INDUSTRIAL AND RADIOACTIVE HAZARDOUS WASTES TREATMENT BY ELECTROCHEMISTRY AND MOLTEN SALT OXIDATION

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Nowadays electrochemistry is considered as an important partner in the treatment of wastes and other chemical processes due to its no pollutant characteristics. Many times, the only reagent necessary in this technology is the electron. For this reason, electrochemical processes have been under study for waste treatment and synthesis of compounds at CQMA. The applied areas, nuclear and industrial, can be resumed as follows:
a) Treatment of radioactive (Cs, Ru, etc.) and industrial (toxic metals) wastes using electrochemical ion exchange. Ion exchange resins and inorganic ion exchangers (zirconium and titanium phosphates) will be added to electronic conductors, to perform a high separation degree of these contaminants from waste. The best composition of electrode material is still under investigation. b) Separation of rare earths (Eu, Sm, etc,) in a packed bed electrode, associating the ion exchange technique. Since Brazil has great monazite reserves and IPEN has approximately 25 ton of thorium and rare earth waste, from which these elements can be recovered, this research becomes very important economically. c) Recovery of Pb from RETOTER (Thorium and rare earths waste. First studies show a great possibility of recovering Pb with high purity. d) Electrodissolution (or anodic dissolution) of aluminum presents in irradiated uranium silicide fuels. The main objective of this research is to reduce volume waste for storage. This process can dissolve aluminum selectively, keeping uranium silicide in its original state. The electrolytic cell and the basket-anode, made of platinized titanium, were developed. Experiments with irradiated samples showed that very few fission products are dissolved in this process, producing a low to medium level radioactivity waste. The effect of temperature over the Al matrix will be the next study. e) Electrochemical synthesis of rare earth chromates for application as corrosion inhibitors. Lanthanum chromate has been synthesized electrochemically from a solution of ammonium dichromate and lanthanum nitrate, and electrodeposited on a metallic cathode showing good adherence. Cerium chromate is now under evaluation. Molten Salt Oxidation of Hazardous Wastes. The growing of the society's concerns, related to the final disposal of some wastes, has been manifested, for example, with the establishment of international protocols and with the creation of more restrictive legislation in the different countries. The suitable final disposal of hazardous organic wastes such as PCBs (polychlorinated biphenyls), pesticides, herbicides and hospital residues constitutes a serious problem. In some point of its lifecycle, these wastes should be destroyed, in reason of the risk that they represent for the human being, animals and plants. The thermal decomposition has been used commercially in the waste disposal, mainly the incineration, whose most important characteristic is the combustion with flame. However, the conventional incineration, as way of destruction, presents some restrictions, due to the gaseous emissions eventually generated in the process. An alternative to the incineration, for the treatment of a vast range of dangerous wastes, is the decomposition in molten salt baths. It consists of a submerged oxidation of organic materials that allows that the hydrocarbon molecules are immediately oxidized to carbon dioxide and water in the vapor form. In this process, the waste and the oxidizer are mixed in a turbulent bed of molten salts. Due the flame absence, it is not considered an incineration process. During the last decades, IPEN has performed different research developments to dominate the nuclear fuel cycle and have generated some effluents in the form of organic solutions containing radioactive elements that could be discarded after radioactive decay. Nevertheless, in spite of the possibility of waste discharging from a radiological point of view, as consequence of the low activity , some wastes containing organic solvents cannot be discarded in the sewerage system due to legislation restrictions. Some wastes, with high potential risk, such as pyridine or toluene, should be destructed. However, their destruction in incinerators is not permitted since the presence of radioactive elements. An alternative process would be the oxidative decomposition in molten salts that is not considered incineration, because there is no flame. IPEN has developed a bench scale equipment for thermal decomposition studies in molten salts (FIG.1) and has performed decomposition tests of different hazardous organic wastes, such as: 1,2-dichlorethane, dichlorodifluormethane (Freon 12, considered ODS - Ozone Depleting Substance) and toluene from cyntilators. The samples of the gases produced in the decomposition have been analyzed by gas chromatography coupled to mass spectrometer. The process efficacy has been demostrated in tests accomplished in the equipment and a very important fact is the retention of the halogens (as Cl, F and Br) in the form of innocuous salts.

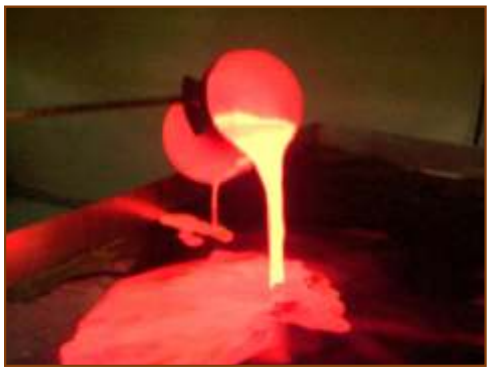

FIGURE 1 - Molten salt fusion.