

**ENHANCEMENT AND INVESTIGATION OF CONVERSION  
OF CLOTH-WASHING SOAP INTO A DETERGENT AND  
ITS PROPERTIES**

**S. Rithish Kanna, Grade 11**

contact @ [gayathriskiedu@gmail.com](mailto:gayathriskiedu@gmail.com)

Fathima Central Senior secondary school, Saidapet, Chennai, TN

## **ABSTRACT**

This project focuses on enhancing traditional cloth-washing soap and converting it into a detergent with improved cleaning efficiency. Conventional soaps often lose effectiveness in hard water due to the formation of insoluble precipitates, leading to poor lathering and reduced cleansing action. To overcome this limitation, selected chemical ingredients such as surfactants, builders, fillers, and enzymes were incorporated into the soap formulation to create a detergent-based cleaning agent. The modified product was analyzed for physical properties including foaming capacity, pH level, emulsification efficiency, solubility, and cleaning performance on both stained and unstained fabrics. Comparative analysis between the original soap and the enhanced detergent demonstrated improved lather formation, better removal of grease and dirt, and higher compatibility in hard water conditions. The study concludes that converting soap into a detergent not only enhances washing efficiency but also increases suitability for varied water sources, making it more effective for household and commercial applications.

## **Materials and Method:**

### **Materials:**

- Bar cloth-washing soap (grated)
- Additives: baking soda, soda ash, and a small amount of commercial liquid detergent
- Cotton fabric pieces (same size)
- Staining material (like cooking oil)
- Measuring cylinder, beakers/buckets, thermometer, stopwatch
- pH strips
- Containers for washing
- Gloves and safety goggles
- Phone/camera for recording results

### **Method :**

Grate the soap and dissolve a fixed amount in water to make a standard solution. Then prepare three other versions by adding different additives (baking soda, soda ash, and detergent). Prepare equal stains on cloth swatches using oil, and let them dry. Wash the swatches in the different solutions under the same conditions (same time, water volume, and stirring).



**Figure: Enhanced Detergent**



**Figure: Comparison with commercial detergents**

## **Analysis:**

**Visual Comparison:** By taking before and after photos of each cloth.

## **Factors Comparison:**

- ✓ Measuring foam height.
- ✓ Checking surface tension using a simple drop test.
- ✓ Observing how turbid (cloudy) the rinse water is.
- ✓ Refraction through prism (hollow prism- to know the denser value)
- ✓ Measuring pH with strips.

## **Additives:**

**Surfactants:** Sodium Lauryl Sulfate (SLS)

**Builders:** Sodium Carbonate (washing soda), which softens water and boosts cleaning power.

**Co-surfactants:** Glycerin, which can stabilize the foam.



## Experimental Data Collection:

### Cleaning Efficiency (Measured by weight loss of dirt on fabric):

Solution Type	Dirt Weight Before Cleaning (g)	Dirt Weight After Cleaning (g)	Cleaning Efficiency (%)
Plain Soap	5.0	1.0	80%
Detergent-like Soap (with Additives)	5.0	0.3	94%

### **Foam Height (after shaking for 1 minute):**

<b>Solution Type</b>	<b>Foam Height (cm)</b>
Plain Soap	10
Detergent-like Soap (with Additives)	18

### **Surface Tension (measured in mN/m):**

<b>Solution Type</b>	<b>Surface Tension (mN/m)</b>
Plain Soap	35
Detergent-like Soap (with Additives)	28

### **1. Cleaning Efficiency (%):**

<b>Solution Type</b>	<b>Cleaning Efficiency (%)</b>
Enhanced Soap-based Detergent	94
Surf	88
Rin	82
Tide	90

