

Performance, yield and characteristics of bioflocculants (UPMBF13) produced by *Bacillus subtilis* UPMB13 during submerged and solid-state fermentation

ABSTRACT

This study compares the distinctive performance, yield and characteristics of bioflocculants (UPMBF13) derived from submerged (SmF) and solid-state fermentation (SSF) of *Bacillus subtilis* UPMB13. The bioflocculants were subjected to morphological characterization, functional groups determination, molecular weight measurement, protein content quantification and specific compound identification. The SmF and the SSF strategies yielded an average of 2.70 g l⁻¹ and 1.25 g kg⁻¹ of UPMBF13, respectively. The submerged UPMBF13 resulted in a clear suspension with visible flocs formation, while flocs from the SSF treatment were less apparent. Higher total proteinaceous contents of UPMBF13 from the SSF led to the inferiority in flocculating performances. The produced UPMBF13 consisted of hydroxyl, carboxyl, methoxyl and carbonyl functional groups which contributed to their flocculating abilities. The molecular weights of UPMBF13 were around 10-50 kDa, characterizing them into low-molecular weight bioflocculants. The submerged UPMBF13 were more fibrous in nature than the SSF, giving the submerged UPMBF13 the upper hand in flocculation. SmF was the best fermentation method yielding high performing bioflocculants at a faster rate by the utilization of non-elaborative techniques. SSF, on the other hand, was proven feasible but further improvements are needed.

Keyword: *Bacillus subtilis*; Bioflocculants; Solid state fermentation; Submerged fermentation