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SCIENTIFIC RESEARCH OF EFFECTIVE METHODS OF ENRICHMENT OF KAOLIN ORES

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Abstract
Kaolin ores, as high-quality aluminosilicate minerals, are widely used in various industries. The article is devoted to the analysis of the processes of enrichment of kaolin ores, mechanical, chemical, flotation and thermal methods are considered in detail. This study analyzes the effectiveness of each method, as well as technological, environmental and economic factors associated with their implementation. optimization of kaolin enrichment processes.

Keywords: Kaolin, ores, enrichment, flotation, chemical, mechanical, thermal, efficiency, ecology, industry.

Introduction

Kaolin rudalari tabiy aluminum, silicate mineralari bўlib, asosan, ceramics, kogoz, pharmaceuticals, cosmetics va boshqa sanoatlarda keng kóllaniladi. The main component of kaolin ore is aluminum silicate ($Al2Si2O5(OH)4$), which is very valuable at very high purity. Therefore, the process of beneficiation of kaolin ore is aimed at getting rid of unnecessary components and improving its quality. Kaolin rudalarini boitgan holda sanoat uchun talab yuqori bólgan yuqori sifatli madzsulotlar olish muǵim aǵamiyatga ega. The efficiency of the beneficiation process depends on the composition of the ore, the method used and the processing conditions. The article analyzes in detail the mechanical, chemical, flotation and thermal methods of beneficiation of kaolin ores and discusses their efficiency.

The development of instrumental and technological solutions for the processing of kaolinite ores for the conditions of Egypt was carried out taking into account the characteristics of the mineral resource base and the existing production complex. At the same time, the principal technological solutions for kaolin processing by sintering can be considered quite well developed, taking into account the known production experience in processing aluminosilicates as part of the integrated processing of nepheline raw materials, which is complemented by the experience of cement production, including the processing of belite sludge. This makes it possible to fully use the existing close analogues for the preparation of two-three or more complex-composition charges in relation to the existing schemes of

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Portland cement production, which in the simplest version are associated with the preparation of two-component mixtures based on lime and silicate components. Thus, this scheme is the closest analogue for the preparation of charge using limestone and clay component, which, in relation to the conditions of alumina production, should be supplemented by the introduction of defense materials and activating or mineralizing additives. Taking into account the production experience, two options for the preparation of raw material mixtures based on the wet and dry methods can be considered, Figure 5.1.

In the technological scheme of complex processing of kaolin ore for alumina production, the process of preparing the initial raw material mixture containing kaolin, limestone and carbon-containing additives, with a given chemical and granulometric composition, taking into account a significant share of costs for this processing in the structure of the cost of alumina, which is about 30%, is of great importance [30]. When choosing a rational scheme for the preparation of raw materials, it is necessary to pursue the goal of maximum extraction useful components during subsequent processing. A feature of the raw charge preparation processes in the alumina industry is the separate and at a certain stage joint grinding of components of different strengths (kaolin ore, limestone, activating and energy additives) for the purpose of further grinding to the required sizes and homogenization of the material composition to obtain a given ratio of size classes in raw material mixtures. Thus, the preparation of mixtures with a homogeneous chemical and mineralogical composition with specified granulometric characteristics is one of the most difficult tasks due to the use of materials of different strengths, including those differing in the initial granulometric composition.

