Preparation and Characterization of Microsized Cellulose Beads Made Using NaOH/Urea/ZnO Aqueous Solution

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In the present work, we prepared cellulose microbeads by dissolving it in a mixture of 7 wt% NaOH and 12 wt% urea aqueous solutions and coagulating in hydrochloric acid medium. To the mixture of NaOH and urea, different concentrations of ZnO were added to study the effect on physical and morphological properties of the prepared beads using different analytical techniques like, FT-IR, TGA, BET isotherm and scanning electron microscopy. It has been observed that cellulose beads prepared with lower concentrations of ZnO show shrinkage while drying, whereas cellulose beads prepared with higher concentrations of ZnO do not exhibit much shrinkage. Overall, the size of dried cellulose beads was found to be in the range of 2-2.5 mm. The skeletal density of all the dried cellulose beads was calculated as 1.5 g/cm^3. FT-IR spectra reveal that the structure of cellulose I transformed as cellulose II during the dissolution and regeneration process. The beads prepared with NaOH/urea/ZnO aqueous solution exhibit better thermal stability. Cellulose beads prepared with 0.5 wt% ZnO show higher surface area of 407 m^2/g with large porosity (94%) and increased pore volume of 1.56 cm^3/g compared to control cellulose beads (1.48 cm^3/g). SEM images show that all the beads exhibit good spherical shape and further evidence that dense fibrillary nano network structure was formed in the interior of the cellulose beads prepared with 0.5 wt% ZnO. All the results indicate that the bulk density, surface area, pore volume and pore size of the cellulose beads could be tuned by changing the concentration of ZnO.

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