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Cleansing Action of Some Daily Useable Detergents

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Abstracts:

Present research describes the cleansing action of some daily usuable and easily available detergents in our local market. Several parameters like surface tension, pH, CMC (Critical Miscellisation Concentration), hardness, foaming stability etc were studied experimentally. Different medium such as Tap water (TW), Distilled water (DW) and Ground water (GW) were used for this study. Different marketable detergents such as Surf Excel (S1), Sunlight (S2), Safed(S3) and Sayni(S4) were used for this experiment. Due to the decrease in surface tension, CMC of S1 in distilled water is better than other two medium.
Decreasing order of surface tension are Surf Excel (S1)< Sunlight (S2) < Safed (S3) < Sayni (S4). The cleansing action of the medium are Distilled water (DW)> Tap water (TW) > Ground water (GW). Cleansing property of the detergents from this study: S1>S2>S3>S4.
Keywords: CMC, emulsion, foaming, Detergent, Surface tension.

INTRODUCTION

In continuation of our earlier studies [1-4] , we are trying to searching the cleansing property in different aqueous medium of various detergents available in our market. Different Detergent companies trying to improve the quality of detergents by adding cleansing materials [5-9]. Surfactants in the detergent were developed in 1950s. Decrease of surface tension [10-16] improves the cleansing property of detergents.

Micelle formation in solution is a criteria for the betterment of detergent activity. Micelle formation depends on the longer hydrophobic tail of a surfactant. The concentration of surfactant above which micelle formation arises is called Critical Micellization Concentration (CMC). If CMC formation increases in a surfactant [17-18], then surface tension decreases automatically. So, the cleansing activity of the detergents increases.

Less quality detergents produces more scum in hard water but good quality detergents produces lesser scum in hard water.

The present work is focused mainly on the cleansing action of different marketable easily available detergents in different aqueous medium. For this purpose we collect four(4) detergents in our local market. Different physicochemical studies have been done. After that a strong correlation has found between the cleansing action of different detergents.

MATERIALS AND METHODS

1.1.Material

The solution of detergents were prepared and used to measure surface tension (0.1%), pH (0.1%), CMC (0.01 to 0.1%), foaming stability (0.1%), hardness (2%), emulsions stability (1%) of the detergents S1, S2, S3, S4, in distilled water, tap water and ground water. And detergents solutions were prepared and several parameters such as surface tension, pH, critical micelle concentration foam stability, hardness of water, and emulsion stability test were considered for study to estimate the cleansing action of the detergents.

Sample Preparation

The solution of detergents were prepared and used to measure surface tension (0.1%), pH (0.1%), CMC (0.01 to 0.1%), foaming stability (0.1%), hardness (2%), emulsions stability (1%) of the detergents S1, S2, S3, S4, in 5% ethanol in distilled water, distilled water, tap water and ground water. And detergents solutions were prepared and several parameters such as surface tension, pH, critical micelle concentration foam stability, hardness of water, and emulsion stability test were considered for study to estimate the detergents.

Physical Properties of Detergent Solutions

Surface tension

Number of drops for the same volume of each detergent solution, distilled water, and weight were measured using stalagmometer and specific gravity bottle respectively. The surface tension of the detergents solution and distilled water was measured using the formula.

$$\gamma_2 = \{n_1/n_2 \times \rho_2/\rho_1\} \times \gamma_1$$

γ_1, γ_2 are the surface tension of the water and detergent solution respectively.

n1 and n2 are the number of drops of water and detergent solution respectively. ρ_1 and ρ_2 are the densities of water and detergent solution respectively.

pH of the Detergent Solutions

At first, the pH metre was calibrated using buffer solutions of pH 4.0 and 9.2. Then the solution's pH was measured at room temperature (25 °C) by using a pH meter. pH study of the above solutions were measured with a pH meter(Elico L1 614 pH analyser).

CMC (Critical Micelle Concentration)

Detergent form associative colloids or micelles in an aqueous solution that decreases water's surface tension. As the surface tension decreases, the extent of adsorption of dirt in micelles increases and the detergent's cleansing action increases. Solutions of ten different concentrations of the detergents S1, S2, S3, and S4 were prepared and used to measure the detergents solution's surface tension and distilled water.

Foaming Stability Test

Foam stability tests were performed using 10 ml of detergent solutions separately in test tubes and were shaken for 10 times. The time for disappearance of 2 mm width of foam was recorded.