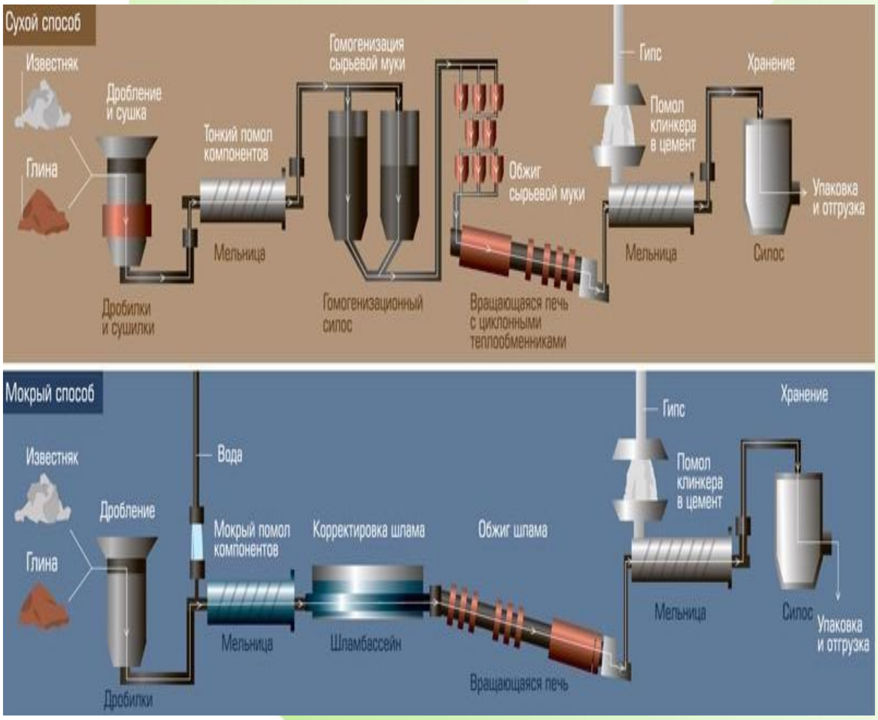

Figure 5.1 – Instrumentation and technological solutions for the production of Portland cement using the scheme of wet and dry preparation of raw materials.

The development of instrumental and technological solutions for the processing of kaolinite ores in Egypt can be considered on the example of the processing of kaolin ore from the Wadi Kalabsha deposit (Arab Republic of Egypt). The chemical composition of the ore of this

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deposit is presented in Table 3.1. Figure 5.2 shows the basic technological scheme for processing kaolin raw materials with an indication of the main material flows per 1 ton of alumina.

