquid) phase is composed by water, tar and oil. Yields and composition of the fractions depending on same parameters, such as: temperature, residence time, pressure, heating rate, condensation temperature and feed material size distribution. The process consists in the injection of organic-based wastes beneath a bed of molten salts. Different salt compositions with low or high fusion temperature can be selected depending on the waste. The molten salt enhances the completion of chemical reactions by providing intimate physical contact between the reactants and provides a stable heat transfer medium with small deviations in the temperature. Laboratory scale molten salt equipment has been developed at IPEN to perform organic waste pyrolysis experiments. Recovery of Values in Reloadable Batteries. This work presents the development, in the IPEN, of a viable process for the recovery and recycling of the constituent elements of exausted batteries of Ni-Cd, with sight to the conservation of the environment. The process encloses since the stage of opening of the batteries until the final purification of its main constituent. It is become full filled recovery of the elements for leaching with acid and using different processes of separation as ionic exchange and selective precipitation. The batteries are sawed in the lateral and their parts leached in hydrochloric acid medium, together with the plastic case. After that it is filtered for the recovery of the materials that had not been dissolved, as the plastic material and some paper. The resultant solution is adjusted for a retention in a anionic resin where zinc and cadmium are retained. Nickel and iron that passed in the effluent are separated for hydroxide selective precipitation. The elements in the column of ionic exchange are elutted with diluted acid, being able to be separate, later, for cementation of nickel in metallic zinc. The process has been proved in laboratorial level, intending itself, after otimization, to scaleup to benches level.