Project title

"ECOLOGY OF PHENOL DEGRADING BACTERIA IN WASTE WATER TREATMENT PLANTS OF SELECTED INDUSTRIES."

Submitted to

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EXECUTIVE SUMMARY

Environmental pollution is considered as a side effect of modern industrial society. With the immense growth of industries, major problem is encountered as contamination of the environment with hazardous and toxic chemicals. Phenolics, one of the major pollutants, are discharged in the waste water from the various industries such as phenol resin and pharmaceutical, oil refineries, petrochemical plants, ceramic plants, steel plants, and coal conversion processes. Phenol and its derivatives is the basic structural unit in a wide variety of synthetic organic compounds. Biological processes using microbial systems provide an alternative to the existing physical/ chemical technologies (expensive and commercially unattractive) because they are more cost-effective, environment friendly and do not produce large quantities of sludge. Number of microorganisms can utilize phenol under aerobic conditions as source of carbon and energy. Biodegradation is used to describe the complete mineralization of the starting compound to simpler ones like CO2, H2O, NO3 and other inorganic compounds.

The research work entitled ***"Ecology of phenol degrading bacteria in waste water treatment plants of selected industries"*** aimed at the isolation and identification of potent phenol degrading bacteria in waste water treatment plants of four selected industries-Petrochemical industry, Textile industry, Coir industry and Paper industry. From all the four effluents, a total of 20 highly potent bacterial strains which are very efficient in phenol degradation, were isolated and used for further study.

In case of petrochemical effluent, out of 13 strains isolated, 5 strains were selected for further analysis and they were *Neisseria* sp, *Erwinia* sp, *Micrococcus* sp, *Mesophilobacter* sp and *Campylobacter* sp. From textile effluent, the selected strains were *Micrococcus* sp, *Brucella* sp, *Pseudomonas* sp, *Aquaspirillum* sp and *Moraxella* sp. The strains were identified as *Brucella* sp, *Aquaspirillum* sp, *Erwinia* sp, *Aeromonas* sp, and *Moraxella* sp from coir effluent and *Vibrio* sp, *Moraxella* sp, *Brucella* sp, *Micrococcus* sp and *Neisseria* sp from paper effluent. All these selected strains were used to study the effects of concentration of medium (200ppm, 400ppm, 600ppm, 800ppm and 1000ppm), temperature (27°C, 35˚C and 47°C and pH (5, 7 and 9) on their

phenol degradation potential. From this, it was revealed that all these selected strains were capable of giving maximum degradation at the prescribed standard pH and temperature (7 and 35˚C) and most of them were very active up to 800ppm concentration of phenol. The isolation of genomic and plasmid DNA were also done as future perspective so that in future studies, these strains can be used to study the role of plasmid in phenol degradation.

In case of petrochemical and textile effluents, it was clear that *Neisseria* sp from petrochemical effluent contained a clear band of 700 bp, *Micrococcus* sp from petrochemical effluent, *Micrococcus* sp and *Pseudomonas* sp from textile effluent showed a feeble band at 1200 bp position. The plasmid DNA content was relatively less in 3 strains and almost absent in one strain. In case of the plasmid DNA, This study primarily gave the information about the absence of plasmid DNA in *Pseudomonas* sp from textile effluent, so it might be concluded that this strain encodes the genes for biodegradation of phenol in genomic DNA.

In the case of coir and paper effluents, four potent strains were selected for the isolation of genomic and plasmid DNA- *Micrococcus* sp and *Moraxella* sp from coir effluent and *Brucella* sp and *Aeromonas* sp from paper effluent. In this case, it was noted that all those selected strains showed clear DNA bands in the same base pair position. The *Micrococcus* sp showed a relatively higher amount of plasmid DNA when comparing to rest of the strains studied. In addition, the remaining strains showed degraded plasmid DNA. These strains can be used to study the role of plasmid in phenol degradation.

Future studies should be carried out to isolate more potent useful microbes from industrial effluents so that they can be used for the bioremediation of contaminated sites.

PAPERS PUBLISHED

1. **Rajani V.,** published a paper entitled' Microbial degradation of Phenol - a Review in International Journal of Research and Review, ISSN: 2349-9788, vol. 2(2), 46-54, 2014.
2. **Rajani V** and Neethu Vijayan published a paper entitled" Isolation and Identification of Phenol Degrading Bacteria from Effluent Treatment Plant of

Textile Industry in Kerala" in International Journal of pure and Applied Biosciences, ISSN: 2320 – 7051, vol 3 (5): 88-94, 2015.

3. Neethu Vijayan and **Rajani V** published a paper entitled" Isolation and Identification of Phenol Degrading Bacteria from Effluent Treatment Plant of Petrochemical Industry in Kerala" in International Journal of Advanced Research, ISSN 2320-5407, Vol 3 (10): 1173 – 1181, 2015.
4. **Rajani V** and Reshma J K published a paper entitled" Isolation of Genomic and Plasmid DNA of selected Phenol Degrading Bacteria from Effluent Treatment Plants" in International Journal of Current Research, ISSN 2320-5407, Vol 8 (3): March 2016, 27173-27178.
5. Aswathy R and **Rajani V** published a paper entitled "A Preliminary Study on Phenol Degrading Bacteria from Effluent Treatment Plant of Paper Industry, Kerala, India" in International Journal of Scientific & Engineering Research, ISSN 2229-5518, August-2016.Volume 7(8), 1402-1412,
6. **V. Rajani,** S. Sowparnika and R. Aswathy published a paper entitled "Isolation and Identification of Phenol Degrading Bacteria from Effluent Treatment Plant of Coir Industry, Kerala, India" in International Journal of Current Research in Biosciences and Plant Biology, ISSN: 2349-8080, September 2016, 3(9): 69-73.
7. S. Sowparnika, **V. Rajani,** and R. Aswathy published a paper entitled " Effect of pH and Concentration on Phenol Degradation Potential os selected bacterial strains from effluent treatment plant of coir industry, Kerala, India" in the International Journal of Pure and Applied Bioscience, ISSN 2320-7051, October, 2016, 4(5), 175-181.
8. Sowparnika S., **Rajani V.** and Aswathy R. published a paper entitled "Effect of temperature on degradation potential of selected bacterial strains from effluent treatment plant of coir industry" in International Journal of Advanced Research, ISSN:2320 -5407, September 2016, 4(9), 248-254.

9. **Rajani V** and Reshma J K published a paper entitled" Factors affecting phenol degradation potential of microbes – a review" in World Journal of Pharmacy and Pharmaceutical Sciences, ISSN 2278-4357, 2016, 5(11), 691-706.