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Decolorization of Triphenylmethane Dyes Using Immobilised *Penicillium* Sp; Dye Removal, Biosorption Mechanism and Phytotoxicity Assay

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Structured Abstract

Background: Increase discharge of dye effluents from industries affects the water ecosystem and deteriorates environmental quality as well as dye dumping into water streams eventually deposit into soil, risking living organisms especially to aquatic live and humans. Earliest human civilizations already used natural dyes extract from organic sources in their daily live. As society demand more vibrant colorant, synthetic dyes were introduced. The purpose of this study was to quantify the efficiency of immobilized *Penicillium sp*. in decolorizing Triphenylmethane dyes and to investigate the biosorption mechanisms and toxicity of selected dyes before and after fungal treatment.

Methods: Biomass of *Penicillium sp*. were collected after 7 days incubation, divided into two-part, free cells and immobilised cells before autoclave at high temperature. Both mechanisms are added into 50ml TPM dyes and incubated at shaking incubator for 7 days at 130rpm. Daily observations and reading were taken to record the decolorization efficiency. After 7 days, selected treated dyes tested on Vigna Radiata seed to assess the toxicity after fungal treatment.

Results: In this study, three types of Triphenylmethane dyes (Crystal Violet, Methyl Blue and Malachite Green) were subjected and treated by immobilized cells (*Penicillium Chrysogenum*) to measure the decolorization efficiency of 100mg/L of the dye solution. The finding of this study showed that Crystal Violet exhibited highest DE (54-66%) compared to other dyes. The UV-Vis analysis displayed that there were significant differences of absorption spectra between treated with immobilized cells and untreated, proving breakdown of dye chromophores molecule. From FTIR analysis, it showed a clear difference between peak numbers of functional groups for immobilized cells, before and after dye treatment, suggesting dye absorption and degradation occur. Then, phytotoxicity assays reveal that the toxicity level of treated dyes was significantly reduced after treated with immobilized cell.

Conclusion: In conclusion, through this project, utilising immobilised cells using Penicillium Chrysogenum was competent to decolorize and remediate toxic dyes via biosorption mechanisms.

Keywords: Triphenylmethane dyes, *Penicillium Chrysogenum*, Immobilised cells, Treated dyes, Decolorization Efficiency.

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