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DEVELOPMENT AND RESEARCH OF HEMOSORPTION MATERIAL WITH A HONEYCOMB STRUCTURE

Currently, for the treatment of toxicological diseases, as well as in septic conditions, hemosorbents in the form of balls and granules are widely used. However, the use of hemosorbents in the form of a microcellular structure in clinical practice is not described. Carbon high-porous material with microcellular structure, obtained by high-temperature carbonization of rice husk (RS). The choice of rice husk due to the fact that the composition of this raw material includes cellulose, lignin and mineral ash, consisting of 92-97% of silicon dioxide, which are useful substances for the human body.
Keywords: *Hemosorption; toxicology; hemosorbent; cellular structure; adsorption activity*

Introduction. Hemosorption, an efferent therapy method, removes various toxic products from the blood by contacting the blood with a sorbent outside the body. Perfusing blood through the sorbent, on which sedimentation of toxic substances occurs. It has an effective detoxifying property.

The method is used to remove from the blood of various medium and large-molecular toxins in patients with endogenous and exogenous intoxication, as well as for the active extraction of hydrophobic and fatty toxic substances.

In case of poisoning, the effect of hemosorption has a threefold orientation: etiospecificity (removing the poisoning agent from the body), pathospecificity (removing middle molecules and other pathogenetic agents from the blood), non-specificity (improving the rheological properties of blood by removing products from it) destruction of fibrin — fibrinogen, disaggregation of uniform elements).

The hemosorption method is based on two properties of the sorbent:

• adsorption (fixation of the substance molecule on the surface of the absorber);
• absorption (fixation of the substance in the volume of the absorber).

The fixation of chemical agents occurs due to the formation of covalent or ionic bonds of the substance with active scavenger groups.

For hemosorption, hemosorbents are used, which are divided into two classes: non-selective, absorbing several substances from the blood, and selective, extracting substances of a certain structure [1].

The first class includes activated carbons, which are the main component of the innovative hemosorbent.

The second class includes ion exchange resins capable of removing potassium ions, ammonium, and haptoglobin from the body [2-3].

The efficiency of hemosorption is due to rapid systemic detoxification due to the binding of a large amount of sorbent dissolved in the blood, compounds and metabolites. Especially clearly the effect of hemosorption is manifested in alcohol poisoning or products of its metabolism, which manifests itself in the ultra-rapid elimination of the main symptoms of poisoning - general discomfort, headache, vegetative disorders [4-5].

After the first procedure, there is a significant decrease in the concentration of pathological products, but after several hours their concentration in the blood rises and approaches the initial one. This is explained by the fact that substances dissolved in a tissue and cellular fluid actively enter the bloodstream. Subsequent efferent hemosorption procedures ultimately remove pathogens in the body. Conditioned long-term remission (no manifestations of the disease). Therefore, to achieve a lasting positive effect, it is recommended that several procedures be carried out [6-7].

Among the various methods of extracorporal hemocorrection, hemosorption is distinguished by technical ease of implementation, compatibility with medical equipment for plasma exchange. Hemosorption is distinguished by the simplicity of the contour [8].

Objective: to increase the adsorption capacity of the carbon material with respect to toxic products and the pathological metabolite.

Hemosorption is a modern method of removing substances toxic to the body cells from the patient's blood. The procedure is performed outside the body by pumping blood flow through a cartridge filled with a sorbent (hemoperfusion procedure). As a rule, the entire volume of circulating blood is passed through a sorption cartridge. Critical parameters for therapeutic effectiveness are the type of sorbent, its volume, the number of repeated procedures; they are individualized depending on the identified pathological abnormalities and the patient's condition, assessed in a medical institution.

Experiment. The following materials were used for the study: Carbonized rice hulls, nitric acid, binders. The carbon composition of hemosorbent includes the production of carbon by carbonization of raw materials of plant origin - rice husk, its activation in water vapor at 800–850 ° C, followed by demineralization of 2–15% nitric acid. As a result of the process it turns out carbonized rice husk [patent number 26708, publ.15.03.2013].

