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PROCESS OF PHYSICO-CHEMICAL PROPERTIES OF VEGETABLE SORBENTS

This article discusses the results of a study of sorbents based on plant raw materials. At present, one of the urgent problems in industrial cities is pollution by heavy metals. In this regard, it is necessary to study sorbents from plant raw materials.

At present, one of the urgent problems in industrial cities is pollution by heavy metals. In this regard, it is necessary to study sorbents from plant raw materials.

These can be sorbents from plant raw materials, which are effective and used in various fields [1]. The most popular are cellulose.

Keywords: sorbents, vegetable raw materials, oats, rye, wheat, specific surface area, exchange capacity, sorption isotherms, heavy and radioactive metals.

Introduction

Cellulose is an organic compound that belongs to the category of polysaccharides. It is a polymer made up of glucose subunits. It is found in bacterial and plant cells and is present in large quantities in their cell walls.

The advantages of cellulose include its widespread use. It is used in the production of pulp and paper products, in the production of various fabrics, in medicine, in the production of varnishes, in the manufacture of organic glass and in other fields of industry.

Materials and methods

This article discusses the possibility of obtaining a sorbent from a non-wood material.

The use of non-wood plant raw materials instead of wood will not only save wood, but also get a cellulosic material with properties different from wood cellulose.

The stems (straw) of oats (Avena sativa), rye (Secale sp.) And wheat (Triticum sp.) Were harvested at the end of the growing season. The composition of the main components (phenolic, aliphatic hydroxyl and carboxyl) is shown in Table 1. According to Table 1, the three selected plant materials contain a sufficient mass of the required components (18 ... 24 %).

From table 1 it follows that the straw of rye, oats and wheat contains a significant amount of lignin, comparable to its amount in hardwood (18 ... 24 %). The proportion of cellulose is high, especially in rye and wheat straw. It is known that non-woody raw materials are characterized by a lower cellulose content than wood, but the total carbohydrate (holocellulose) content is approximately the same due to the high proportion of hemicelluloses, especially pentosans [6]. Non-woody plant materials are characterized by high ash content. According to the data, the highest ash content was noted in oat straw – 5.0 %

Table 1 – Composition of plant raw materials, %

Characteristics	Name		
	Oats	Rye	Wheat
cellulose Kyurshnera	44,7	49,0	48,7
Lingin Komarova	22,5	20,0	21,4
Polysaccharides: Readily hydrolysable Difficult to hydrolyze Total amount	 21,0 39,2 60,2	 17,4 43,3 60,7	 20,5 33,9 54,4
Water-soluble substances	14,6	9,4	14,3
Extractive substances	4,2	3,1	5,6
Ash content	5,0	2,6	3,1
Content COOH	 1,7 1,4 1,2	 1,7 2,0 0,8	 2,3 2,7 0,7

Bio-inorganic sorbent Figure 1 shows a scheme for obtaining sorbents from plant raw materials.

According to it, processing of 1-year-old cereal plants is carried out, as a result, we get plant material. There are two acidic methods for processing plant materials, which are shown in Figure 1.

The total exchange capacity of sorption materials is determined by the number of active ionogenic groups that make up the ion exchanger. It is a constant value corresponding to the state of limiting saturation of all active groups of the exchanged ions capable of ion exchange.

The exchange capacity of the samples was determined by the method [3], while the sorbent samples were in contact with a constant volume of the working solution for 1 day.

The specific surface area of a porous solid is one of the main physicochemical characteristics that determine the course of many surface mass transfer processes, in particular sorption. It was calculated as described in [1], based on the sorption of methylene blue.

