Isolation and Characterization of Heavy Metal Resistant *Bacillus flexus* P2785 from Eloor Industrial Area, along the Extremities of Periyar River

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Abstract

The aim of the study was to isolate heavy metal resistant bacteria from the sediments of Periyar River, which can remediate heavy metal contaminated soils and effluents. Heavy metal resistant bacteria, *Bacillus flexus P2785* was isolated from contaminated sediment and characterization were done. The strain was able to survive at Copper (Cu) concentration of 13,000µg/mL and showed maximum growth and activity in10,000µg/mL of Cu. Further investigation revealed that the strain was able to bio remediate Cu up to 90± 5% within 16 hours. Therefore the strain of *Bacillus flexus* isolated from the Eloor stretch of the Periyar River has tremendous potential for *in situ* and *ex situ* bioremediation of heavy-metal rich effluents.

Keywords: *Bioremediation; heavy metal; Bacillus flexus; Copper; Periyar*

1. Introduction

The Twentieth Century set the pace for economic development at the cost of the environment. The liberal use of heavy metals in sectors of agriculture, medicine, pharmaceuticals, communication, construction and their subsequent release into the environment has led to an accumulation of toxic metals. Heavy metal having economic significance in industries, has currently become a significant environmental problem throughout the world (Igiri et al., 2018; Siddiquee et al., 2015). Untreated effluents, agricultural runoff and improper disposal of consumables cause heavy metal pollution which eventually enter water resources. Enrichment of heavy metals due to industrialization and urbanization has been recorded inVembanad Lake by many scientists (Remani et al. 1983 and Ouseph, 1992).Sediment deposited in Vembanad Lake by the PeriyarRiver and Cochin estuary contains heavy metals and trace elements due to anthropogenic contamination (Priju and Narayanan, 2007). Repercussions of this exposure are felt by flora and fauna across terrestrial, atmospheric and aquatic habitats, eitherdirectly or indirectly. This has engendered heavy metal accumulation in marine fish in Cochin (Martin et al. 2008). Heavy metal exposure becomes a major threat to human and animal life. Effects of heavy metals on humans is regularly studied and reviewed by international bodies such as World Health Organization.

With a length of 244km and a basin of 5398 km², Periyar is the longest riverin Kerala. Being one of the few perennial rives of the state, it is considered the 'Lifeline of Kerala'. Twenty five percent of Kerala's industries are located on the Periyar river banks, mostly crowded within a 5 km stretch in the Eloor-Edayar region, about10 km north of Kochi harbour. In that, the Eloor Industrial area is notorious for its heavy metal pollution. Mangroves adjacent to Cochin estuary are under increasing heavy metal stress with very high concentration of Cd and moderately high levels of Zn reported in the sediments (Kumar et al. 2010).

Prasanth S and Mahesh V (2016) challenged thirty bacterial strains isolated from sediment samples of Periyar River against different concentration of Cu and Cr. The isolates showed resistant to a minimal concentration for both metals. 93.3 % were resistant to copper solution and 90.0 % were resistant to chromium solution. The results indicated that the river received effluents from different pollution sources throughout the river-line. The sensitivity to the metal solution by bacterial isolates depended on the metal concentrations. Accumulation of heavy metal in Periyar River has resulted in adaptation of bacterial diversity and distribution and showing a proportional growth to the extent of pollution. This suggests that Periyar River would need uninterrupted impoundment for maintaining sanitation. Microbial bioremediation is a safe, affordable *in situ* technique, more effective than other physicochemical methods (Salt et al. 1995).

The present study dealt with following objectives

(i) To determine the physico-chemical characteristics of the sediment samples like E^h, pH, TOC, organic nitrogen, texture and total heavy metalcontent.

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