POSTER

COMPOSITES BASED ON POROUS MODIFIED FIBRES AND MINERAL ADSORBENTS, THEIR PROPERTIES AND APPLICATION

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Introduction

Global environmental pollution, recurrently occuring ecological emergencies are dramatically affecting the organism endogenic habitat with detrimental and toxic substances. Chronic poisoning of an organism, causing disorders in metabolism processes, are the major reason for diminishing its protective functions, i.e. immunity, as well as early aging and vital breakdown. Considering the above situation as well as the results, we have obtained, studing the adsorbents for medical use, we are recently developing the idea to raise and solve the problems aimed to prevent harmful and toxic substances entering an organism and, in case of their accumulation, to decontaminate an organism recurrently. In the last few years among different adsorption methods of detoxication of human organism particular attention is pade to "per os" method (enterosorption) . Nowadays enterosorbents (ES) find more and more spheres of their application in medicine [1]. That is why the problem of new materials for the production of such ES is of fundamental importance.

Experimental

In the ISPE we worked out the scientific base of the technology of the wide-scale production of the novel activated carbons from synthetic porous polymers (phenol formaldehyde resins, styrene divinylbenzene, vinilpyridine, sinthetic fibre) SCN, SCS, FFC as well as from crashed apricot and peach stones and walnut shells [2]. Acording to the developed procedure we can prepare adsorbents having the uniform porous structure as well as with combination of micro-, mezo- and macro porosity. Due to their structural and adsorption properties - pore volume of 1.6-2.1 ccm/g, low bulk density of 0.21-0.27 g/ccm, high mechanical strength of their granules of 70-85 per cent - such adsorbents are widely used in medicine as conventional nonspecific adsorbents for oral application. In distinction of the ordinary "Carbo Activatus", synthetic adsorbents have nitrogen atoms in their lattice which attribute to the mechanical strength of their grains 0,25-0,63 mm in diameter. As it follows from the quantitative data obtained synthetic carbons have a large adsorption capacity in comparison with ordinary "Carbo Activatus". As reference substances we used Methylene Blue (M.m.319), Vitamin B_{12} (M.m.1355) and serum albumine. It has been claimed that carbon is a good adsorbent of organic substances but after being oxidized it possesses the propertly of ion-exchanger, having different oxygen-containing groups on its surface which are able to adsorb heavy metal ions and radionucleides. So, by means of chemical treatment of carbon surface, it is possible to produce the modified carbon adsorbents which are able to adsorb not only substances of molecular origin, such as creatinine, different pesticides, uric acid a.o. but also some cations and anions as well, what finally leads to more efficient binding of micro quantities of heavy metal ions and radionucleides [3]. Such species, being modified by some biologically useful micro elements, such as K, Mg, Co, Zn, Fe, Cu a.o., could be used for correction of the elecrolyte composition of body fluids and decontamination of human body from radionucleides. Synthetic active carbons, therefore, proved to be effective remedy to evacuate a number of radionucleides from different complex solutions as well as body fluids. They were applied to treat personnel, who worked in the contaminated areas

of Chernobyl NPP, particularly during the first months after Chernobyl accident.

Result and Discussion

These carbon adsorbents behaved as specific adsorbents to bind such radioactive elements as I-131, Ru-103, La-130, Ce-144 and some others. As it followed from the data obtained the total concentration of radionucleides in the body of people who were treated with carbon enterosorbent was 5-6 times less than in the reference group: in blood it dropped by 6-7 times, in urine - by 3-4 times and feces it was 1.5-2.0 as much as the control group [4]. It means that the major part of radionucleides was irreversibly bound by adsorbent. These results were in a good accordance with direct measurements of radiation dose by the Whole-Body-Counter. But these carbons failed to adsorb Cs-137 and Sr-90. Having in mind the fact that the half-life time for cesium and strontium is rather long and, that is why their contribution in the total radioactivity is larger for many years in future we investigated how these ions were adsorbed on a large number of inorganic substances. For many years ISPE deals with the development of highly specific inorganic ionites which can selectively bind some heavy metals and radionucleides [5]. By composition they are hydroxides or acidic phosphates of some elements in groups IV and V in Periodic Table as well as some insoluble ferrocyanides, such as Prussian Blue. Their capacity to evacuate radionucleides from liquid foodstuff is 10-100 times more than that of the widely used natural zeolites and synthatic ion-exchangers. As specific adsorbent for Cs-137 and Sr-90 we used a natural clay, being chemically modified. These species were shown to possess a good stability and worked well in a wide range of pH values (pH 2-9) and had rather good selectivity coefficients: $\lg K_{sel}$ for Cs is 3.5-5.5 and for Sr 2-3.

By combination of the above carbons (carbonaceous fibre) and the modified natural clay with a binder (pectin, strach) we produced tablets of the composition material "Ultrasorb", which bound not only substances of a molecular origin well but also a large number of radionucleides, including Cs-137.

Conclusion

- A composition material "Ultrasorb", made of carbon fibre and the modified natural clay and a binder, was produced;
- "Ultrasorb" appeared to be good to adsorb a large number of radionucleides (including Cs-137) and toxic substances of a molecular origin (radiotoxins,creatinine,uric acid,pesticides and many others);
- Pills of "Ultrasorb" were tested for their toxicity on experimental animals. They appeared to be efficient in preliminary tests in clinics to treat ecologically dependent diseases.

References

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