A NOVEL *BACILLUS PUMILUS*-RELATED STRAIN FROM TROPICAL LANDFARM SOIL IS CAPABLE OF RAPID DIBENZOTHIOPHENE DEGRADATION AND BIODESULFURIZATION

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Abstract:

Background: The presence of organic sulfur-containing compounds in the environment is harmful to animals and human health. The combustion of these compounds in fossil fuels tends to release sulfur dioxide in the atmosphere, which leads to acid rain, corrosion, damage to crops, and an array of other problems. The process of biodesulfurization rationally exploits the ability of certain microorganisms in the removal of sulfur prior to fuel burning, without loss of calorific value. In this sense, we hypothesized that bacterial isolates from tropical landfarm soils can demonstrate the ability to degrade dibenzothiophene (DBT), the major sulfur-containing compound present in fuels.

Results: Nine bacterial isolates previously obtained from a tropical landfarm soil were tested for their ability to degrade dibenzothiophene (DBT). An isolate labeled as RR-3 has shown the best performance and was further characterized in the present study. Based on physiological aspects and 16 s rDNA sequencing, this isolate was found to be very closely related to the *Bacillus pumillus* species. During its growth, high levels of DBT were removed in the first 24 hours, and a rapid DBT degradation within the first hour of incubation was observed when resting cells were used. Detection of 2-hydroxybiphenyl (HBP), a marker for the 4S pathway, suggests this strain has metabolical capability for DBT desulfurization. The presence of MgSO4 in growth medium as an additional sulfur source has interfered with DBT degradation.

Conclusions: To our knowledge, this is the first study showing that a *Bacillus* strain can metabolize DBT via the 4S pathway. However, further evidences suggest RR-3 can also use DBT (and/or its derivative metabolites) as carbon/sulfur source through another type of metabolism. Compared to other reported DBT-degrading strains, the RR-3 isolate showed the highest capacity for DBT degradation ever described in quantitative terms. The potential application of this isolate for the biodesulfurization of this sulfur-containing compound in fuels prior to combustion was discussed.

Keywords: *Bacillus pumilus*, Dibenzothiophene sulfoxide, 2-hydroxybiphenyl-2-sulfinate, 4S pathway, Bioremediation.

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