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OPTIMIZATION OF CHLORPYRIFOS BIODEGRADATION AND ELIMINATION FROM CONTAMINATED WATER/ WASTEWATER USING SPECIALIZED MARINE BACTERIA

SHORT TITLE: CHLORPYRIFOS BIODEGRADATION USING MARINE BACTERIA

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ABSTRACT

- **Problem statement:** Chlorpyrifos (CPS), is an organophosphate pesticide that is widely applied to control foliage and soil-born insects in residential settings, golf course turf, as a structural termite control agent, and on agricultural crops. Pollution of water courses with **Chlorpyrifos** can lead to severe negative environmental impacts and high human health risk. The World Health Organization classifies **Chlorpyrifos** as **Class II**: moderately hazardous pesticide to humans. **Chlorpyrifos** exposure may lead to acute toxicity at higher doses, results mainly from interference with the acetylcholine neurotransmission pathway, leading to a range of persistent health effects neuromuscular symptoms such as seizures, unconsciousness, paralysis, and suffocation from lung failure. Mild poisoning can result in eye-watering, increased saliva and sweating, nausea, headache, muscle spasms or weakness, vomiting, or diarrhea, and impaired vision. Moreover, developmental effects appear in fetuses and children even at very small doses, where they are more likely to experience muscle weakness rather than twitching; excessive saliva rather than sweat or tears; seizures; and sleepiness or coma. Therefore, effective procedures to control its levels in water courses is a must.
- **Methods:** Synthetic wastewater samples supplemented with three elevated levels of **Chlorpyrifos (100, 250 and 500 mg/L)** were treated in a batch mode using individual free-living cultures of **six** pure marine indigenous bacterial isolates (**E 7, 8, 9, 11, 12 and 13**) that were previously isolated and identified in a previous work of the authors. The remediation bioassays were performed for **7** consecutive days, where samples were aseptically drawn at **24-h** interval for analysis.
- **Results:** Extremely high **Chlorpyrifos** removal was achieved by all cultures tested, reaching almost complete elimination (**100%**) by almost all the tested cultures (**6**) at all the **3** tested concentrations. Unexpectedly, increasing **Chlorpyrifos** concentration, enhanced the removal efficiency (**RE**). Results recorded **97.0-99.3, 99.0-100** and **100%** REs of **Chlorpyrifos** at **100, 250 and 500 mg/L**, respectively, within only 48 h. The current study's findings confirmed that the proposed bioremediation technology by almost all the selected cultures, is a highly active,



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promising, renewable, and inexpensive biotechnology for the treatment of a wide range of contaminated aquatic media.

- **Conclusion:** Biological remediation using **Chlorpyrifos** degrading- bacterial system is highly effective, low-cost, and readily available technology for **Chlorpyrifos** removal. It also offers an attractive chance to decontaminate the environment from toxic pollutants, produce high quality effluents, compiling with the environmental regulations for the safe drainage into open environment.
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Key Words: Bacteria, Batch Mode, Bioremediation, Chlorpyrifos, Free-Living, Water, Wastewater