Harnessing Symbiotic Association of Lactic Acid Bacteria and Cellulose-Synthesizing Bacteria for Enhanced Biological Activity

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Abstract

Bacterial cellulose (BC) is an extremely pure and highly valuable biomaterial. However, its production cost poses a challenge for large-scale manufacturing. This study explores a cost-effective approach by co-cultivating lactic acid bacteria with cellulose-synthesizing bacteria. Four BC-producing isolates from spoiled fruits and four lactic acid bacteria from fermented buttermilk were isolated and characterized. Growth studies demonstrated successful lactic acid bacteria cultivation in HS media. Co-cultivation of cellulose-synthesizing bacteria and lactic acid bacteria showed enhanced BC production, with a twofold increase in dry weight (0.35 g/150 ml) compared to the monoculture of cellulose-synthesizing bacteria (0.15 g/150 ml). Scanning electron microscopy revealed improved BC microfibril quality in co-culture. Reversed-phase HPLC confirmed higher lactic acid

concentrations in co-culture. 16S rRNA sequence analysis revealed that lactic acid bacteria had a 100% match with *Lactococcus lactis*. These findings highlight the potential of co-cultivation for cost-effective BC production and lactic acid yield, offering a sustainable approach to biomaterial production.

Abbreviations

BC: Bacterial cellulose

MRS: DeMan, Rogosa and Sharpe

HS: Hestrin and Schramm

LAB: Lactic acid bacteria

CSB: Cellulose-synthesizing bacteria