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SELECTION OF AN EFFECTIVE STARCH OXIDIZER FOR THE PURPOSE OF USE OF ITS MODIFICATIONS IN PAPER SIZING

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Abstract:
This article presents the results of studying the properties of corn starch in the process of oxidation with hydrogen peroxide in the presence of FeSO4. It has been established that an increase in the concentration of solids in oxidized starch dispersions also leads to an increase in the strength of the jelly. At the same time, the equilibrium moisture content of oxidized corn starch has been somewhat lower than that of native starch samples.

Keywords: starch, sizing, oxidation, jellies, sorption, humidity.

Introduction

Adhesives consist of water-soluble colloids. The traditional adhesive for coating is casein in an alkaline solution. However, the most widely used colloids at present are modified starches, that is, starches that, after a certain treatment (oxidation, hydrolysis, enzymatic treatment, etc.), have become water-soluble [1].

It is known that in practice for the preparation of modified starches for surface sizing of paper and cardboard, two technologies are most widely used: starch oxidation and enzymatic hydrolysis. Approximately 60% of the total consumption of modified types of starches is oxidized [2].

It is known that surface sizing requires starch, which has a reduced viscosity in comparison with natural, increased stability and increased binding capacity. This is necessary so that the starch dispersions in the size press have a sufficiently high concentration, are processable and remain stable.

The technology of starch oxidation is based on the process of treating a starch suspension or dispersion with oxidizing agents (for example, sodium hypochlorite or hydrogen peroxide) [3]. When oxidized with hydrogen peroxide, highly dispersed colloidal solutions with reduced viscosity are obtained, which have high adhesion, which penetrate deeper into the pores of the paper, better glue the fibers, and give a stronger film. Oxidized starch is also obtained by treatment with 1-2% NaClO solution at 35°C. This type of starch increases the strength and degree of sizing with rosin glue at half the consumption of conventional paste. Oxidized starch gives an elastic film, has a lower gelation temperature, is less prone to thickening, and disperses coating pigments [4].

Obtaining oxidized starch according to our developed method is the action on starch with a solution of sodium chlorate in an alkaline medium. The formation of carboxyl and carbonyl groups leads to improved solubility and stability of starch dispersions.

This is due to the fact that carboxyl and carbonyl groups in starch interact better with water than hydroxyl groups, and due to this, the force of interaction of amylose molecules with water increases, the solubility of amylose increases, and the processes of retrogradation, crystallization and gelation decrease. The oxidation process can be carried out both at a low temperature, below the starch gelatinization temperature (up to 60 ° C), which is usually done in starch factories. Oxidized starch is used for bulk sizing and surface sizing. Its share in the production of paper and cardboard on paper machines is up to 60%.

But in the surface sizing of the paper industry, modified starches are mainly used. Native and modified starches have different structures and properties. In this regard, a lot of research is being done to show these characteristic features. As is known, when starch is modified with strong oxidizing agents, the primary and secondary hydroxyl groups contained in the elementary unit of the starch macromolecule are oxidized to carboxyl (COOH) groups. According to the mechanism, these reactions proceed similarly to the oxidation of natural cellulose polymer. It is known that in practice for the preparation of modified starches for surface sizing of paper and cardboard, two technologies are most widely used: starch oxidation and enzymatic hydrolysis. Approximately 60% of the total consumption of modified types of starches is accounted for by oxidized ones [5].

The technology of starch oxidation is based on the process of treating a starch suspension or dispersion with oxidizing agents (for example, sodium hypochlorite or hydrogen peroxide). When oxidized with hydrogen peroxide, highly dispersed colloidal solutions with reduced viscosity are obtained, which have high adhesion, which penetrate deeper into the pores of the paper, better glue the fibers, and give a stronger film. Oxidized starch is also produced by hydrogen peroxide in the presence of FeSO4 at temperature conditions (35, 40, 50 °C) and reaction times of 1 and 2 hours. This type of starch increases the strength and degree of sizing with rosin glue at half the consumption of conventional paste. Oxidized starch gives an elastic film, has a lower gelation temperature, is less prone to thickening, and disperses coating pigments [6, 7].

Obtaining oxidized starch according to our developed method is the action on starch with a solution of sodium chlorate in an alkaline medium. The formation of carboxyl and carbonyl groups leads to improved solubility and stability of starch dispersions. This is due to the fact that carboxyl and carbonyl groups in starch interact better with water than hydroxyl groups, and due to this, the force of interaction of amylose molecules with water increases, the solubility of amylose increases, and the processes of retrogradation, crystallization and gelation decrease. The oxidation process can be carried out both at a low temperature, below the starch gelatinization temperature (up to 60 ° C), which is usually done in starch factories. Potassium permanganate is an oxidizing agent with a redox potential higher than that of hydrogen peroxide as shown in the literature. But we have produced the oxidation of starch with sodium chlorate under mild conditions, which is a locally produced product.

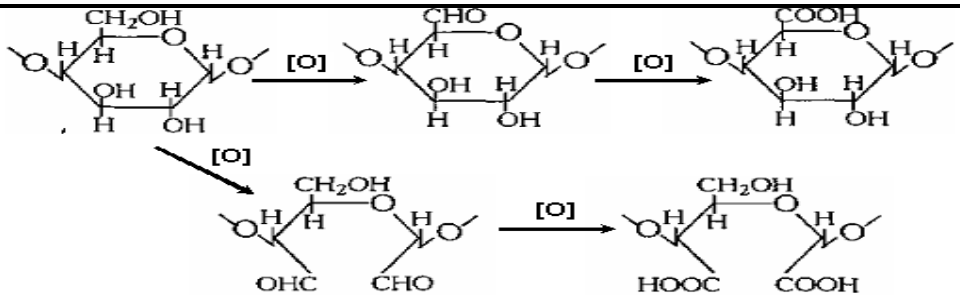

Photo. Schematic representation of the starch oxidation process

The main uses of starch in papermaking are surface sizing, as an additive to paper pulp, as a coating binder and as an adhesive for corrugated cardboard. Surface sizing of paper for offset printing with oxidized starch increases the stability of the paper's physical and mechanical properties magicians in the process of artificial heat-moist aging, which allows make a forecast about increasing the period of its storage and operation [8].

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