UNIVERSITY OF NAIROBI

ISOLATION AND CHARACTERIZATION OF BIOMASS MODIFYING ENZYMES FOR BIOREMEDIATION AND PRODUCTION OF "GREEN SPECIALTY PRODUCTS"

BY

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DECLARATION

I declare that this thesis is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work, or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's requirement

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DEDICATION

This work is dedicated to my dear parents for their steadfast support and sacrifice they made throughout my studies and always believing in my academic potential. You are my biggest pride.

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ABSTRACT

Environmental pollution has been a major problem and poses many challenges to sustainable development to the chemical-based industrial development in both developed and developing countries. Leather industry which extensively uses lime and sodium sulfide in dehairing hides and skins is currently facing serious environmental pollution problems. Lime and sodium sulfide heavily contribute to increased odour, effluent toxicity, health hazards to the tannery workers, production of poisonous sludge with disposal challenges and blockage to sewerage pipes. Similarly, use of organic dyes in industries pose pollution problems in the form of colored wastewater discharge into water bodies resulting into high turbidity, increased chemical oxygen demand (COD) and reduced light penetration. Furthermore, dyes are not only recalcitrant and refractory pollutants but also toxic, mutagenic and carcinogenic. To address these concerns, the present research affords the opportunity to isolate crude alkaline protease enzyme from extremophile bacteria from Lake Bogoria, Kenya and apply the isolated enzyme in processing leather and bioremediation of industrial wastewater containing organic dyes as part of the process of developing biotechnology for solving environmental problems.

Four (4) protease producing bacterial strains were isolated from Soil samples collected from different parts of Lake Bogoria in the Kenyan Rift Valley. Biochemical test and phylogenetic characterization indicated that the four isolates were all associated mainly with members of the *Bacillus Cereus*. The submerged fermentation process parameters such as pH, temperature, incubation time, different substrates and concentrations that influence production of protease enzyme were analyzed and optimized for large scale enzyme production.

Decolorization and biodegradation of Malachite Green (MG) dye and Reactive Black 5 (RB5) dye was studied using crude alkaline protease enzyme from isolate *1-p*. From the dynamic batch