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Recovery of uranium and REEs from phosphate rocks: The GCT experience

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Interest in nuclear power has increased substantially over the past decade worldwide leading to increased attention being paid to supply of uranium from conventional sources. With a possible forecast of mismatch in uranium demand and production in the near future, uranium recovery from unconventional sources is seen is a viable alternative to narrow down the supply gap. Phosphoric acid is an important source not only of uranium but also for rare earth elements (REEs) as well. Rare earth elements are critical materials for advanced Technology and green- energy applications, which give them an undeniable strategic aspect.

In this context, a study was recently carried out in Tunisia under an IAEA technology Cooperation project TUN/2/006 on extraction of uranium from industrial phosphoric acid. Studies were carried out to evaluate with more accuracy the content of U and REEs in the three main phosphates deposits in general, and that of the Gafsa mining basin in particular. The results obtained show that uranium in phosphate rock samples vary between 20 to 120 ppm depending on the deposit location. REEs were mostly light REEs belonging to the cerium series, in the order of 300 to 1500 ppm.

The distribution of these elements, between phosphoric acid and phosphogypsum products were also investigated. In particular the distribution coefficients particularly of U, La, Ce, Nd and Th, were determined.

For this purpose, phosphoric acid production tests were carried on certain grades of selected phosphates, according to an experimental protocol developed for this purpose. The results show that, in the case of U and Th, partitioning rates recorded in product acid were higher than 75%, whereas for Ce, Nd and La, maximum values of 20% were obtained. These results were in good agreement with the data available for other similar studies in the literature.

The investigations carried out under TUN/2/006 project looked into the recovery of uranium and REEs from phosphoric acid by the improved Octyl Phenyl Acid Phosphate OPAP process at a pilot plant scale. The main objective was to come up with a more cost effective route by selecting the right combination of the P2O5 concentration of the phosphoric acid, the appropriate solvent and the optimization of the different operational parameters.

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