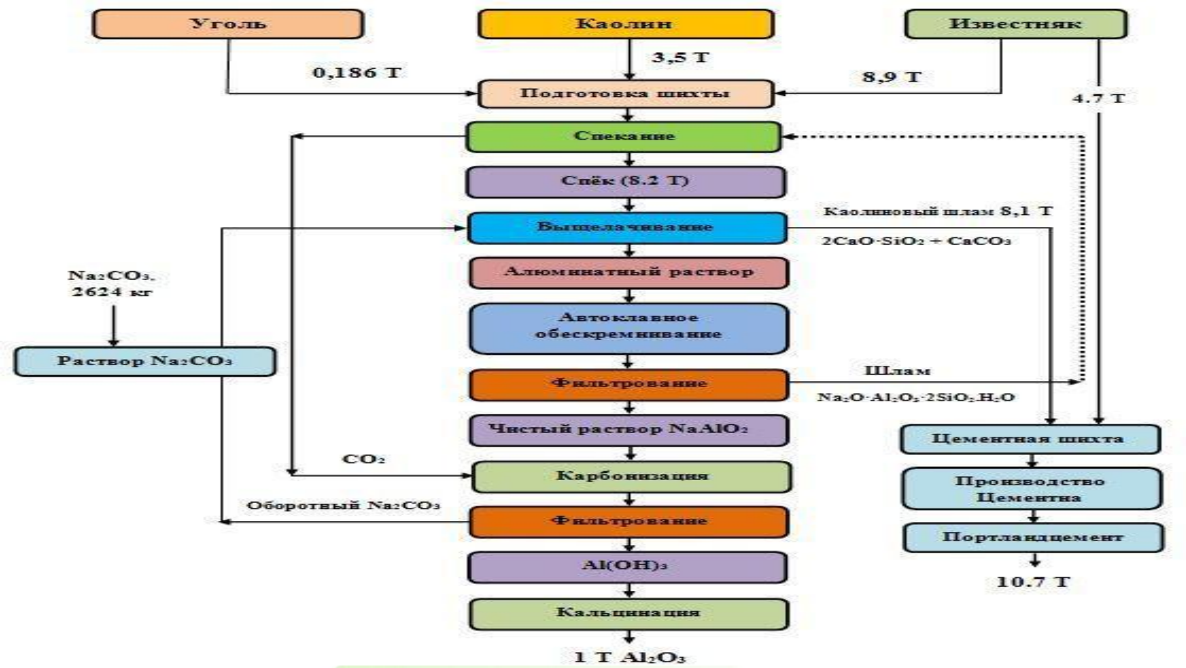
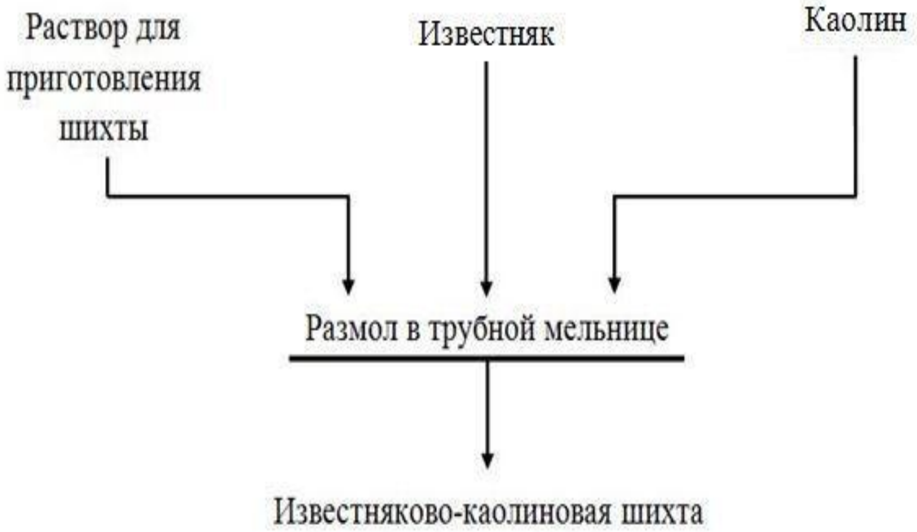


Figure 5.2 – Basic technological scheme for processing kaolin raw materials with an indication of the main material flows per 1 ton of alumina

Limestone enters production in its original form (20-50 mm) and is unloaded into the hopper of the receiving device. From the receiving hoppers, it is fed by a belt conveyor system to the hoppers above the mills. Each mill has its own hopper. Limestone grinding is carried out in single-chamber ball mills with a size of □2.2 □2.4×13 m, which, depending on the size and hardness, can process from 80 to 120 t/h of limestone. Limestone grinding is carried out together with liquid and solid circulating products of hydrochemical processing stages of alumina production. The moisture content of the pulp after the mills is in the range of 33-37%. Humidity control after each mill is adjusted by changing the position of the pan feeder's drop blade. The amount of injected intermediate water is determined by the specified humidity.

The proposed option is basically similar to the well-known method of preparing limestone-nepheline charge, of course, corrected for the differences in hardness and size of the initial materials [3]. The basic technological scheme for the preparation of limestone-kaolin charge is shown in Figure 5.3. This scheme has proven itself well in production conditions. First, the crushed kaolin ore enters the warehouse and is discharged into a parabolic hopper. It is then fed either directly into production via a hopper above the pulpers (chain agitators) or to the warehouse in the silo tanks.



From the silo warehouse, kaolin ore is fed directly to the charge preparation site. Since the hardness of kaolin and limestone ores is close to each other, they are crushed in one stage or with subsequent grinding for the final fine-tuning of the fractional composition to the required values. As practice shows, this scheme makes it possible to consistently obtain a charge that satisfies the residue on the 80 μm sieve of no more than 5-7 %, according to the data of the production complex in Pikalevo, Leningrad Region. Taking into account the proximity of the strength characteristics of carbon materials to the strength used directly at the charge preparation site.

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