

SUMMARY OF ABSTRACT

Title of the Research:

Bioremediation of Heavy Metals in Effluents from Chemicals and Allied Industries in Lagos State, Nigeria

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ABSTRACT

Background: Industries in Nigeria, including the chemicals and allied, produce effluents which when discharged untreated into the environment, become a serious environmental and public health threat. Despite several studies on heavy metal microbial degradation, there is dearth of information on the use of bacterial consortia in the bioremediation of effluents from chemicals and allied industries in Lagos State. The overall objective of this study was to degrade heavy metals in effluents from chemicals and allied industries in Lagos State using different bacterial combinations in order to recommend bioremediation as a primary effluent treatment method for industries.

Materials and Methods: Using an experimental design, this study adopted a quantitative research method. Ikorodu, Ikeja and Lekki were purposively selected, being the major industrial areas of Lagos State. Using simple random sampling, a soap and detergents industry from Ikorodu, a cosmetics industry from Lekki and a paint industry from Ikeja, were selected and coded as A, B and C, respectively. Using sterile plastic bottles, two litres of effluent sample were collected from each of the three industries, and labelled as sample A,

sample B and sample C, and immediately transported in ice packs aseptically to the laboratory for analyses. The samples were subjected to physico-chemical analysis, using Atomic Absorption Spectroscopy, after which the isolation, biochemical and molecular characterization were done. Minimum inhibitory concentrations of all the isolates were determined, after which the optimum pH and temperature for growth was determined. The three isolates which tolerated the seven heavy metals of interest (Arsenic, Copper, Cadmium, Chromium, Nickel, Zinc and Lead) were coded as 6, 15 and 19 and used for bioremediation by inoculating them into the samples, singly, in binary and triple combinations, using a shaker for seven days. The product of the bioremediation exercise, twenty-one experimental units with three controls (effluent sample with no inoculum), were subjected to heavy metal analysis, using Atomic Absorption Spectroscopy, after which the bioremediated effluents were sterilized by autoclaving. Results were analyzed using statistical methods, e.g., ANOVA, $p < 0.05$.

Results: Five (5) isolates from sample A, fourteen (14) from sample B, and six (6) from C were obtained, distributed as *Alcaligenes faecalis* (24%), *Pseudomonas* sp. (32%), *Proteus mirabilis* (20%), *Enterobacter* sp. (8%), *Providencia* sp. (8%) and *Bacillus* sp. (8%). Copper and Arsenic were highest in Sample B (2.027 ± 0.029 and 3.520 ± 0.036 respectively) while Zinc, Lead, Cadmium and Chromium were highest in sample C (4.163 ± 0.137 , 2.062 ± 0.249 , 3.425 ± 0.073 and 3.594 ± 0.032 respectively), all exceeding the NESREA permissible limits. In sample B, the consortium of *Bacillus* sp., *Pseudomonas* sp. and *Providencia* sp. had the highest reduction of Copper (98.96%) while *Bacillus* sp alone had the least (72.27%). In sample C, the consortium of *Bacillus* sp., *Pseudomonas* sp. and *Providencia* sp. had the highest reduction (91.99%), while *Pseudomonas* sp. alone had the least (63.00%).

Conclusion: In conclusion, the heavy metals were most reduced in the triple bacterial combinations. Hence, a consortium of *Bacillus* sp., *Pseudomonas* sp., and *Providencia* sp. present a promising solution for bioremediation of wide range of heavy metals in industrial effluents.

Keywords: Bioremediation, Heavy metals, Industrial Effluent, Bacterial consortium and Physico-chemical.

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