ISSN 3084-8563
Proceedings of the 1st International Symposium for Ocean Research (iSOR)-2024
16th January 2025 at Ocean University of Sri Lanka, Crow Island, Colombo 15, Sri Lanka

Bioremediation of synthetic textile dyes using native cyanobacteria & their co-cultures isolated from extreme ecosystems in Sri Lanka

Maflah M.M.F.[1], Bandara S.M.D.C.[2], Nuwansi K.K.T.[1], Indika B.A.N.[1] and Ratnayake R.R.[2]*

[1]*Department of Aquaculture and Seafood Technology, Faculty of Fisheries and Ocean Sciences, Ocean University of Sri Lanka*
[2]*National Institute of Fundamental Studies (NIFS), Kandy, Sri Lanka*

**Corresponding author: renuka.ra@nifs.ac.lk*

Abstract

The textile industry, a major global contributor to water pollution, generates vast amounts of dye-laden wastewater that threaten aquatic ecosystems and human health due to their toxicity and persistence in the environment. Physical and chemical treatment methods are costly and inefficient. This study explores the bioremediation of synthetic textile dyes using native cyanobacteria and their co-cultures isolated from extreme ecosystems in Sri Lanka. Cyanobacteria, known for their enzyme production and adaptability, offer a promising solution for dye degradation. This research focuses on identifying effective cyanobacterial strains and co-cultures capable of decolorizing various dyes including Disperse Yellow 211, Disperse Red 73, Disperse Blue 79, Disperse Navy Blue Mix, at concentrations of 30 mg/L and 50 mg/L to study the growth rate of selected cyanobacterial strains & their Co-cultures during the degradation process. Eleven cyanobacterial strains, including seven individual strains and four co-cultures, were tested under optimized laboratory conditions. The selected individual strains were labeled as C1, C2, C3, C4, C5, C6, C7 and the selected Co-Cultures were labeled as C8 = (C1+C2), C9 = (C1+C3), C10 =(C6+C2), C11=(C6+C7). The decolorization was detected by UV-VIS Spectrophotometer. Majority of Cultures grew efficiently in the medium of dye solutions while decolorizing them effectively. The strains labelled as C3, C4, C6, C7, C8, and C10 demonstrated the highest decolorization capabilities. Biological dye decolorization can occur through biosorption, biodegradation, or a combination of both. Cultures that are capable of significantly decolorizing the dye but show a little to no growth are likely involved in biosorption. The study found that co-cultures, particularly C8 and C10, were most effective in dye removal, achieving over 80% decolorization of yellow and blue dyes. C11 showed the highest growth, with over 50% dye removal overall. Yellow dyes were the easiest to degrade, while red dyes were the most challenging. These results highlight the potential of cyanobacteria in treating dye-contaminated water, offering a promising approach for industrial effluent management.

Keywords: Bioremediation, Cyanobacteria, Textile dyes, Decolorization, Spectroscopic analysis