

CHAPTER 15

ENVIRONMENTAL STUDIES

Doctoral Theses

01. RAWAT (Deepak)
Ecotoxic Potential of Presumably Non-Toxic Textile Dyes and their Microbe-Assisted Remediation.
Supervisor : Dr. Vandana Mishra
Th 25110

Abstract
(Not Verified)

Textile industry relies heavily on artificial dyes and is the backbone of economies of several developing countries. However, the price of this economic development is environmental degradation. Textile dyes, which have been known to induce toxicological predicaments, are not thoroughly viewed with a wider environmental perspective. Moreover, the current research work undermines their ecotoxicological impact by neglecting the role of biotic/abiotic environmental factors in influencing their biotransformation and fate. Therefore, in this thesis, I investigated the interactions between microbes and textile dyes and then extended these principles to developing a more sustainable microbe-mediated dye remediation processes. The systematic review identified the need to reassess the textile dyes in context of the environmental relevance of toxicological classifications. The study highlights the potential toxic effects of 'presumably non-toxic dyes' on interaction with environmental microbes. The non-toxic Acid Orange 7 dye, on microbial interactions, formed more toxic products, primarily aromatic amines, under halophilic and low-oxygenated conditions pertinent at sites contaminated with textile effluent, the bacteria failed to degrade aromatic amines under oxygen limitation. Therefore, to overcome this challenge, a bacterial-mediated single-stage remediation system was developed using facultative aerobic microbes. The bacterial consortium of *Bacillus firmus* and *Serratia proteamaculans* under oxygen-limiting condition successfully degraded azo dye and amines with minimum supplementation of carbon. Besides this, algal-bacterium association was also employed to develop a self-sustainable model system for dye degradation. The algae-bacteria consortium, under photoautotrophic conditions, is a sustainable microbial remediation process that overcomes the limitation of bioavailable iron to algae and carbon limitation to bacteria via active metabolic exchange. Therefore, prospect of an iron-based association between dye degrader microalgae *Chlorella sorokiniana* and siderophore producing bacteria *Ralstonia pickettii* was explored for textile wastewater remediation. The study highlights the need for the incorporation of ecological principles of microbial associations in bioremediation.

Contents

1. Introduction 2. Detoxification of azo dyes in the context of environmental processes: a systematic review 3. Ecotoxic potential of a presumably non-toxic acid orange 7 dye after incomplete degradation by environmental microbes 4. Microbial degradation of aromatic amine and azo dye in single-stage bioremediation system:

towards a detoxification centric approach 5. The incorporation of ecological principles in bioremediation processes: an algae-bacterium based model system for azo dye degradation 6. Summary and Conclusions. References. Appendix.

02. SHAILENDER KUMAR

Analysis and Geospatial Assessment of PTEs Contamination in Urban Environment with Special Reference to Mercury.

Supervisor : Dr. Chirashree Ghosh

Th 24474

*Abstract
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Potentially toxic elements (PTEs) like mercury, zinc, chromium, cadmium, copper, nickel and lead enter the soil and water naturally as a result of soil forming processes such as weathering of rocks. Toxic chemicals present in localities, streets and in pavement, at the time of rainfall carried away through runoff in to water resources which disturb the aquatic ecosystem. Urban environment of Delhi becomes a concern for the dilapidation of natural settings. This research is conducted to comprehend the qualitative water and soil analysis, geospatial assessment and mapping of potentially toxic elements (PTEs) distribution in different spheres with special emphasis on risk of mercury exposure. Four objectives were undertaken for the study where river Yamuna, ground water of five districts and three different land use area were monitored for assessing PTEs and mercury. Study showed that rapid urbanization and disturbed hydrological cycle influenced by built up growth, loss in water area and declining trend of rainfall in recent years. PTEs variability in river Yamuna indicated that sites of mid-stream and downstream were majorly contaminated with PTEs. Ground water PTEs study showed New Delhi, Central Delhi and North Delhi were highly contaminated districts within NCT, Delhi and in North Delhi; mercury contamination was reported higher than permissible limit i.e. 1 ppb (BIS, 2012). Significant variation of Hg presence at different land use sites (Residential, dumping and Landfill area). Seasonal variation of Hg also showed presence of high elemental Hg than ionic and organic mercury.

Contents

1. Comprehensive context 2. Understanding land use/land cover change and water resource of NCT, Delhi using remote sensing and GIS 3. Geospatial and statistical assessment of spatio-seasonal variability of physico-chemical parameters and PTEs in river Yamuna 4. Spatio-seasonal variation of PTEs and other water quality parameters in sub-surface (Ground) water in "Urban Delhi" 5. Seasonal behaviour assessment of total gaseous mercury (TGM) along with soil at different land use configurations 6. Conclusion and recommendation.