

SYNTHESIS OF ALUMINIUM PHOSPHATES BY CHEMICAL PRECIPITATION IN AQUEOUS SOLUTIONS VARYING ACIDITY AND COMPONENT MOLE RATIO

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Food additive E541 is a chemically pure aluminum phosphate, which is used as an emulsifier, stabilizer, leavening agent, acidity regulator, etc. Most often, this food additive is used in confectionery and for baking, because aluminophosphate reacts with the product elements. It leads to the formation of carbon dioxide, which provides a lush structure of the finished product. Aluminum phosphate is used in the production of some types of yogurt, sausages and fish semi-finished products. Also, the use of additive E541 is very suitable for the production of processed cheeses. This food additive gives plasticity and elasticity to the finished product. Aluminum phosphate is a very good emulsifier using to improve the consistency of products containing fats and water.

Unfortunately, there are no deposits of high-quality phosphorus raw materials in Ukraine, and therefore E541 is not produced by Ukrainian enterprises. The food industry must import food phosphates from Belarus, Russia and China. To solve this problem, it is necessary to look for an easier way to get this supplement in our country.

A known method to obtain the chemically pure aluminum phosphates is its chemical precipitation using high-purity orthophosphate acid and chemically pure aluminum salt.

Based on a critical analysis of the scientific and technical literature, it was assumed that the precipitate composition primarily depends on such synthesis conditions as the pH of the solution and a mol (or a mass) ratio of aluminum and phosphate in the reaction mixtures.

Therefore, the aim of our work is to research the chemical precipitation processes of aluminum phosphates from aqueous solutions and to determine the optimal parameters of the precipitation process. As such parameters were used acidity and molar ratio of Al: P. The results of the research will allow to choose the appropriate method of aluminum phosphate synthesis, will help to avoid the dependence of the purchase of this additive from imported manufacturers, which, in turn, will reduce the cost of finished products.

To study the regularities of the precipitation process of aluminum phosphates, the synthesis of salts was carried out by varying the acidity of solutions (pH) from 3 to 11 and at different molar ratios of Al: P, which varied in the range of 0.5–1.6. To ensure the crystal structure during the aging of the precipitate in the mother liquor, aqueous suspensions with the precipitate were divided into several parts, and each of which was kept under isothermal conditions at certain temperatures (30, 50, 90, 150 and 250 °C) during 6 hours in a Teflon reactor RVD-200 with tightly closed lid. After cooling, the precipitate was filtered off under vacuum and dried in an oven at 100–110 °C. The phase composition of the precipitates was studied by X-ray diffraction.

Analysis of the obtained diffractograms allowed us to draw conclusions about the presence of the main forms of the obtained aluminum phosphates. It is also concluded that with the aging of precipitates, its phase transformation into less soluble forms of phosphates is possible. It has been experimentally proved, it is necessary to control the time of crystallization and settling (aging) of sediments in addition to pH and the molar ratio of Al:P in solution in the synthesis of salts.

The conducted experimental researches confirm our theoretical predictions.