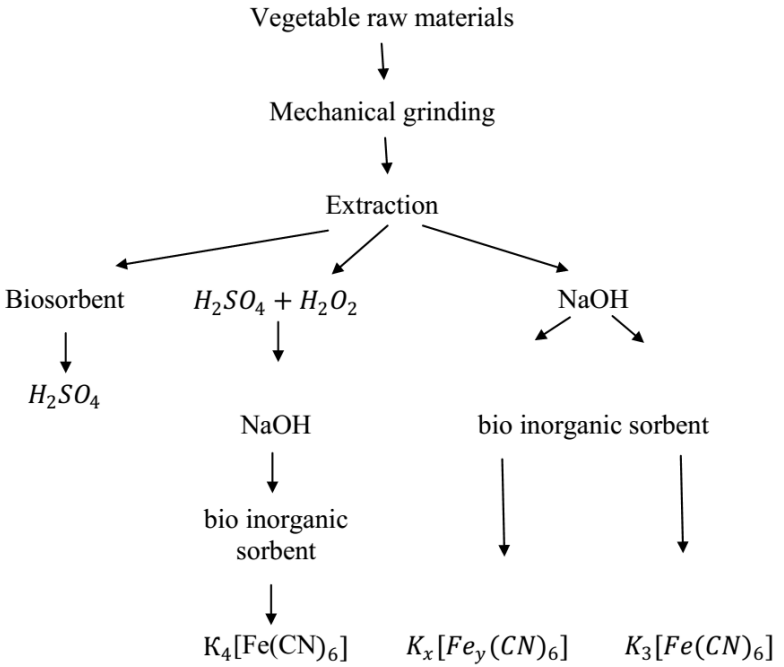

Figure 1 – Scheme of obtaining sorbents

Results and discussion

Table 2 shows the sorption capabilities of the feedstock and sorbents based on it.

Table 2 – Sorption (%) of metal cations by feedstock and sorbents based on it

Sample	Fe (III)	Cr(IV)
Oats	3,0	5,0
Wheat	3,0	7,0
Rye	4,0	7,0
RS-K	41,0	50,0
Active carbon	8,5	-
Polyphepan	14,2	-

Table 3 shows the main characteristics of activated carbon, polyphepan, greenery of crushed wood and needles from spruce.

The main indicator that determines the efficiency of sorption is the specific surface area, the value of which is given in Table 3.

Table 3 – Specific surface area Ssp

Active carbon	7,9
Polyphepan	2,1
Crushed greens	1,4
Spruce needles	0,3

The results obtained showed that the exchange capacity of the sorbents is significantly higher than that of the original plant material. From the data in Table 3, it can be seen that the values of the specific surface area of the samples Ssp of the obtained sorbents are somewhat higher than that of activated carbon, and 4, 6 and 27 times higher than that of polyphepan, crushed greenery and spruce needles. Basic information about the nature of sorption can be obtained from sorption isotherms, which characterize the dependence of the sorption capacity of a material on the concentration of the absorbed component at a constant temperature.

By the nature of the dependences of sorption, and methylene blue samples of sorbents based on oat, rye, and wheat straw, it can be concluded that all the obtained sorbents have a heterogeneous porous structure. Within the studied concentration range, a fairly uniform increase in the sorption of methylene blue was noted. The maximum absorption of iron cations from solutions is observed in the region of the equilibrium concentration of Comp. ~ 0.3 mg/ml, chromium ~ 0.04 ... 0.05

mg / ml. The concentration values at which saturation occurs correlate with the results shown in Table 2.

Conclusions

Based on the results obtained, the following conclusions can be drawn:

– the materials used in the study are promising for the production of sorption materials;

– also sorption materials that are obtained from a sorbent made of non-wood material have excellent characteristics in comparison with traditional sorbents: an eco-product, low-cost in financial terms, availability, increased physical, chemical, sorption criterion.

In addition, these sorbents can be widely used in the national economy, in the industry for the purification of liquid products, pharmacology, and agriculture.

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ӨСІМШІ СОРБЕНТТЕРДІҢ ФИЗИКА-ХИМИЯЛЫҚ ҚАСИЕТТЕРІ

Бұл мақалада өсімдік шикізатына негізделген сорбенттерді зерттеу нәтижелері талқыланады. Қазіргі кезде өнеркәсіптік қалалардағы өзекті мәселелердің бірі – ауыр металдармен ластану. Осыған байланысты өсімдік шикізатынан алынған сорбенттерді зерттеу қажет.

Кілтті сөздер: сорбенттер, өсімдік шикізаты, сұлы, қара бидай, бидай, меншікті бетінің ауданы, айырбас қабілеті, сорбциялық изотермалар, ауыр және радиоактивті металдар.

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ПРОЦЕСС ФИЗИКО-ХИМИЧЕСКИХ СВОЙСТВ СОРБЕНТОВ ИЗ РАСТИТЕЛЬНОГО МАТЕРИАЛА

В данной статье рассмотрены результаты исследования сорбентов на основе растительного сырья. В настоящее время одной из актуальных проблем промышленных городах является загрязнение тяжелыми металлами. В связи с этим необходимо изучение сорбентов из растительного сырья.

Ключевые слова: сорбенты, растительное сырье, овес, рожь, пшеница, удельная поверхность, обменная емкость, изотермы сорбции, тяжелые и радиоактивные металлы.

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