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Biodegradation of nicotine by a newly isolated Pseudomonas stutzeri JZD

Jelena Petricevic (1), Vera Gujanicic (1), Danka Radic (1), Jelena Jovicic Petrovic (2), Jelena Jovic (3), and Vera Raicevic (2)

(1) Institute "Jaroslav Cerni", Jaroslava Cernog 80, 11226, Belgrade,Serbia, (2) University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Zemun, Serbia, (3) Institute for plant protection and environment 11080 Belgrade-Zemun, Serbia

The tobacco-manufacturing process and all activities that use tobacco, produce solid or liquid wastes with high concentrations of nicotine. Nicotine is a significant toxic waste product in tobacco industry. This waste is classified as 'toxic and hazardous' by European Union regulations when the nicotine content exceeds 500 milligrams per kilogram dry weight. Therefore, there is a major environmental requirement to remove nicotine from tobacco wastes.
Bioremediation techniques which involve nicotine degradation by microorganisms have attracted attention during the last years, because microorganisms have the potential to reduce nicotine levels in tobacco and to detoxify tobacco wastes.
The aim of this study is isolation and identification of nicotine degraded bacteria and optimization of nicotine degradation in laboratory conditions.
An aerobic bacterial strain capable of effectively degrading nicotine was isolated from the tobacco industry waste, Serbia. After isolation, the liquid culture was spread onto the solid plates of the nicotine inorganic salt medium using the dilution plate method. Cell morphology of strain was observed by a light microscope and physiological characteristics were determined by Api technique and sequence analyzes of 16S rDNA.
This isolate was identified as Pseudomonas stutzeri based on morphology, physiological characteristics, and Apiweb technique. Comparison with sequences available in data library showed the 99% similarity with 16S rDNA gene sequence of the species Pseudomonas stutzeri (GenBank Acc. No. CP003725).
We analyzed the effect of initial nicotine concentration (1g/L, 1.5 g/L, 2.5 g/L) on microbial activity in aim to optimize biodegradation. The effect of cultivation temperature (25°C; 30°C; 37°C) on nicotine degradation by P. stutzeri was evaluated after 24 h of cultivation, with 1.5 g/L nicotine added as the sole carbon source.
Effect of biodegradation has depended on initial concentration. During incubation, number of bacteria was increased in all variants of initial concentrations.
Nicotine degradation rate increased with increasing cultivation temperature. The
optimal temperature was 37°C.
The results suggest that the P. stutzeri may be useful for bioremediation of nicotine-polluted waste and confirms its possible application in solving of nicotine contamination problems.

Key words: Pseudomonas stutzeri, biodegradation; nicotine; waste