Hard Water Test

For the hard water test, 2% detergent solutions were prepared by the dissolution of the detergent followed by filtration. 15 ml of each detergent solution were taken in separate test tubes. Then 10 drops of 5% $MgCl_2$, 5% $FeCl_3$, and 5% $CaCl_2$ solutions were added individually. The precipitate of the solutions was filtered, dried and weight.

Emulsion Stability Test

For the emulsion stability test, 1% detergent solutions were prepared. This test was performed by taking 5 ml of detergent solutions; 0.5 ml of mustard oil and petrol were added separately and shaken for 1 minute. The time was recorded when the solution became clear.

RESULTS AND DISCUSSIONS

Surface tension study

For surface tension study it has been found that least surface tension detergent was S1 (Surf Excel) than the other three detergents in distilled water medium (DW). Among the different aqueous medium this study shows better performance in Distilled water. So, cleansing action order of our study is S1>S2> S3> S4. The order of the different aqueous medium is Distilled water (DW) > Tap water (TW) > Ground water (GW).

Fig.1. shows the surface tension data of the different detergents. From the analysis of the graph, peak of the DW is lower in case of S1 (Surf Excel) than the other three. So, surface tension decreases as well as cleansing action increases.

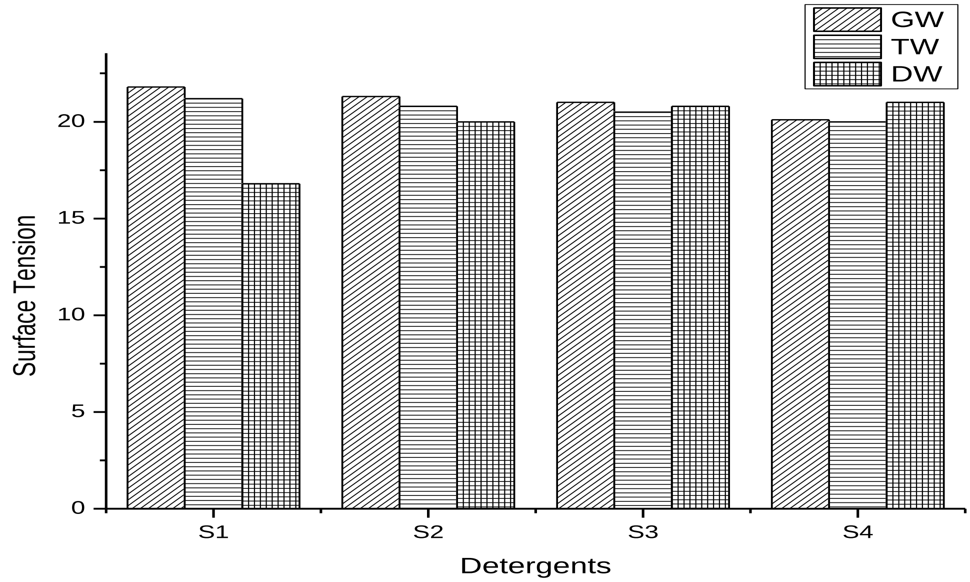

Fig.1. Surface tension of 0.1% w/v of the detergent solution in a different aqueous medium

pH of Detergent Solutions study

Fig.2. shows the pH value of different detergents with different aqueous medium. From the experiment it was observed that pH values are of order DW>TW > GW. As alkalinity increases, cleansing action increases of the detergents. So, the order of cleansing property after pH experiment is S1> S2> S3> S4. Distilled water medium is responses better than the other two medium.

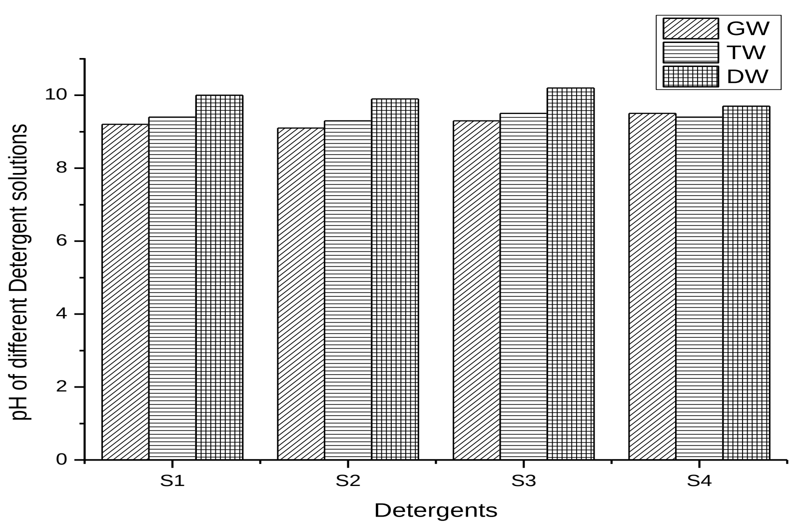

Fig.2. pH of 0.1% w/v of detergent solution in different aqueous medium.