The method of preparation of carbon material for hemosorption includes: mixing the following components for the preparation of "uterine milk":100 weight parts of the main active ingredient - SRS (for carbonized rice husk consisting of carbon and silicon dioxide), a binder as the carboxy compound (CS) or polyvinylpyrrolidone (PVP) in an amount of 6 weight parts, lubricant - surfactant - op-10, distilled water in an amount of 2 parts by weight, 3 components are mixed, polyvinyl alcohol is pre-subjected to swelling by heating to 100 ° C until a gelatinous mass is formed. In 3 components injected swollen PVA is mixed until a homogeneous pasty mass. Next, the mass is subjected to molding and heat treatment. The composition and qualitative characteristics of carbonized rice husk and ingredients allow to create a plastic mass of carbon hemosorbent with high adsorption activity, tuned to the extraction of pathological toxic substances.

The aim of the work is to develop a method for obtaining hemosorbent from plant materials for the removal of toxic products and pathological metabolites from the blood.

The method is as follows. The carbon composition of hemosorbent includes the production of carbon by carbonization of raw materials of plant origin - rice husk, its activation in water vapor at 800–850 ° C, followed by demineralization with nitric acid. As a result of the process it turns out zarbonizovannaya rice husk [patent number 26708, publ.15.03.2013]. A distinctive feature of the material being developed is: the demineralization of carbonized rice husk is carried out with 5% nitric acid at a ratio of rice husk: 5% nitric acid = 1: (3-7); boiling for 2-3 hours; washing, neutralization to pH = 7.

Use for the hydrolysis of 5% nitric acid due to the availability, safety. When using 1-4% nitric acid - low physico-chemical indicators (sorption capacity, specific surface).

The result is achieved by the proposed method of obtaining carbon material for hemosorption, including mixing the following components for the preparation of "uterine milk": 100 weight parts of the main active ingredient - SRS (carbonized rice husk consisting of carbon and silicon dioxide), a binder as a carboxy compound (CS) or polyvinylpyrrolidone (PVP) in the amount of 6 weight parts, lubricant - surfactant - op-10, distilled water in the amount of 2 weight parts, 3 to mponenta mixed, polyvinyl alcohol previously subjected to swelling by heating to 100°C to form a gelatinous mass.In 3 components injected swollen PVA is mixed until a homogeneous pasty mass. Next, the mass is subjected to molding and heat treatment. The composition and qualitative characteristics of carbonized rice husk and ingredients allow to create a plastic mass of carbon hemosorbent with high adsorption activity, tuned to the extraction of pathological toxic substances.

A distinctive feature of the proposed technical solution is that the proposed hemosorbent is made of carbonized rice husk without the use of ammonium chloride and mixed as a binder - "royal milk", a multi-component composition and formed into blocks with a multi-channel honeycomb structure. Raw materials of plant origin - carbonated rice husk, selected as a source of raw materials due to its chemical composition, which allows to obtain carbon as a result of processing, which is physiologically compatible with blood and is able to absorb toxins. The choice of carbonized rice husk is due to the fact that the composition of this raw material includes carbon and silicon dioxide. Also, the raw material from rice husk belongs to the rapidly renewable sources and is environmentally friendly. In addition, plant material - ZRSH is an environmentally friendly affordable product - waste from crop processing in Kazakhstan, which has an initial high porosity.

Example 1. A lot of hemosorbent is made as follows: KS - 52 g, Water - 240 ml, op - 8 g, PVP - 4 g, ZRSH - 250 - 320 g. The specified ingredients are mixed to prepare the carbon dough, then get the form.

Example 2. The mass of hemosorbent is made as follows: ZRSH - 120-160 g, KS - 24 g, op - 4 g, Water - 60 ml, PVP - 2 g. The specified ingredients are mixed to prepare the carbon dough, then get the form.

