Production and Characterization of Bioflocculant produced by *Bacillus clausii NB2*

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Microbial flocculants or bioflocculant are biodegradable polymeric compounds produced by many microorganisms (eubacteria, actinomycetes and fungi) during their growth (Gao et al., 2006).

Bioflocculation is a dynamic bioprocess resulting from the synthesis of extracellular polymers by microorganisms during their growth.
Bioflocculant have some advantages over conventional synthetic organic flocculants; this includes biodegradability, non-toxicity to humans and the environment, safety for ecosystems highest flocculating capability (Cosa et al., 2011).

As a result of these it can be applied in wastewater treatment, downstream processing, fermentation processes (Seo, 1993; Salehizadeh and Shojaidati, 2001).
METHODOLOGY

- Microorganism and culture preparation
- Bioflocculant production by Bacillus clausii NB2 strain
- Determination of flocculating activity 16S rDNA sequence determination and phylogenetic analysis of the bioflocculant producing strain
- Effects of biotechnological parameters on bioflocculant production by Bacillus clausii NB2 strain
Methodology cont’d

- Extraction and purification of the bioflocculant
- Chemical characterization of bioflocculant
- Flocculation inhibition assay
- Chemical analyses of the purified bioflocculants
- Statistical analysis
RESULTS and Discussion
Figure 1. Phylogenetic tree showing the relationships between NB2 strain and Bacillus clausii species (in pointed arrow) and other closely related sequences collected from the Gene Bank. The dendogram was generated by the neighbor-joining method. Bootstrap values per 100 bootstrap analysis presented for values greater than 50%
Figure 2. Effect of initial pH on the biomass flocculation of Bacillus clausii NB2 strain

Figure 3. Effect of temperature on the biomass flocculation of Bacillus clausii NB2 strain
Figure 4. Effect of carbon sources on the biomass flocculation of Bacillus clausii NB2 strain

Key: BRE = Brewery effluent; POE = Palm-oil effluent; ABE = Abattoir effluent; SWG = Sewage; GLU = Glucose.

Figure 5. Effect of incubation time on the flocculating activity of Bacillus clausii NB2 strain
Figure 6. Effect of stationary and with agitation cultivation on the flocculation of Bacillus clausii NB2 biomass

Figure 7. Effect of agitation speed on the flocculating activity of Bacillus clausii NB2 strain
Figure 8. Effect of temperature on the bioflocculant produced by Bacillus clausii NB2 strain

Figure 9. Effect of pH on the activity of the bioflocculant produced by Bacillus clausii NB2 strain
Figure 10. Effect of potential inhibitors on the flocculating activity of bioflocculant produced by Bacillus clausii NB2 strain

Figure 11. Fourier transform infrared (FT-IR) spectrum of the partially purified bioflocculant produced by Bacillus clausii NB2 strain
CONCLUSION

- A new bacterial strain phylogenetic determined as Bacillus clausii strain was studied for their bioflocculant activity. Some biotechnological parameters as: temperature, pH, time, agitation and agitation speed during submerged cultivation were studied in order to establish the optimum conditions for biomass flocculation.

- Also it was established that some cations can serve as potential inhibitors on bioflocculant activity.

- The fact that bioflocculant can be produced relatively inexpensively from a variety of bacteria, themicrobial flocculation is a promising alternative to present treatment processes for wastewater and drinking water treatment.
Selected References

- Bioflocculant production by Virgibacillus sp. Rob isolated from the bottom sediment of Algoa Bay in the Eastern Cape, South Africa Molecules, 16, 2431-2442; doi:10.3390/molecules16032431