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MODIFICATION OF VEGETAl WASTES TO INCREASE THE EFFICIENCY OF WATER SOLUTIONS PURIFICATION

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New methods of chemical modification of wastes of food industry which allow to obtain effective lignocellulosic sorbents were developed. Crashed walnuts shells were used as a raw material and its chemical composition and sorption properties were investigated. The influence of the parameters of chemical modification on the yield of lignocellulose product, its sorption ability towards methylene blue and static exchange capacity for 0.1 N NaOH was studied. Optimal parameters of the process were established.

The problem of pollution of water objects of the environment is an urgent for different countries. For nowadays, the priority direction of chemical technology is the application of "green technologies" to ensure the ecology of production. It can be achieved by the application of by-products or vegetal wastes of agriculture and food industry as biosorbents. En effective biosorbents can be obtained by chemical modification of plant materials, for example, with phosphoric acid, at low temperature.

During experiments, three fractions of the raw material were used: 0.5 mm> fraction A> 1.0 mm; 1.0 mm> fraction B> 1.5 mm; 1.5 mm> fraction B> 2.0 mm. It was shown that reducing the particle size of the initial material leads to an increase in the efficiency of methylene blue removal from water solution from 17.2% for fraction B to 39.20% for fraction A. The static exchange capacity increases by an average of 30% for each subsequent fraction. To provide the plant materials with additional sorption properties, along with mechanical treatment, it is possible to apply chemical modification. It was established that an increase in the concentration of phosphoric acid from 5 to 75%, there is a decrease in the yield of the final product is observed. It can be connected with the dissolution and removal of the extractives and the low molecular weight fraction of the polysaccharides. And the maximum reducing in the yield of the product corresponds to the modification during first 60 minutes. Further increase in the processing time up to 180 minutes has low effect on the yield of phosphorylated lignocellulose product. Static exchange capacity of biosorbents is also increase with an increase in the concentration of inorganic acid and with the increase of time of the process to 120 minutes. Further increase in the processing time up to 180 minutes does not effect on static exchange capacity.

Increasing of both parameters during phosphorylation of crashed walnuts shells has a positive effect on absorption efficiency towards methylene blue. It can be explained by the fact that in the process of modification the removal of the part of extractives of organic and inorganic nature from the plant raw material, depolymerization of polysaccharides components, which leads to the formation of porous structure in phosphorylated lignocellulosic biosorbents takes place. Absorption of cationic dye on such sorbents occurs both through physical adsorption and by mechanisms of chemisorption with the participation of functional groups of modified plant material.

According to the results of the experiments, the regression equations for the phosphorylation of walnuts shells (the values of the correlation coefficients are close to 1) were obtained. To find the optimal solution it was decided to apply a combination of quality indicators using the generalized desirability function. According to the calculations, the optimal parameters of the process (the concentration of phosphoric acid and the time of the process are 54.8% and 120 minutes, respectively) were established. The maximum value of Harrington's desirability function in optimum point is 0.7612.

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