New Urea-Absorbing Polymers for Artificial Kidney Machines

The problem:
The goal is to develop an inexpensive artificial kidney that removes urea from the dialyzing fluid efficiently. Activated charcoal can adsorb 0.2 to 0.8 gram of urea per 100 grams of carbon. Enzyme decomposition of urea followed by treatment with sodium zirconium phosphate extracts about 2 grams of urea per 100 grams of phosphate. A better absorbent is needed to make dialysis devices portable.

The solution:
A new urea-absorbing polymer has been synthesized from polysaccharides which are either etherified or cross linked.

How it's done:
The etherified polymer is made from a modified cellulose derivative which is then reacted with periodate. It will absorb 2 grams of urea per 100 grams of polymer. The cross-linked polymer is prepared from a modified oxidized starch which is cross linked with isocyanates to form urethane copolymers or is cross linked with carboxylic acids to form ester copolymers. Other cross-linking compounds may also be used. After post treatment and purification, 100 grams of the polymers can absorb 6.5 grams of urea at room temperature and pH 2.

The absorption occurs because aldehyde groups, in the cagelike structure formed by the polymer cross-links, have an affinity for urea molecules. Indications are that the polymers could be packed in a column to help remove uremic wastes in artificial kidneys, or they could be administered orally as therapy for uremia. [Also see NASA Tech Brief B75-10327 (NPO-13487)].

Note:
Requests for further information may be directed to:
Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP75-10336

Patent status:
This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:
Patent Counsel
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103

Source: William A. Mueller, George C. Hsu, and Harold E. Marsh of Caltech/JPL (NPO-13620)