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Effect of different additives on bacterial cellulose production in PCS rotating disk bioreactor

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Cellulose is the most abundant macromolecular on earth observed in large quantity from nature which is predominantly generated by vascular plant and algae, but also by bacteria. Bacterial cellulose (BCel) exhibits the unique physical properties at nanoscale network (i.e. high water content and high tensile strength), and does not require extra processing steps to remove impurities such as lignin, pectin, and hemicellulose. Previous study demonstrated that BCel can be produced semi-continuously utilizing PCS rotating disk bioreactor (PCS-RDB). In this study, different additives including avicel, carboxymethylcellulose, agar and sodium alginate were added into culture medium in PCS-RDB to improve the productivity of BCel and its material property. The produced BCel was analyzed using fourier transform infrared spectroscopy (FTIR), scan electron microscopy (SEM), thermogravimetric analysis (TGA), X-ray diffraction (XRD) and dynamic mechanical analysis (DMA). The results demonstrated that both CMC and avicel addition can increase the productivity of BCel in PCS-RDB. The highest BCel production reached 0.64 g/slice when 0.8% of avicel was added. The FTIR and XRD results indicated that CMC and avicel might be incorporated into BCel during production, and disordered BCel structure to decrease its crystallinity. The SEM result showed that the incorporated additives may attach on BCel fibers and increase fiber size. In future work, dynamic mechanical analysis (DMA) should be finish to confirm the effects of different additives addition in mechanical property.

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