Synthesis of Bacterial Cellulose in Low-cost Culture Medium Using Hot Water Extracted Wood Sugars

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Technology description

a). Bacterial cellulose (BC) is a form of extracellular cellulose that is produced by various kinds of acetic acid bacteria such as Gluconacetobacter hansenii. In recent years, bacterial cellulose (BC) nanofibers have received great attention as a source of nanometer-sized fillers because of their ultra-fine nano-sized 3D fibrous network structure, purity and high crystallinity, large water holding capacity, excellent biodegradability, biological affinity and high mechanical properties. Another most attractive property of bacterial cellulose is the ability to control and modify the physical characteristics of the cellulose product while it is being produced. Ability to control cellulose production can enable the manufacturer to change the properties of the cellulose. Because of these unique properties of BC, several applications based on advanced technologies in human and veterinary medicine, odonthology, pharmaceuticals, acoustic and filter membranes, biotechnological devices and in the food and paper industry and for highly technological applications such as transparent nano-composite supports for organic light-emitting diode (OLED) displays, electrically conductive transparent papers, and magnetic nanopapers.

b). In general, BC is produced from expensive culture media, including glucose, yeast, peptone etc. resulting in very high production costs. Presently, BC is made in the form of small discs or pellicles.

c). Wood hot water extract is a residual material originating from pulp mills and lignocellulosic biorefineries. It consists mainly of monomeric sugars (glucose, arabinose and a combination of xylose, mannose and galactose (XMG)), organic acids (lactic, acetic, formic and glycolic) and organics (furfural and hydroxymethylfurfural). In spite of their low percentage of sugar composition, wood hot water extract is a suitable raw material for production of bacterial cellulose not requiring pretreatment or additives which reduces BC production costs significantly.

d). Hot water extract from wood, which is an inexpensive culture medium containing wood carbohydrates (sugars), and acetate as a fermentation medium, which also does not contain other nutrients or require treatments such as dilution, precipitation etc., for Acetobacter xylinus 23769 strain was used for this invention. The optimum culture conditions were found to be 10% v/v inoculum, 28°C temperature, pH 8.0 and 20 days incubation.

e). Large size and scalable production requires optimization of the BC culturing process and synthesis at affordable costs with using inexpensive carbon sources. The present invention provides an optimized economic process for the production of BC in the presence of hot water wood extractives, providing a

potentially low-cost, environmentally-friendly nanomaterials for advanced applications on the large scale in static conditions from bacterial species, Acetobacter xylinus 23769.

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