ABSTRACTS

A two-step precipitation using ammonium carbonate and oxalic acid as the precipitants for thorium and iron is developed for the purification of $^{233}$U. Ammonium carbonate is added to the feed to increase the pH of the solution. The effect of pH on the solubility of U, Th and Fe in an excess of ammonium carbonate is studied. This indicates that the solubility of Th and Fe is minimum at pH 7.0 and the recovery of uranium is maximum. The effect of the concentration of thorium and iron on the recovery of uranium at pH 7.0 is studied. This indicates that the ammonium carbonate precipitation tolerates 2g/L of thorium and 10g/L of iron keeping losses of uranium to a minimum. If the feed solution contains more than a tolerable concentration of thorium, the precipitation is followed in two steps. In first step bulk of the thorium is removed by oxalate precipitation and in second step the remaining thorium and iron are removed by ammonium carbonate precipitation. A flow sheet is proposed and successfully implemented for the purification of $^{233}$U from thorium and iron present in the strip product concentrate obtained during the reprocessing of irradiated thorium rods.

A method is developed for the selective leaching of $^{233}$U from a thorium oxalate cake. The leaching capacity of ammonium carbonate
and nitric acid have been investigated, showing that (NH₄)₂CO₃ leads to higher recovery. The maximum leaching efficiency is obtained using 0.5% ammonium carbonate, with a minimal thorium pick-up. A uranium recovery of 94% is obtained after three consecutive contact experiments in carbonate media, with minimal thorium uptake in the leachate. This process was applied to an actual plant stream, allowing the reduction of the ²³³U α-activity from 5.64 μCi to 0.13 μCi per gram of thorium oxalate cake.

Ammonium Uranyl carbonate (AUC) is precipitated by using saturated ammonium carbonate solution as precipitating agent. The concentration of uranium in the filtrate is reduced to <10ppm when the precipitation is carried out at low temperature. The decomposition of AUC precipitated at 5-13°C is studied by TG/DTA and EGA-MS. The AUC and derived U₃O₈ are characterised by XRD studies. The thermal decomposition and XRD results are comparable with the reported values of AUCs (prepared at room temperature) and corresponding U₃O₈ products.

A method is developed for the recovery of plutonium present in uranium strip product obtained after partitioning during the reprocessing of FBR fuel. Ammonium carbonate salt is added to the strip product containing Pu (0.1 to 2 g/L) and U (20 g/L) to
precipitate selectively uranium as AUC at pH 8.0-8.5. The effect of decontamination as a function plutonium concentration and effect of pH on the recovery of plutonium are studied. It is observed from the study that plutonium is completely (100%) coming into the filtrate when the concentration of plutonium is in the range of 0.1-0.6 g/L and above 0.6 g/L saturated ammonium carbonate solution washing is required to get maximum plutonium recovery. Plutonium present in the filtrate is recovered by precipitating as plutonium carbonate at pH 6.5-7.0 with the addition of ammonium carbonate. AUC prepared in this condition is characterized by TG/DTA and EGA-MS to find out decomposition behaviour and gases evolved during decomposition. XRD is also carried for AUC. These show that the structural characteristics of AUC obtained by the above conditions is very much consistent with published information.

A simultaneous partitioning and reconversion method for uranium and plutonium is developed for the recovery of uranium and plutonium present in spent fuels of Fast Breeder Reactors. Effect of pH on the solubility of carbonates of uranium, thorium and plutonium in ammonium carbonate is studied. Simulation study for partitioning of Th(IV) - U(VI) present in the solution containing varying concentrations of uranium and thorium but fixed mole ratios
(C_U/C_Th=8/3.5, 15.7/7, 30/13, 45/19.5 and 50/21.45) is carried out. Feasibility of reconversion of thorium in carbonate filtrate is also carried out. It indicates that uranium could be selectively precipitated as AUC at pH 8.0-8.5 by adding ammonium carbonate salt leaving thorium in the filtrate. Thorium in filtrate after acidified with concentrated nitric acid could also be precipitated as carbonate at pH 6.5-7.0 by adding same ammonium carbonate salt. The similar procedure is followed for Pu(IV) – U(VI) system containing 30 g/L of uranium and 13 g/L of plutonium by adding ammonium carbonate at pH 8.0-8.5. A flow sheet is proposed for partitioning and reconversion of uranium and plutonium. Decontamination factors for U in Pu =10^4 and Pu in U=10^5 are achieved by this method.