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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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**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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**Final Year Project Proposal Submitted in Partial Fulfilment of the  
Requirements for the  
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Faculty of Applied Sciences  
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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 ( $\text{Ca}^{2+}$ ) and magnesium ( $\text{Mg}^{2+}$ ) 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  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  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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