USE OF ACTIVATED CARBON FOR WASTEWATER TREATMENT

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ABSTRACT

This article provides information on wastewater treatment methods

Keywords: adsorbent, nosing wastewater

This cleaning is the most effective of all known cleaning methods, but is not widely used due to the lack of sufficiently cheap and standardized sorbents. In addition, sorption treatment, as well as any other, as mentioned above, leads to the formation of a large amount of sludge, which requires a special and usually very complex processing technology.

$$Ca_3(PO_4)_2 + 3Na_2CO_3 \rightarrow 3CaCO_3 + 2Na_3PO_4$$

The role of carbon sorbents in solving environmental problems is constantly increasing: drinking water and wastewater treatment In drinking water treatment, powdered activated carbon is sometimes used before coagulation. This coal cannot be recovered and the process produces large amounts of sludge.

Carbon sorbents are used in various forms: in the form of powder with a particle size of up to 0.8 mm, larger granules, blocks of various shapes and sizes, films, fabric fibers. Effective purification of natural waters from the most toxic substances is provided by granular coal of type AG with trademark SKD-515, as well as activated powdered coal of type OU with brand SPDK-27D.

Currently, the biosorption mechanism is not fully established. The most possible thing is the rapid absorption of the substrate directly from the solution by bio cells on the surface of the activated carbon particles and the subsequent biochemical oxidation of the srobite substrate. As a result, biochemical oxidation of any organic sorbate increases the amount of pollutants from water by 1.5-7 times compared to their adsorption in the absence of microorganisms. The industrial use of activated carbons is considered in the monograph. According to the study, the structure of consumption of activated carbon materials is characterized by the following indicators (%):

_ production of food products -42.6;
– technological use -38.0;
– environmental protection -10.0;
– drinking water purification -4.7.

In industry, coal is used in the extraction of iron and ferroalloys, gold and a number of non-ferrous metals. Coal is used in pharmaceuticals, chemical synthesis, analytical chemistry, purification of liquids and gases from toxic substances, etc.

Conditions that make production profitable are determined. Criteria are proposed to describe installations that meet these conditions. The article provides an example of compliance with these conditions, description of installation. An attempt was made to connect the technology of active carbon production with the existing technological processes of delignification and hydrolysis of wood raw materials.

Mathematical modeling of the carbonization stage in obtaining activated carbons from wood waste is described. Physico-chemical constants of the carbonation reaction were determined, and a mathematical model of the carbonation reaction was developed

Currently, the raw material for the production of BAU coal (ground activated carbon, GOST 6217-74) is grade A coal, which is obtained from hardwood trees, mainly birch.

In the production of carbon adsorbents, steam-gas activation of raw materials containing carbon is used, which includes two stages: pyrolysis and carbonization of raw materials with the formation of porous carbon material. Then the latter is activated by a steam oxidizer at high temperature.

The complex two-stage technology does not allow to obtain coal with a yield of more than 15%. Therefore, one of the possibilities of improving the technology of production of activated carbons is the thermochemical process of pyrolysis and activation with water vapor. Formation of porous and supramolecular structure of activated carbons in the combined process of sodium-based pyrolysis-activation of industrial lignosulfonates was studied. The main laws of the process were determined, they are the primary pore structure of activated carbons formed at the stage of carbonization of lignosulfonate. Steam-gas treatment is necessary to open the formed pores, which provides access to them for adsorption molecules. In the process of pyrolysis-activation of lignosulfonates, developed cracks of coal, including micropores with a half width of 0.50-0.64 nm are formed.

The technology of one-step production of activated carbons from different types of carbon raw materials has been developed: brown coal, mixed hardwood, wood processing waste (wood shavings, bark) and saw cuttings. wood shavings) without distinguishing by wood species, hydrolytic lignin, etc. The process is carried out by pyrolysis and activation in fluidized devices. The design of the apparatus, which ensures the spearing of the layer, is proposed. Activated carbons were obtained from non-standard wood and wood waste, which are not inferior to BAU and BAU-MF types of coal in the main normalized parameters.

Original technology and equipment have been developed for the combined method of wood pyrolysis and charcoal activation, which are characterized by a special organization of steam-gas flows, pyrolysis and activation action, which allows more complete use of the gas activator. provides and recycles heat. The structure of the device excludes the use of mixing components. The device is characterized by low metal consumption, compactness and low power consumption. This technology includes the use of many types of raw materials to obtain activated carbon and its components.

