

ABSTRACT

Bacterial cellulose (BC) has recently gained popularity due to better properties and a wider range of application compared to plant cellulose. At present, BC production at industrial scale utilizes pure sugar as a carbon source, which is relatively expensive and consumes about 30% of the total production cost. A new alternative medium that allows high production, and that is economically feasible is required. The current study aims to study the effect of BC fermentation using sugar cane molasses (10-20% w/v) and caffeine (300-700 mg/L) in acetate buffer at pH 4.0, 4.75 and 5.5, on the mechanical properties of the BC biofilm. The result shows that the highest yield (1.43 ± 0.57 g/L) and the highest tensile strength (32.36 ± 0.86 MPa) was obtained from fermentation buffered at pH 4.75 with initial molasses and caffeine concentrations at 15% (w/v) and 500 mg/L, respectively. The highest elongation at break ($3.55\pm 0.19\%$) was achieved from non-buffered fermentation with 10% (w/v) molasses and 500 mg/L caffeine concentrations. The highest Young's modulus achieved in this study was 1205.6 ± 40.86 MPa, which was produced with buffer at pH 4.75, 10% (w/v) molasses, and 500 mg/L caffeine concentrations. Furthermore, fermentation buffered at pH 4.75 with molasses and caffeine concentrations of 15% (w/v) and 500 mg/L, respectively, produced BC with the highest water holding capacity of $366.1\pm 56.6\%$. This study demonstrates that molasses as a low-cost medium have a potential to be utilized for BC production. However, the fermentation parameters should be tailored depending on the final application and the desired mechanical properties of the BC biofilm.

Keywords: bacterial cellulose, molasses, caffeine, acetate buffer, yield, mechanical properties, water holding capacity