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APPLICATION OF EDTA IN DETERGENT FORMULATION TO IMPROVE EMULSIFICATION AND REDUCE HARDNESS ION EFFECTS ON FIBER-REACTIVE DYE IN HARD WATER

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NURADILA FATIHAH BINTI A'SRI

Final Year Project Proposal Submitted in Partial Fulfilment of the Requirements for the

Degree of Bachelor of Sciece (Hons.) Chemistry with Management in the Faculty of Applied Sciences

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This Final Year Project Report entitled "**Application of EDTA in Detergent Formulation to Improve Emulsification and Reduce Hardness Ion Effects on Fiber-Reactive Dye in Hard Water**" was submitted by Nuradila Fatihah binti A'sri in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Chemistry with Management, in the Faculty of Applied Sciences, and was approved by

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ABSTRACT

APPLICATION OF EDTA IN DETERGENT FORMULATION TO IMPROVE EMULSIFICATION AND REDUCE HARDNESS ION EFFECTS ON FIBER-REACTIVE DYE IN HARD WATER

Color fading of fiber-reactive dyed textiles during domestic laundering is worsened by hard water, which has high concentrations of calcium (Ca^{2+}) and magnesium (Mg^{2+}) ions. These ions affect detergent performance by forming insoluble precipitates with surfactants, leading to dye desorption and decreased cleaning efficiency. This study examines the effectiveness of ethylenediaminetetraacetic acid (EDTA) as a chelating agent in detergent formulations to reduce color fading in hard water. Detergents with and without EDTA were tested using simulated hard water. The chelation efficiency of EDTA was assessed using complexometric titration, which demonstrated that 0.1 M EDTA required the least titrant volume, indicating effective complexation of Ca^{2+} and Mg^{2+} ions. This improved performance enhanced dye stability, as UV–Vis analysis showed absorbance values for dye solutions treated with 0.1 M EDTA closely matched the control, while lower concentrations resulted in decreased absorbance due to remaining metal–dye interactions. Overall, EDTA effectively enhances color retention of fiber-reactive dyes in hard water, minimizing fading in fabrics washed. This research underscores the significant role of EDTA in improving detergent efficacy and fabric appearance in hard water, offering insights into chelation mechanisms that enhance textile durability and color quality during laundering.

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