A technology for the production of wood activated carbons with the combined activation method of pyrolysis-steam-gas using alternating current is offered. Ways of targeted regulation of parameters of pore structure and adsorption properties of coal activated carbons were studied. In the combined process, charcoal extraction from freshly cut wood involves drying and pyrolysis of the wood by heating with a gaseous heat carrier. The removal of the waste heat carrier from the drying stage and the cooling of the resulting coal are different from the existing ones with a circulating waste heat carrier in the drying stage. The latter is taken in a ratio of

3:1 to 4:1 to the gaseous heat carrier and is introduced in the zone with a relative humidity of wood of 10-25%.

By changing the conditions and nature of the raw materials, it is possible to change the properties of the resulting coal. Thus, an increase in the amount of wood used leads to a 3.5-fold increase in the volume of macropores in coal 0.982 cm3/g, a 3.4-fold increase in the specific surface area, and an increase in the marginal volume of the adsorption space. Changes in the rate of wood pyrolysis also have an effect. Thus, increasing it increases the macropore volume 5 times to 0.395 cm3/g and the specific surface area increases 3.4 times.

At the same time, the specific volume of macropores increases to 0.357 cm3/g, and the limiting volume of the adsorption space for activated carbons is 0.023 cm3/g. The properties of activated carbons obtained from plant waste allow them to be used as adsorbents for solving environmental problems.

Birch shavings produced during the use of grinders as raw materials, as well as shavings from rosin extraction plants were studied.

Activated carbons of birch bark have adsorption activity for methylene blue - 290 mg/g, for molasses - 106 mg/g, ash content - 7.5%, i.e. The resulting activated carbon meets the technical requirements for activated carbon OU-A GOST 4453-74. Activated carbon in shavings of rosin-extraction plants is superior to OU-A activated carbon in all parameters. The characteristics of activated carbons allow them to be used in the medical and pharmaceutical industry, in the purification of drugs, technological solutions and other fields.

Since lignin is a large waste of pulp and paper production (20-30% of the weight of wood), much attention is paid to the use of lignin for processing into coal. The analysis of many literatures and literature data allows us to conclude that pyrolysis of industrial lignins is an alternative to other processing methods if it is aimed at obtaining sorbents with simultaneous recovery of chemicals and heat generation.

The first workshop for the production of activated carbons from hydrolytic lignin was created at the Biryusa Hydrolysis Plant. The technology adopted at the plant is based on the production of activated carbon from wet molded granules. The process has disadvantages, including low strength and high density of lignin granules, among others. for lignin processing (granules and briquettes), slotted devices are offered, which allow pyrolysis and activation of wood materials with a particle size of 10-100 mm in a vertical layer. Hydrolyzed lignins from coniferous trees and corn cobs, and cellolignin obtained from furfural pulp bark were used as raw materials.

Research shows that it is possible to obtain activated carbon of class A on the basis of coal of class B and coal of birch stove (sorption activity of iodine is not less than 2) 60%, ash content is not more than 7%. Activated carbon from hydrolytic lignin successfully obtains BAU level MF (sorption activity for iodine not less than 70%, ash content not more than 10%). The latter allows to expand the sources of raw materials for the production of activated carbon.

The production and use of oxidized activated carbons based on technical lignins has been developed. The conditions for the synthesis of lignin-based coals have been scientifically substantiated. Adsorption of organic vapors on oxidized active lignin carbons is accompanied by chemisorption effect. The method for obtaining activated carbon from lignin consists of carbonizing kraft lignin at 623K N2 for 2 h, followed by graphitization at 1373 K under Ar at a heating rate of K 50 K/min and holding at 1373 K for 1 h.

The method of producing lignocoal and the plant producing it are patented. To increase the yield of coal from hydrolytic lignin and reduce its ash content, percolation hydrolysis of plant materials with 0.3-1% H_2SO_4 solutions is provided to obtain an aqueous solution of lignin and pentose and hexose sugars containing furfural.

The pyrolysis of hydrolytic lignin at 400-500 °C was studied. The composition of the outgoing liquid products was determined by thermography and chromatography-mass spectrometry. In such conditions, it was shown that pyrolysis products do not contain highly toxic carcinogenic substances, and the formed coals have high adsorption activity.

