SOLUTION BLOWING OF BIOPOLYMER NANOFIBERS AND THEIR APPLICATIONS FOR HEAVY METAL ION ADSORPTION AND SUPERCAPACITORS

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Solution blowing is one of the most industrially viable processes for mass production of nanofibers without significant change of trade practices. In this work an industrially scalable approach to nanofiber production by solution blowing is demonstrated and applied to biopolymers. Nanofiber membranes containing such biopolymers as lignin, oats, soy protein, sodium alginate and chitosan used in this work were formed using solution blowing. The heavy metals adsorption on these membranes from aqueous solutions was studied in equilibrium in the batch experiments, as well as under the throughflow conditions. The mechanical properties of nylon-6-based biopolymer-containing membranes important under the throughflow conditions were also evaluated using tensile tests. A model of metal adsorption in the throughflow experiments was proposed and verified by successful comparison with the experimental data. The results revealed attractive capabilities of these inexpensive nano-textured biopolymer adsorbents formed from waste materials using the process scalable to the industrial level. The results also elucidated the physico-chemical mechanisms of heavy metal adsorption on biopolymers.

Lignin-derived carbon nanofibers (LCNFs) formed by solution blowing were also shown to be a promising replacement for polyacrylonitrile (PAN)-derived carbon nanofibers (PCNFs) formed by electrospinning for such applications as supercapacitor (SC) electrodes.

BIO

Dr. Alexander L. Yarin, Richard and Loan Hill Professor, UIC Distinguished Professor, Director of Multiscale Mechanics and Nanotechnology Laboratory at the University of Illinois-Chicago. He was awarded several national and international research awards and elected a Fellow of American Physical Society (APS): Citation - For seminal theoretical and experimental contributions to the understanding of capillary and bending instabilities in jets, drop impact, splashing, and electrospinning processes. Dr. Yarin's contributions to hydrodynamics, mechanics of solids, polymer science and forensics, as well as combustion and manufacturing processes were published in 500 per-reviewed papers and 6 books and covered by national and international media. One of Dr. Yarin's inventions during COVID-19 was licensed to the company 'Ivoclar' (a world-wide manufacturer of dental materials) and from mid-2024 is marketed in Europe and the United States under the commercial name VivaDent Aerosol Reduction Gel. It is used in dentistry to prevent aerosolization and spreading airborne viruses and bacteria.