

MANUFACTURE EXTRACTION PHOSPHORIC ACID BY WET METHOD

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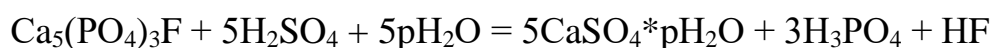
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Abstract: Results of comparative analyses of a chemical compound and technological exponents of manufacture extraction phosphoric acid are resulted. It is shown, that optimum conditions of reception extraction phosphoric acid with the content of 21,5-23% P_2O_5 are temperature 85-90°C, ratio L:S = 2,5-3,5 and the content free SO_3 1,5-2,5%.

Keywords: extraction, wet method, movable suspension, gypsum, hemihydrate, anhydride.

In contrast to the production of phosphoric acid by the thermic method, the reaction of natural phosphates by sulfuric acid decomposition:



and at the next stage, the method based on separating the sulfate precipitate from the liquid phase is called extraction or wet method. The resulting product is called extractable phosphoric acid (EPA). This widely used method of obtaining phosphoric acid is used in the production of mineral fertilizers, nutritional and technical phosphates [1].

The main condition for carrying out the extraction process with sulfuric acid that sufficiently large, easily separated and well-washable crystals of calcium sulfate from phosphoric acid. This includes the rational selection of equipment for some stages of the process and the technological procedure defined in the extraction process, that is, the precipitation of calcium sulfate in the required form (gypsum, hemihydrate or anhydrite) and the concentration, temperature and other parameters that ensure the production of phosphoric acid as a product of the specified concentration [2].

During the extraction process, it should be possible to obtain a movable suspension of calcium sulfate in phosphoric acid, mix it and transport it. When natural phosphate is directly mixed with concentrated sulfuric acid, a thick suspension is formed that practically does not allow phase separation. To ensure its mobility, the so-called "circulating" acid is the mass ratio of liquid and solid phases due to the recirculation of the mixture of the solution formed by washing the phosphate precipitate (phosphogypsum) separated from phosphoric acid with a part of phosphoric acid as a product (L:S) is kept between 2.5:1 and 3.5:1.

The basis for choosing the temperature and concentration parameters of the extraction process is the information about the limits of existence of different modifications of calcium sulfate and the rate of their conversion to each other in phosphoric acid solutions; these data were shown above for pure solutions. However, in real solutions of extractable phosphoric acid, the exact boundaries of the crystallization areas of gypsum, calcium sulfate hemihydrate and anhydrite, and especially the rates of inter-phase transitions that occur, change sufficiently.

For example, in pure solutions of phosphoric acid containing 10-25% P_2O_5 , at 80°C, most of the hemihydrate is the first crystallized phase of the system and turns into gypsum within 1-5 hours. Additives such as iron phosphates and silicon significantly enhance this process. The resulting gypsum can exist in a metastable (stable phase - anhydrite) form for several months in solutions containing less than 10% P_2O_5 , and for several days in solutions containing 25% P_2O_5 . In accordance with the extraction conditions, the liquid phase suspension contains 25-30% P_2O_5 , the

temperature is 70-80°C and the mass stays in the reactor for 5-8 hours. The precipitate is not a stable anhydrite but a metastable dehydrate [3].

Phosphate raw materials, sulfate and circulating phosphoric acid are transferred to the first section of the extractor with the help of regulating devices and pumps. Since the initial mixture also contains phosphoric acid:



the reaction represented by the equation can also occur. The resulting monocalcium phosphate is processed with sulfuric acid and calcium sulfate is crystallized. Some of the suspension is returned to the first compartment of the extractor, as well as from the last or previous compartment - this ensures that the saturation is reduced and the conditions for the crystallization of calcium sulfate are improved. The fluorine gases released as a result of the decomposition of raw materials from the gaseous space of the extractor are pushed into the absorption system, where they are captured by an aqueous solution of H_2SiF_6 [4].

From the last section of the extractor, it is sent to filtration to separate the liquid and solid phases in the phosphoric acid suspension of calcium sulfate. As a result of separation of phosphogypsum from the liquid phase of suspension mass - main filtrate, and as a result of washing phosphogypsum with water - washed filtrate is formed. A part of the main filtrate is removed as finished product, and the rest is mixed with the washed filtrate and returned to the extractor as a rotary solution.

Separation and washing of phosphogypsum is carried out in drum tape, rotating conveyor boat (carousel) and other vacuum filters. The main requirement for filters is to ensure good washing of the precipitate from phosphoric acid [5].

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