Treatment of bark and various lignins with iron sulfate under certain conditions allows obtaining adsorbents with different properties. In addition to the porous structure, adsorbents can have magnetic sensitivity. The specific saturation magnetization of individual samples determined by the method of magnetic moments increases to 60 A ·m2/kg, which makes them similar to magnetite. The resulting ferromagnetic adsorbents can be used to purify wastewater from phenols, surfactants and other pollutants. The considered adsorbents have a unique feature, they are easily separated from the treated medium by magnetic separation methods.

The method of formation of sorption and magnetic properties and synthesis of ferromagnetic adsorbents has been developed. This method is carried out during the pyrolysis of wood processing waste in the presence of iron hydroxide (III). If we take into account that ferromagnetic adsorbents are made on the basis of activated carbons or on the basis of metal polymers, and the first method is cheap, the importance of this work is clear. Ferromagnetic adsorbents reduce waste water pollution in terms of COD and BOD5 at the level of industrially produced ShchU-A sorbents and have the following indicators: sorption of methylene blue - up to 360 mg/g, iodine - up to 120%; magnetic susceptibility at a magnetic field strength of 4000 Gs - up to 38–A·m2/kg; according to low-temperature nitrogen adsorption data, the volume of adsorption pores is 0.58 cm3/g.

The characteristics of Br_2 adsorption were determined. Adsorption/desorption cycles and sorption capacity reduction were considered. Research on the synthesis of adsorbents from various wastes of wood industry enterprises is considered: it is shown that it is possible to obtain carbon-mineral adsorbents from waste water containing aluminum hydroxides from bark, waste water, etc. One of the ways to obtain charcoal involves pre-drying the waste when it is obtained from wood waste. The latter is carried out at 230-250 °C until the final moisture content of wood waste is 13-16%. The production of activated carbon, sodium sulfate and furfural from black liquid from pulp and straw has been developed. The liquid is carbonized under low pressure. Charcoal and $Na_2SO_4 \cdot 10H_2O$ are filtered from the liquid. Furfural is obtained from the filtrate. The process reduces the COD of the black liquor by 95% and the color on by 99%.

The possibility of obtaining active clarifying carbons from bagasse and bagasse cellolignin was studied. A method of obtaining clear coals with high sorption properties is proposed. A method of obtaining sorption active carbon materials was developed on the basis of cheap non-traditional raw materials - flax waste (storms) of the processing industry.

The production process of granular activated carbon (GAC) from walnut shells has been optimized. Shell content, cellulose 25.8-51.9%; lignin 16.8-47.6%; hemicellulose 8.7-17.9%; humidity3.8-10.4%; ash content0.2-3.1. Activation shell is held for H_3PO_4 in atmosphere at 170

°C for 0.5-1 hour N2 and air. GAC oxidation was carried out for 4 hours at a temperature of 300°C.
The use of Siberian pine nut bark was studied. The obtained activated carbons have the following properties: methylene blue activity - 48-200 mg/g, which is lower than the requirements of GOST 4453-74, indicating a poorly developed mesoporous structure of coal; for iodine - 87-99%, which exceeds the parameters of GOST 6217-74 and shows a well-developed microporous structure. The cheekbone has a hemispherical shape. The gas dynamics of the activation process is such that the activating gases cannot enter the shell freely, so the formation of the secondary mesoporous structure of coal is slow. To eliminate this shortcoming, it was proposed to grind the shell to destroy the spheres, to change the gas dynamics of the activation process.
The production of activated carbon from xylose waste was studied. Bagasse, furfural production waste, xylose and tannins were used as raw materials for activated carbon. Chemical composition of xylose waste: cellulose35.12-37.21%; pentosans4.16-4.38; lignin 28.53-30.17; ash content 2.1-2.8%.
Treatment with phosphoric acid at a temperature of 340-420 °C. Possibilities of using pulp and paper mill residues as raw material for coal production were discussed. Experimental data on the fractional and quality composition of bark residues and the resulting coal are presented. Production of activated carbon from fine chips, including drying of the material, pyrolysis, cooling of the resulting coal after the furnace using flue gases as a heat carrier, is proposed, with the material being loose and divided into small volumes. is described and the gas is used as a drying agent after pyrolysis. It is used as a refrigerant to cool the coal and then returned to the furnace.
Method and device for thermal treatment of plant-derived materials used in the pyrolysis of wood and agricultural waste in forestry. For this, the material is loaded into a sealed chamber, heated through the chamber wall, and heat treatment is carried out by adding gas to the processed material to 0.25-0.5 performed in a preheated natural gas environment with a mass ratio of more than 1500.
The process of carbonization and activation of chemical and mechanical wood processing waste was studied. As a result of the study of the thermolysis of the modified charge and its individual components during the production of raw coal, the processes occurring in the initial stages of pyrolysis were proposed, which lead to the structure of the initial components and contribute to the production of raw coal. of certain quality, capable of further activation. The device and method of coal production are described in the patent. The device is manufactured in the form of a steel vertical retort equipped with several interconnected 3-5 chamber sections separated by perforated vertical lifting doors. The latter ensures the placement of wood in each subsequent chamber when raised in sequence. Wood is heated in 3-5 chambers to 400-600 °C, and unloading is carried out periodically.
An installation for the production of activated carbon was proposed. The installation includes raw materials, a set of filling containers, equipment for reloading containers, a thermal housing with heating modules, a mobile part and a working unit for the product receiving station. A set of raw material filling containers is made of interconnected containers, each of which is equipped with a bottom mounting, a lid mounting cone and a side rest. Each of the vessels is

