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Research on New Raw Material Source for the Paper Industry

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ABSTRACT: The article analyses experimental data on the study of the possibility of efficient use of licorice root waste in the pulp and paper industry. The process of obtaining half-cellulose from licorice root waste with its subsequent bleaching is investigated. The influence of cooking and bleaching process factors on the properties of half-cellulose was studied. Based on the results of the experiment, a technology is proposed for the production and bleaching of licorice half-cellulose.

I.INTRODUCTION

Research on the application of non-woody plants in the chemical and cellulose-paper industry has investigated the effect of boiling methods of straw, bran, muskantus on nitrogen, ammonia and hydrotrop on the quality of cellulose. Experimental research has shown that it is promising [1]. It is established on the basis of experiments that the indicated raw materials can be obtained by boiling in various ways by 30.6-45.5% cellulose, which is 85.7 - 77.75% of α-cellulose. S. Pathak and others proposed the use of electron beam method of raw materials for boiling cellulose. Bio-waste was used as a raw material. According to the proposed technology, cellulose has been saved up to 50% on energy consumption in paper production. This process is called "ECTMP" - a method of energy-efficient chemical-thermomechanical boiling of cellulose [2]. The composition of the packaging paper presents an ecological raw material based on bananas. With the help of chemical processing, lignin was extracted from banana fibers and cellulose fibers were obtained [3]. Nowadays scientists are studying the possibilities of obtaining raw materials from various agro-producers. In India, cellulose from sugar cane, which is one of the agrochemicals, is bleached and bleached. Chemical analysis of sugar cane contained 40.4% cellulose, 33.2% gimicellulose, 17.4% lignin and 6.45% lignin [4]. Studies on the use of cellulose from rosemary root waste and its use in paper composition have shown that it is possible to obtain cellulose in the amount of 25-30% (in relation to absorption of dry raw material) by boiling nitrogen root waste [5]. This paper summarizes the results of the experiment on the possibility of hydrolyzing the licorice root waste first and then obtaining semi-cellulose.

Usually, the annual production of cellulose using nitric acid from plants is carried out in the following composition and order. The crushed plant raw material is hydrolyzed with 4% nitric acid solution at 70-75 ° C for 6 h. Semi-finished products boiled in 4% alkaline solution at 80 ° C for two hours. When required, bleach is carried out in chlorine solutions. The cellulose obtained in this series is mainly used for copper-ammonia fiber production.

In our experiments, we aim to develop technology for obtaining semi-cellulose from licorice root waste for use in the production of hygienic paper types. It is known that when hemicellulose and lignin are left in the content of the product, the product is called semi-cellulose, which is 60-80% of the total raw material. The technology of obtaining semi-cellulose from the raw material is similar to that of the cellulose, the difference being the use of chemical reagents at low concentrations almost twice as long as the boiling process, and the duration of the process. The effect of nitric acid concentration on the amount of semicellulose formation during hydrolysis is shown in Figure 1.

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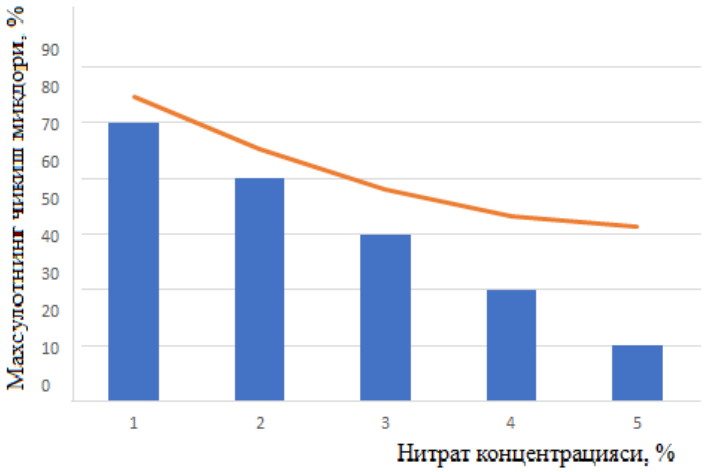

1. the amount of product formation %
2. nitric acid concentration

Figure 1. Effect of nitric acid concentration on the amount of semicellulose formation during hydrolysis.

