Scientists change properties of zeolites to improve hemodialysis

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Scientists of Tomsk State University are working on changing physicochemical properties of zeolites using thermal and mechanical treatment. Based on the results of this research, scientists will be able to create a new material for a portable device for hemodialysis.

The scientists examined synthetic zeolite powder manufactured by SAPO-34 and natural zeolite deposits of Hungary'sTokay region.

Synthetic powder was processed in a ball mill. The spin rate was 150 rotations per minute, and processing time varied between one and 96 hours. Prior to and after the processing, the powder was thermally treated. The material's surface area shrank from 506 m^2/g to 102 m^2/g following a 96-hour-long mechanical activation and a 1000Co annealing.

Natural zeolite deposits underwent mechanical activation in a ball mill for one to 600 minutes. As a result of the activation, the mineral composition of zeolite changed: Smectite, clinoptilolite, calcite and cristobalite contents decreased several times while quartz and orthoclase contents increased, and the surface area increased.

"Natural zeolites are hard alumosilicates. That is why finding the most appropriate chopping technology is important to increase specific surface area," says Alexander Buzimov, a student in the faculty of Physics and Engineering." Changing the specific surface area using mechanical treatment is aimed at changing properties of zeolites."

When they will have learned to control zeolite's properties, the scientists plan to combine the mineral with nanoceramics, and thus produce a new gradient material. Manufactured composite sieves will become the main component of portable devices for hemodialysis.

High-porous ceramics with the desired pore size ranging from nano- to macro-scale are already produced by the scientists of Tomsk State University. Zeolites with high specific surface areas provide effective moisture absorption. Devices will be connected to a shunt implanted under the skin of the patient. The blood will circulate through the composite sieve and cleaned.

The scientists hope to produce the new material within a year; the first hemodialysis device will be created in two years.

"Main advantage of this device is its portability. Nowadays, some analogs of traditional devices for hemodialysis are available, but all of them require the procedure to be performed in a hospital, so people are bound to a medical facility. With the new device, patients will even be able to travel. Hemodialysis can be then done at home and in an emergency situation," said Alexander Buzimov.

More information: E Kurovics et al, Influence of raw materials composition on firing shrinkage, porosity, heat conductivity and microstructure of ceramic tiles, *IOP Conference Series: Materials Science and Engineering* (2016). DOI: 10.1088/1757-899X/123/1/012058

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