equipped with a coaxially located gas channel, in which the part facing the stable support is perforated.

Patented pyrolyzer for coal production. It has containers for horizontal transportation of material, a loading chamber, drying, pyrolysis (equipped with a firebox) and cooling chambers. A special feature of the pyrolyzer is that the containers for transportation are created by pistons with an internal cavity and rods attached to it. The pyrolyzer chamber is divided into two equal zones equal to the size of the container. The second zone is equipped with a steam supply system for coal activation and is connected to the furnace cavity through a gas outlet pipe.

A method for the production of activated carbon is described, which involves pyrolysis of wood particles in a solid bed in an oxygen-free environment and activation in a moving bed with water vapor. Phosphoric acid is effectively used in wood pyrolysis to obtain activated carbon. Active carbon release - 38 ~ 47% at pine pyrolysis temperature of 400-800°C.

Phosphoric acid is also part of the activating agent in the production of granular dense activated carbon from lignin materials. For this, wood shavings and other fibrous raw materials are mixed with an activating agent containing H3PO4 and ZnCl2. After drying at 185 °C, lignosulfonates are added to the mixture as a binder.0.05:1 to 0.1:1 and fine solids. Granules are activated at a temperature of 400-600 °C. The density of coal is 0.25-0.4 g/cm3.

Environment - The use of coal or activated carbon for environmental purposes, i.e. for the treatment of waste water and gases, is well known and intensive research is ongoing. The mode of absorption of Cu, Zn, Cr6+ salts from wastewater was studied when passing through the activated carbon layer. (AU). Experiments were conducted at pH values 2-4. Initial concentrations: Cu - 9.5-10 mg/l; Zn - 8.8-10, Cr6+ - 3.84 mg/l. In the presence of Cr6+, an extraction rate of Cu 73-100% was achieved. Removal of Zn in the presence of Cu 21-48%.

The use of activated carbon to absorb lignin and tannin from sulfate pulp mill filtrates has been proposed. A filter with a load of fine-grained activated carbon with particles with a diameter of 70 µm was used. Experiments were conducted at pH values equal to 2.0; 4.0; 5.0; 7.0; 8.5 and 11. At 200 min of internal processing, the absorption rate of lignin is 90 and tannin - 75. This method is proposed for bleaching filtrates in pulp washing and bleaching plants.

COD reduction of 85% was achieved in the treatment of sulfate cellulose production wastewater with activated carbon powder at 0.5-1 g/l. Reduction of wastewater toxicity. The content of absorbable organic compounds containing halogens will be reduced to the standard - 0.8 kg/t.

For this, the technology of using coal has been developed. Coal is prepared in an electric furnace at a temperature of 1000-1400 °C. After 40-60 minutes of filtration through a layer of coal in gases, it decreases from 88-96 to 25-50 mg/m3. Due to the addition of metal oxide to coal, the level of gas purification increases.

Thus, after reviewing the literature data, it can be concluded that it is advisable to use coal adsorbents obtained from wood processing waste, hydrolysis industry, etc. for adsorption cleaning of liquids and aqueous solutions containing organic and inorganic impurities. The choice of coal as a raw material is justified by the increase in the porosity of the mesopores in the resulting adsorbent, which positively affects its electoral properties. For these purposes, the use of local wood waste from Uzbekistan will significantly reduce technical and economic costs and costs of wastewater treatment processes. Therefore, research in this direction remains relevant.

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