

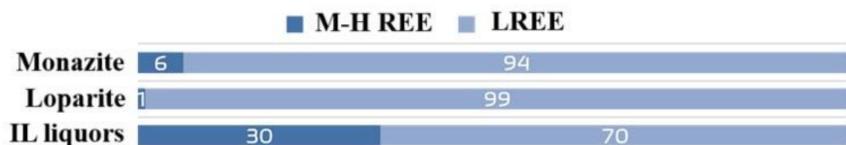
Uranium in-situ leaching liquors are a potential source of “magnetic” REE

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The main reasons for the structural imbalance are the limited and localized deposits of yttrium group REE in China and, in this regard, the global increase in the processing volumes of bastnaesite, loparite, monazite, which results in the overproduction of light REE. The transition to the use of raw REE sources that best satisfy the current and planned market demands in terms of composition is the most justified solution to the problem of the structural imbalance of REE production both in the world and in Russia.

Fig. 1. Comparison of the ratio of light and heavy REE in ore



One of the rich Russian sources of REE containing the above elements (the content of the medium-heavy REE group is up to 30%) are uranium in-situ leaching (IL) liquors. The advantage of these objects is that the REE in them are already in the extracted state.

Table 1 - Composition of uranium in-situ leaching (ISL) solutions

Element	Concentration, mg·L ⁻¹
PЗЭ+Y	30÷50
Sc	0.3÷0.5
U	1÷5
Th	5÷20
Fe	800÷1300
Al	1000÷1500
Ca	300÷500

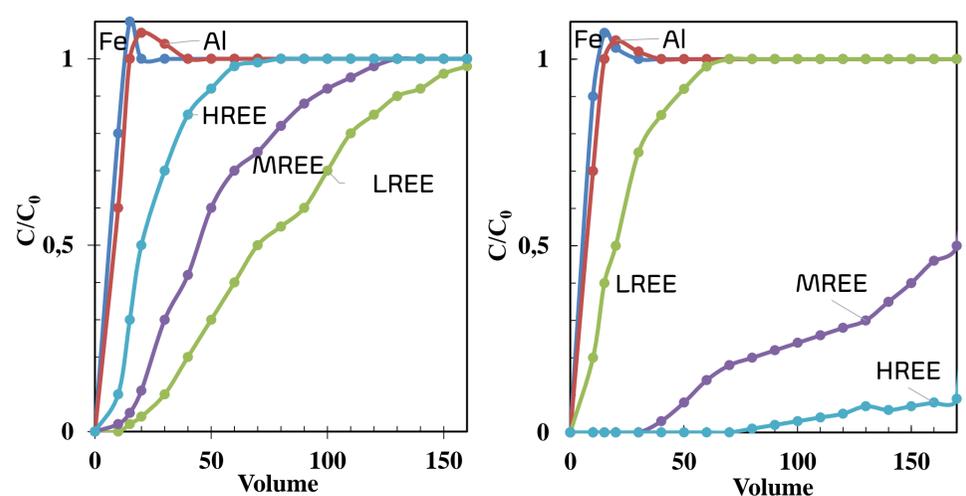


UrFU has developed a pilot plant for the extraction of REE from uranium IL liquors. During the operation of the plant, it was possible to obtain REE concentrates in a stable mode with a purity of at least 99%. In this case, the content of the medium-heavy REE group in the final concentrate decreases to 15-20% due to the use of cation exchange resin for primary concentration, which mainly extracts the light REE group (fig. 2a)

Studies were also conducted on concentrating the medium-heavy REE group from uranium IL liquors using impregnated sorbents containing monosubstituted diglycolamides as an active phase. When passing 100 specific volumes of uranium PV solution through a column, the degree of extraction of heavy REE (Ho-Lu fraction) was more than 90%. The use of this sorbent allows selective extraction of REE from highly mineralized liquors containing significant amounts of iron and aluminum ions/

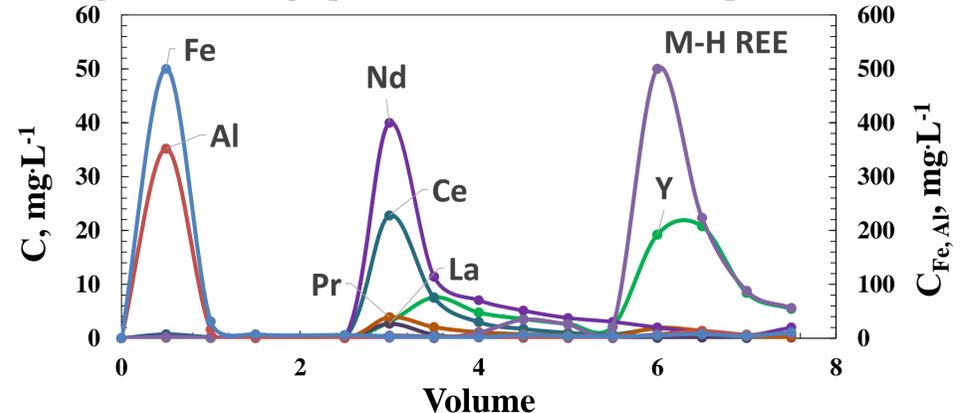
Based on the analysis of the output curves of REE sorption from uranium IL liquors, the degree of concentration of the medium-heavy group can be estimated at 150-300 times (fig. 2b)

Fig. 2. (a) Cation resin sorption; (b) Impregnated resin sorption



Subsequent washing of the rich column with sulfuric acid liquors of different concentrations made it possible to obtain Pr-Nd, Sm-Eu-Gd, Y-Tb-Dy, Ho-Lu concentrates directly at the extraction site.

Fig. 3. Chromatographic elution of REE from an experimental resin



The joint sequential use of sorption units containing cation exchange resin and a sorbent with active acidic diglycolamide will allow the enterprise to respond flexibly to the demand for REE.

Fig. 4. Option for using the obtained technological solutions

IL liquor

