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B. K. Massalimova[1], Kh. R. Sadieva[1], G. K. Matniyazova[1], I. G. Tsoy[1], D. A. Kulbaeva[1], A. B. Satkymbayeva[1], A. A. Bakybayev[2]

[1]M. Kh. Dulaty Taraz State University, Taraz, Kazakhstan,
[2]Tomsk State University, Tomsk, Russia.
E-mail: massalimova15@mail.ru

EXTRACTION OF RARE-EARTH ELEMENTS FROM THE COMPOSITION OF KARATAU PHOSPHORITES

Abstract. Karatau phosphorite concentrate is a perspective and unique raw material for complex processing, which allows to obtain strontium, rare earth metal and fluorine compounds along with the main product - phosphorus fertilizers. In spite of the obvious ecological expediency of complex processing of phosphorite, actually, there is the only industrial scheme involving associated extraction of rare-earth elements, strontium and the utilization of fluorine, based on the decomposition of phosphorite with nitric acid.

This article presents the results of a study of the decomposition of the Karatau phosphorites (Kokzhon and Koksu deposits) with hydrochloric and nitric acids in a ratio of 1: 1, with an increase in temperature to 85-90 °C, for 30 minutes with vigorous stirring. The chemical composition of the products obtained was determined by titrimetric, gravimetric, photocolorimetric, potentiometric methods.

Analysis of the samples showed that the mass fraction of rare-earth elements in the concentrate obtained by extraction with nitric acid was 27%, hydrochloric acid - 36% and the extraction rate of rare-earth elements with respect to their content in phosphorite was 75%. It is possible to obtain 20-36 kg of rare-earth metal concentrate in the processing of 1 ton of phosphorite

Key words: rare earth elements, extraction, phosphorites, decomposition, concentrate.

Introduction. Rare-earth metals are one of the most scarce and demanded types of mineral raw materials, since they are used in various areas, including radio electronics, engineering, nuclear industry, chemical sector, defense industry, etc., and the global demand for them multiple exceeds the market offer [1-4, 13]. The production of rare and rare-earth metals is a promising area of industrial-innovative development of Kazakhstan aimed at creating high-tech industries.

Karatau phosphorite concentrate is a promising and unique raw material for complex processing, which allows to obtain compounds of strontium, rare earth elements and fluorine along with the main product - phosphorus fertilizers [5, 6]. In spite of the obvious ecological expediency of complex processing of phosphorite, actually, there is the only industrial scheme involving the associated extraction of rare-earth elements, strontium and utilization of fluorine, based on the decomposition of phosphorite with nitric acid [7].

The aim of this work is to develop an efficient method for extracting rare-earth elements from the Karatau phosphorites.

Methods. According to the physicochemical properties of Kokzhon, Koksu phosphorite flour (standard grinding, moisture content 0.1-0.3%) has a bulk density (t/per m^3): 1.10-1.20 on the conveyor, 1.45-1.50 when freshly poured in railway carriage, up to 1.6 after transportation by railway and 1.8-2.0 after a long-term storage in the warehouse. Dry Kokzhon, Koksu phosphorite flour is very fluid, flows like a liquid at an angle of 15-20°. Being humidified to 0.75-1.5% flour loses fluidity and is capable of caking.