Example 3. In the above examples, the ingredients of the mass of hemosorbent were immediately mixed with the SRS (figure 1), in this example, “royal milk” is made, then SRS is added in a 1: 1 ratio: KS - 100 g, op - 16 g, Water - 480 ml, PVP - 8 g. The resulting mass is extruded, then get the finished carbon material.

The measurement of the adsorption activity of the carbon material mass was carried out according to the following procedure: methylene blue adsorption activity - GOST 4453-74. To determine the adsorption activity, a methylene blue dye marker was used, which simulates the molecular weight toxicants. The technique consists in measuring the optical density of a clarified methylene blue solution after contacting it with a specific weight of raw material. The resulting mass of carbon material has a high adsorption capacity of 235 mg / liter (0.1 g of activated carbon from rice husk is able to sorb methylene blue dye 235 mg / liter).

Results. As a result, it was shown that hemosorbent is made from carbonized rice husk without the use of ammonium chloride and mixed as a binder, “royal milk”, of a multi-component composition and formed into blocks with a multi-channel honeycomb structure. Raw materials of plant origin - carbonated rice husk, selected as a source of raw materials due to its chemical composition, which allows to obtain carbon as a result of processing, which is physiologically compatible with blood and is able to absorb toxins[9-10]. The choice of carbonized rice husk is due to the fact that the composition of this raw material includes carbon and silicon dioxide. Also, the raw material from rice husk belongs to the rapidly renewable sources and is environmentally friendly. In addition, plant material - ZRSH is an environmentally friendly affordable product - waste from crop processing in Kazakhstan, which has an initial high porosity.

Conclusion. Samples of the mass of carbon hemosorbent with different ratios of ingredients were obtained. It has been established that the use of carboxymethylcellulose to bind carbon powder solves the problem of cracking carbon material. The adsorption activity of the carbon monolith mass in methylene blue was studied. As a result, it was revealed that the mass obtained from SRS has a high adsorption activity.

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МИКРОТОРЛЫ ҚҰРЫЛЫМ ТҮРІНДЕГІ ГЕМОСОРБЦИЯЛЫҚ МАТЕРИАЛДЫ ДАМЫТУ ЖӘНЕ ЗЕРТТЕУ

Түйін: Қазіргі кезеңде токсикологиялық ауруларды, сондай-ақ септикалық ауруларды емдеу үшін шарлар мен түйіршіктер түріндегі гемосорбенттер кеңінен қолданылады. Алайда, микроторлы құрылым түрінде гемосорбенттерді қолдану клиникалық тәжірибеде сипатталмаған. Ғылыми мақалада күріш қауызының жоғары температуралы карбонизациясы арқылы алынған микроторлы құрылымы бар көміртектің жоғары кеуекті материалы сипатталған. Бұл шикізатты таңдау оның құрамындағы адам ағзасына арналған пайдалы зат болып табылатын 92-97% кремний диоксиді, целлюлоза, лигнин және минералды күл кіретіндігіне байланысты.
Түйінді сөздер: Гемосорбция, токсикология, гемосорбент, торлы құрылым, адсорбциялық белсенділік.

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РАЗРАБОТКА И ИССЛЕДОВАНИЕ ГЕМОСОРБЦИОННОГО МАТЕРИАЛА В ВИДЕ МИКРОКЛЕТОЧНОЙ СТРУКТУРЫ

Резюме: В настоящее время для лечения токсикологических заболеваний, а также при септических состояниях широко используются гемосорбенты в форме шариков и гранул. Однако использование гемосорбентов в виде микроклеточной структуры в клинической практике не описано. В научной статье описан углеродный высокопористый материал с микроклеточной структурой, полученный путем высокотемпературной карбонизации рисовой шелухи (РС). Выбор рисовой шелухи обусловлен тем, что в состав этого сырья входят целлюлоза, лигнин и минеральная зола, состоящие из 92-97% диоксида кремния, которые являются полезными веществами для организма человека.
Ключевые слова: гемосорбция; токсикология; гемосорбент; клеточная структура; адсорбционная активность.