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Precipitation and purification of uranium from rock phosphate

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This study was carried-out to leach uranium from rock phosphate using sulfuric acid in the presence of potassium chlorate as an oxidant and to investigate the relative purity of different forms of yellow cakes produced with ammonia $\{(NH_4)_2U_2O_7\}$, magnesia $(UO_3 \cdot xH_2O)$ and sodium hydroxide $(Na_2U_2O_7)$ as precipitants, as well as purification of the products with TBP extraction and matching its impurity levels with specifications of the commercial products.

Alpha-particle spectrometry was used for determination of activity concentration of uranium isotopes (^{234}U and ^{238}U) in rock phosphate, resulting green phosphoric acid solution, and in different forms of the yellow cake from which the equivalent mass concentration of uranium was deduced. Likewise, atomic absorption spectroscopy (AAS) was used for determination of impurities (Pb, Ni, Cd, Fe, Zn, Mn, and Cu). On the average, the equivalent mass concentration of uranium was 119.38 ± 79.66 ppm (rock phosphate) and 57.85 ± 20.46 ppm (green solution) with corresponding low percent of dissolution (48%) which is considered low. The isotopic ratio (^{234}U : ^{238}U) in all stages of hydrometallurgical process was not much differ from unity indicating lack of fractionation. Upon comparing the levels of impurities in different form of crude yellow cakes, it was found that the lowest levels were measured in $UO_3 \cdot xH_2O$. This implies that saturated magnesia is least aggressive relative to other precipitants and gives relatively pure crude cake. Therefore, it was used as an index to judge the relative purity of other forms of yellow cakes by taking the respective elemental ratios. The levels of impurities (Fe, Zn, Mn, Cu, Ni, Cd and Pb) in the purified yellow cake were found comparable with those specified for commercial products.

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