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EXPLORING ALTERNATIVE CULTURE MEDIA AND pH INFLUENCE FOR ENHANCED BACTERIAL CELLULOSE PRODUCTION

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Abstract

Bacterial cellulose (BC) has potential applications across various industries with a market projection of USD 1.5 billion by 2031 (Cruz et al., 2024). The large-scale production of BC using synthetic media, such as Hestrin-Schramm (HS) medium, is not economically and environmentally sustainable due to its high cost, dependence on food-grade ingredients, and limited nutrient diversity. This study assessed the potential of using alternative growth media and the pH optimum for BC production and its pH dependency. Seven bacterial isolates from environmental samples were screened for BC production. The isolates from tomato, overripe pineapple, compost, and legume root nodules, yielded 0.685 g/L, 1.088 g/L, 1.185 g/L, and 0.979 g/L of BC, respectively in HS medium. Three strains, namely, *Escherichia coli*, *Enterobacter aerogenes*, and an unidentified strain isolated from curd did not produce detectable levels of BC in the same medium. Different media formulations, i.e., fresh pumpkin juice, king coconut water, synthetic wastewater supplemented with pumpkin extract or cucumber extract and a modified HS medium made by substituting its 5.0 g/L peptone with different fresh cucumber quantities, i.e., 100, 200 and 300 g/L were tested as alternative culture media. The BC production in these media was tested using the four BC producing bacterial isolates. The data obtained were compared by statistical analysis. The king coconut water supported low levels of BC production (0.39 g/L by the isolate form tomato and 0.30 g/L by isolate form overripe pineapple). The HS medium supplemented with 100 g/L fresh cucumber yielded BC equivalent to the control (standard HS medium), while HS medium supplemented with 300 g/L fresh cucumber yielded the highest BC (3.323 g/L by the isolate form tomato and 2.549 g/L by the isolate form overripe pineapple which were more than double the amount in the controls (1.467 and 1.098 g/L respectively). Similarly, the BC yield at pH 6.0 was significantly higher than that at pH 6.5, and it was more than double in the HS medium supplemented with 200 g/L fresh cucumber. The other three media did not yield detectable levels of BC. FTIR spectroscopy confirmed the structural integrity of BC produced. Those findings indicated the possibility of using low- cost alternative media for BC production. The results showed that the BC yield could be increased by increasing the substitute concentration and changing the cultural conditions such as pH level. It also showed the possibility of isolating high potential BC producing strains from environmental sources.

Keywords: *Bacterial Cellulose, FTIR Spectroscopy, Growth Media Alternative to HS, Hestrin-Schramm Medium*