

Chitosan-based aerogels with exceptional properties for environmental control system

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Abstract:

Aerogels based on polysaccharides are bio-based lightweight open porous materials having high specific surface area and randomly interconnected nano-felt fibrillar structure typically with meso- (2-50 nm) and macropores (50-1000 nm). In recent years, after modifying physically or chemically, they have attracted great interests in many research fields including drug delivery, separation techniques, tissue engineering and catalysis due to their very low toxicity, biodegradability and ease of production from natural resources. The physical modifications bring in the structural hierarchy whereas chemical modifications enhance its hydrophilic and hydrophobic properties.

The production of chitosan-based aerogel particles from lab to pilot scale was developed in our laboratory using JetCutter technique. The rheological properties of chitosan solution under various acidic conditions were analyzed and the data was utilized for tailoring the size and textural properties of aerogels. The chemical modifications were carried out with the reactive functional group (-NH₂) of chitosan polymer. The chemical modifications provide aerogel materials with a variety of properties depending upon the functional groups added. The aerogels were characterized by NMR, FTIR, powder X-ray diffractometer, nitrogen adsorption-desorption analysis, thermogravimetric analysis, elemental analysis and mechanical testing.

These chitosan-based aerogels with versatile properties, after chemically modifying their functional groups, can be used as applied materials in environmental control systems.

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