From the data presented we can see that the increase in nitric acid concentration decreases the amount of product formation relative to the raw material mass. However, the product is fibrous and is not recommended for use in paper mass composition for sanitary and hygienic paper types. This may be because nitric acid is not absorbed evenly by the plant tissue. In subsequent studies, raw crude was processed in 2.0% acid solution. The experiments investigated the effect of the hydrolysis process duration on the quality of the extracted products (Table 1).

Based on the results of the experiments presented in the table, we can see that half-cellulose used in paper mass composition can be hydrolyzed with 2.0% nitric acid for 4 hours and then boiled by sodium. Due to the low whiteness of the products, whitening was carried out.

Table 1

Effect of hydrolysis process duration on semi-cellulose quality indicators

Hydrolysis process duration, hours	Product formation, %	The amount of ash, %	The degree of polymerization	Whiteness level, %
2	70	7,8	650	54
4	62	6,0	544	55
6	68	5,2	415	55
8	54	2,5	395	57

In the experiments, it was found that half-cellulose whitening does not meet the requirements for single-step bleaching in hydrogen peroxide solution at different concentrations (Figure 2).

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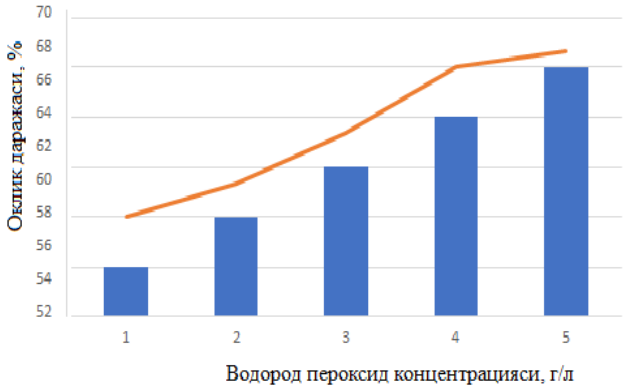

1. degree of whiteness %
2. concentration of hydrogen peroxide solution

Figure 2. Dependence on the degree of whiteness of the licorice semicellulose to the concentration of hydrogen peroxide solution

This is due to the high content of lignin in the plant, due to the hydrogen peroxide bleaching process that does not break the lignin out of the tissue. In the following experiments, the two-step process of semi-cellulose bleaching was obtained from the hydrolysis of the licorice root by acidification and subsequent sodium boiling. In the first step, half-cellulose is treated with hypochlorite solution of 5 g / l for 40 hours at 40 ° C, followed by a 2-hour bleaching process with 2 g / l hydrogen peroxide solution for 2 hours. The results of the experiment are presented in Table 2.

Table 2

Qualitative indicators of bleached licorice semi-cellulose

Qualitative indicators of semi-cellulose	One-step bleached	It was infused in two steps
Ash volume,%	5,2	3,8
The degree of polymerization	508	484
Whiteness level,%	60	78
H_2SO_4 insolouble part, %	2,2	1,7

Based on the experience, the following technologies of boiling of licorice root waste and bleaching of semicellulose obtained are proposed:

Raw materials grind	→	**The first step is hydrolysis**	→	**The second stage hydrolysis**	→
The size of splinter 1-2 mm		HNO_3 – 5% T°C = 40-45 τ = 2 hour		HNO_3 – 5% T°C = 70-75 τ = 4 hour	
Boil	→	**The first stage is whitening**	→	**The second stage is whitening**	
NaOH – 4% T°C = 80 τ = 2 hour		NaClO – 10 г/л T°C = 40 τ = 1 hour		H_2O_2 – 2 г/л T°C = 40-45 τ = 2 hour	

Figure 3. Technological sequence of boiling of rosemary root waste and whitening received semicellulose

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The use of semi-cellulose obtained by the proposed technology in paper composition in the production of sanitary and hygienic paper can solve the needs of the Republic in the paper, so that we can produce high quality paper by making primary paper fibers.

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