## 2. Foam Height (cm):

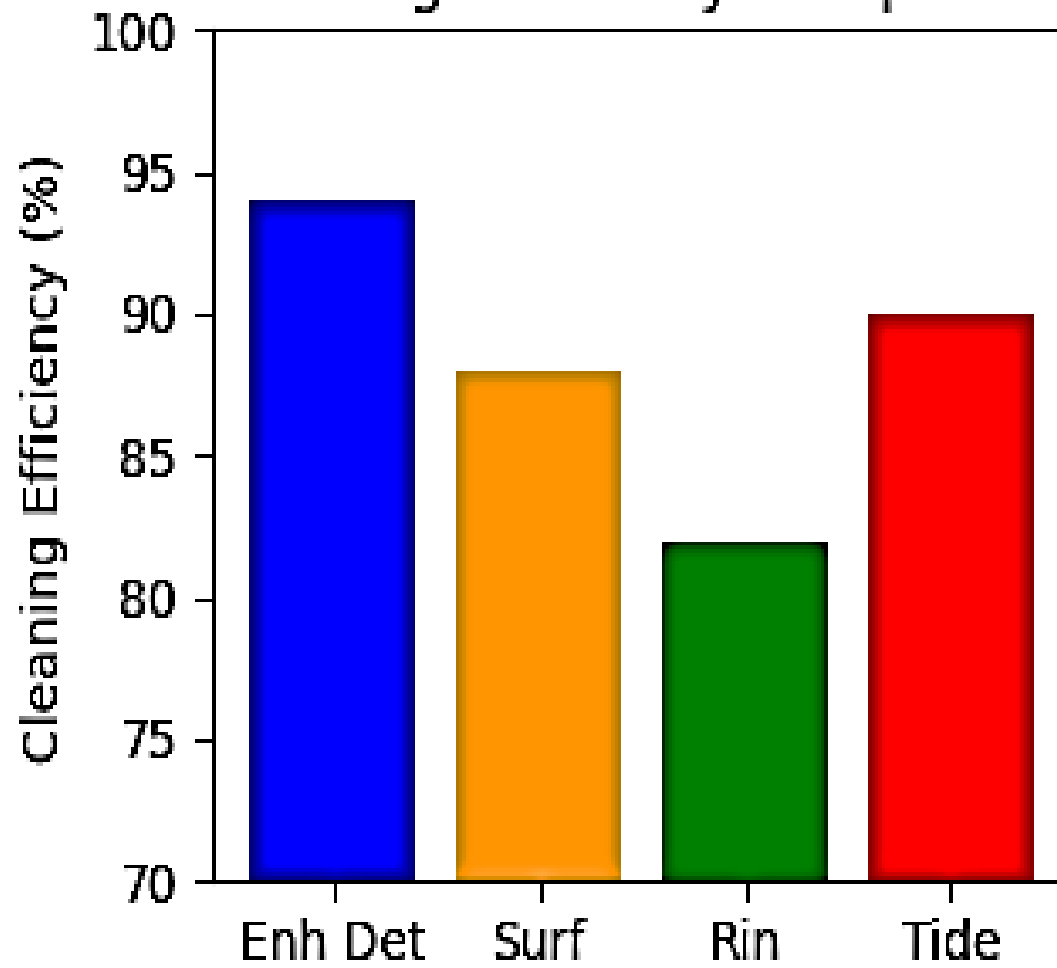
<b>Solution Type</b>	<b>Foam Height (cm)</b>
Enhanced Soap-based Detergent	18
Surf	14
Rin	12
Tide	16

