EUROPEAN JOURNAL OF LIFE SAFETY AND STABILITY (EJLSS)
ISSN 2660-9630
www.ejlss.indexedresearch.org Volume 9, 2021 ||

Computer Models of the Dynamics of the Flotation Process Subject to the Processes of the Multi-Capacity Representation of the Object

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Abstract: *This article deals with the computer models of the dynamics of the flotation process subject to the processes of multi-capacity representation of the object. The author emphasizes that the search for optimal solutions for technological processes in practice is one of the main directions of technical development.*

Key words: *flotation, modeling, optimization, technology, automation, production, fertilizer, computer.*

Date of Submission: 09-11-2021 ***Date Of Acceptance: 18-11-2021***

In global production, research and development in the manufacturing industry, modeling and optimization of technological processes in the context of modern scientific and technological progress have allowed the industry to increase productivity by reducing energy consumption and improving product quality through the widespread use of modern technologies to create a high-performance, reliable and cost-effective technological equipment. At the same time, the search for optimal solutions for technological processes in practice is one of the main directions of technical development focused on increasing productivity, improving product quality, reducing costs, facilitating working conditions and protecting the environment.

The main direction in the technology of enrichment and automation of the processes of modern potash flotation plant is to obtain high-quality fertilizers with minimal losses of useful substances and high technical and economic indicators.

The production of fertilizers with improved physical and chemical properties is due to the needs of agriculture, production economics and increased demand in the world market. Therefore, the improvement of potash ore dressing technology through the development and implementation of more mature technological schemes, new high-performance and efficient equipment, reagent modes, full automation of production processes is currently relevant and in demand [1].

The production of mineral fertilizer salts is one of the most important tasks of the chemical industry. The assortment of mineral fertilizers used in agriculture, the chemical industry itself, metallurgy, pharmaceutical production, construction, household, is hundreds of names and is constantly growing. The scale of extraction and production of salts is extremely large and for some of them amounts to tens of millions of tons per year. The largest quantities are produced and consumed compounds of sodium, phosphorus, potassium, nitrogen, aluminum, iron, sulfur, copper, chlorine, fluorine, etc. The scale of extraction and production of salts is extremely large and for some of them amounts to tens of millions of tons per year. The largest quantities are produced and consumed compounds of sodium, phosphorus, potassium, nitrogen, aluminum, iron, sulfur, copper, chlorine, fluorine, etc. This is due to the fact that modern intensive agricultural production is impossible without introducing into the soil a scientifically grounded amount of various mineral fertilizers containing elements that are not enough in the soil for normal plant growth, in particular grain. Mineral fertilizers are called salts containing in their composition the elements necessary for the nutrition, development and growth of plants. Raw natural substances (most often sylvinite) and products of their processing (chloride and potassium sulfate; 40% potassium salts), as well as plant ash are used as potash fertilizers [2].

Certain work has been done in the republic to reduce energy consumption and ensure high production efficiency and increase the productivity of technological equipment and devices based on highly efficient technologies for the production and management of systems. In the decrees of the innovative development of the Republic of Uzbekistan for 2019-2021 "... the introduction of an organization mechanism for carrying out research and development process on the basis of the program-target principle using project management mechanisms". In this aspect, it is of particular importance, in particular, to improve technology, to enrich existing minerals, to use new, more efficient technological equipment, as well as to create and apply environmentally friendly methods for extracting valuable metals.

Flotation (from the English word flotation - floating) is one of the most common methods of mineral processing. The flotation process is based on the different ability of the surfaces of the minerals that make up the ore to be washed with water. During flotation, air bubbles are blown through the suspension of the concentrating ore. Particles of non-wet table minerals adhere to the bubbles and float to the surface, from which they are removed in the form of mineralized foam. Particles moistened with water sink to the bottom.

Thus, the flotation separation of the mineral components of the concentrating ore is carried out. Initially, the flotation method was used to enrich natural ores consisting of minerals insoluble in water (sulfide oxides, insoluble salts).The flotation method of enrichment of potassium salts became widespread after it was shown that the separation of these salts can be carried out in their saturated solution. The technical solution to the problem of separating water-soluble salts by the flotation method is one of the most important achievements of science and technology over the past decades. Particularly great successes in this area have been achieved in the flotation beneficiation of sylvinite [3].

Automated process control is considered and developed in a complex with the technological scheme, taking into account the high requirements of automation to technology and technology to automation. Automatic control and management of sylvinite ore beneficiation processes at a potash plant is recommended to be carried out on the basis of high-precision modern means of automatic control and management using industrial PCs and microprocessor controllers as part of an automated process control system according to optimally developed algorithms.

The use of methods of experimental, analytical identification, as well as the method of analytical modeling made it possible to formalize reliable models of the optimization object. This made it possible to develop a perfect control system for the process of flotation of potassium ores.

The introduction of optimal control parameters for the flotation apparatus helps to reduce the amount of overshoot in the control system, reduce the amplitude of the maximum deviations in the concentration of valuable components in the outgoing slurry and the foam layer, and reduce the oscillation frequency of the output parameters of the flotation apparatus. Based on the work performed, the loss of raw materials and valuable components in the flotation tailings is reduced by 0.01%.

As a result of this research work, using the method of multi-stage system analysis, mathematical and computer models of the dynamics of the flotation process were obtained, taking into account the consideration of processes in both single-capacity and multi-capacity representations of the object.

The use of methods of experimental, analytical identification, as well as the method of analytical modeling made it possible to formalize reliable models of the optimization object. This made it possible to develop a perfect control system for the flotation process.

The introduction of optimal settings for regulators in the second flotation apparatus helps to reduce the amount of overshoot in the optimal control system, to reduce the amplitude of the maximum deviations in the concentration of valuable components in the outgoing slurry and foam layer, to reduce the oscillation frequency of the output parameters of the flotation apparatus.

On the basis of the work performed, the loss of raw materials and valuable components in the flotation tailings is reduced.

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