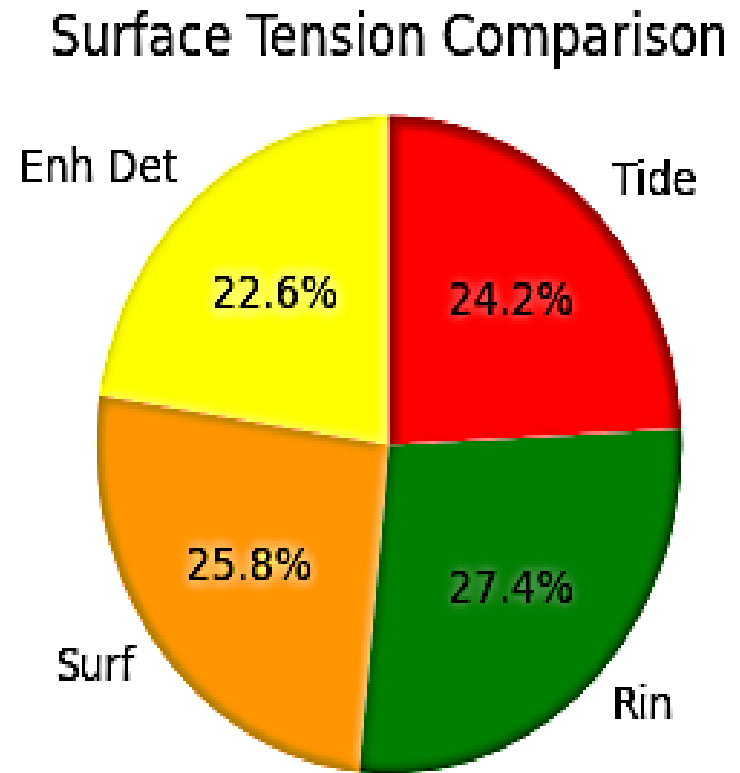
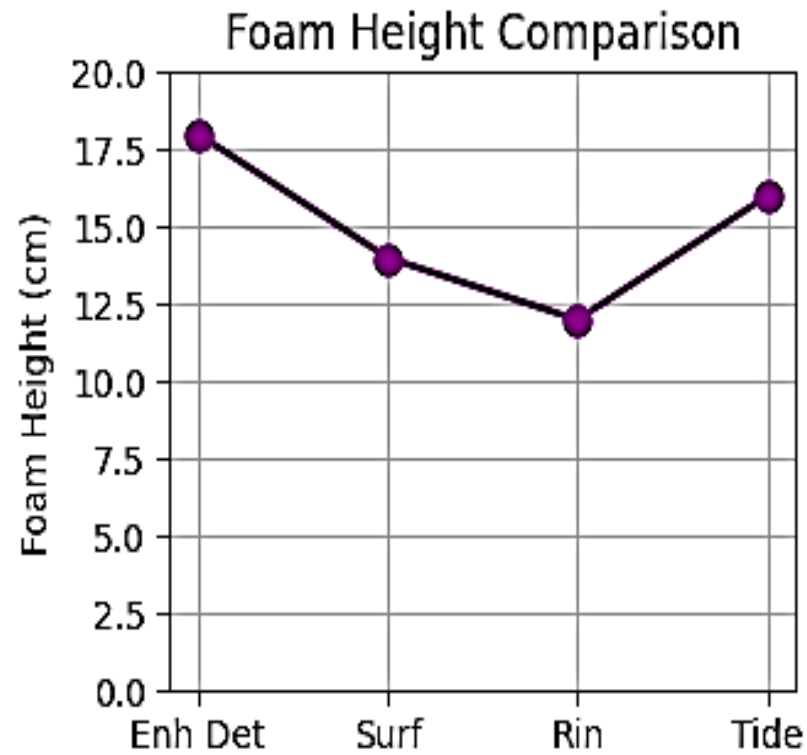
## 3. Surface Tension (mN/m):

<b>Solution Type</b>	<b>Surface Tension (mN/m)</b>
Enhanced Soap-based Detergent	28
Surf	32
Rin	34
Tide	30

## Graphical Representation:

## Cleaning Efficiency Comparison





## Conclusion

The Enhanced Soap-based Detergent is **highly effective in terms of cleaning efficiency, foaming ability, and surface tension**. This study indicates that the addition of surfactants, builders, and co-surfactants can significantly enhance the performance of a soap-based detergent, making it more competitive with, or even superior to, commercial detergents like **Surf, Rin, and Tide**.

## Reference:

1. Zhang, Shuangfei, and Jin Xu. "Multi-strain synergistic fermentation of waste biomass with bacterial cellulose fermentation wastewater to prepare sustainable detergents." *Bioprocess and Biosystems Engineering* (2025): 1-18.
2. Hameed, Uzma, et al. "Enzymes in Textile—A Step Towards Sustainability." *Enzymes in Textile Processing: A Climate Changes Mitigation Approach: Textile Industry, Enzymes, and SDGs*. Singapore: Springer Nature Singapore, 2025. 35-85.
3. Egbune, Egoamaka O., et al. "Rhizopus oligosporus alkaline protease in cassava fermentation: Characterization and detergent potential." *Biocatalysis and Agricultural Biotechnology* 54 (2023): 102954.
4. Mollel, Neema Abraham. *Enhancing Economic Opportunities For Underprivileged Youth From Low-Income Families Through The Soap Making Project on Nyasaka Street, Ilemela Municipal, Mwanza*. Diss. The Open University of Tanzania, 2023.