CMC (Critical Micelle Concentration) Study

From this experiment it was observed that lower the value of surface tension and CMC higher the cleansing property of detergents. Lower surface tension and CMC order: S4> S3> S2> S1 and the aqueous medium order: GW> TW> DW.

The cleansing order: S1> S2> S3> S4 and cleansing medium order: DW> TW> GW.
Fig.3. shows the variation of CMC of different detergents with different aqueous medium.

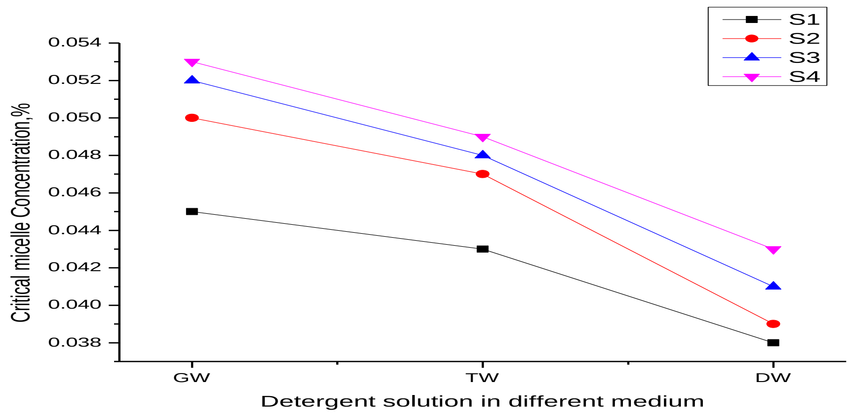

Fig.3. CMC values of the detergents S1, S2, S3 and S4 in different aqueous medium.

1.2.Foaming Stability Study

We know that if foam collapsing time decreases then surface tension decreases. So cleansing action are increases of the particular detergents. From the Fig.4. it was observed that the order of foam collapsing time of the various detergents: S4> S3> S2> S1. And the order of the different aqueous medium: GW> TW> DW. So, the cleansing order of the experimental detergents are S1> S2> S3> S4 and the order of the medium: DW> TW> GW.

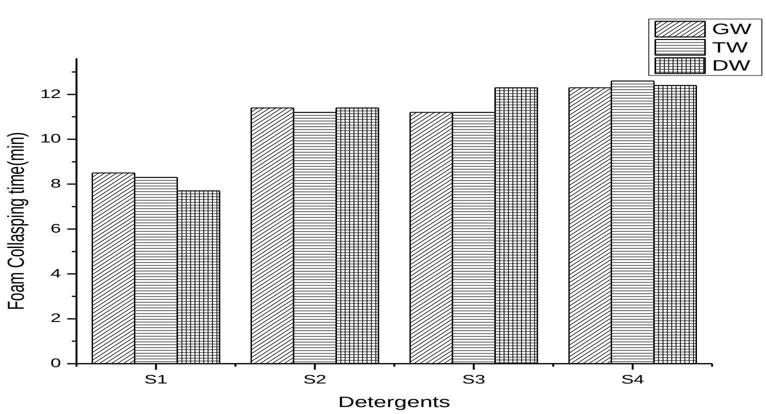

Fig.4. Foam (2mm) collapsing time of 0.1% w/v of detergent solution in different aqueous medium.

1.3.Hard Water Test

Hardness of water mainly arises due to the presence of Ca, Mg, Fe, Mn etc in water. The mineral salts react with soap of detergent solution to form an insoluble precipitate known as scum. We know that better detergents form small amount of scum. Fig.5. shows the weight of scum vs detergent solution in different aqueous medium. Surf Excel (S1) form minimum scum other than three detergents. The order of the cleansing property of the experimental detergents: S1> S2> S3> S4 and order of the medium: DW> TW> GW.

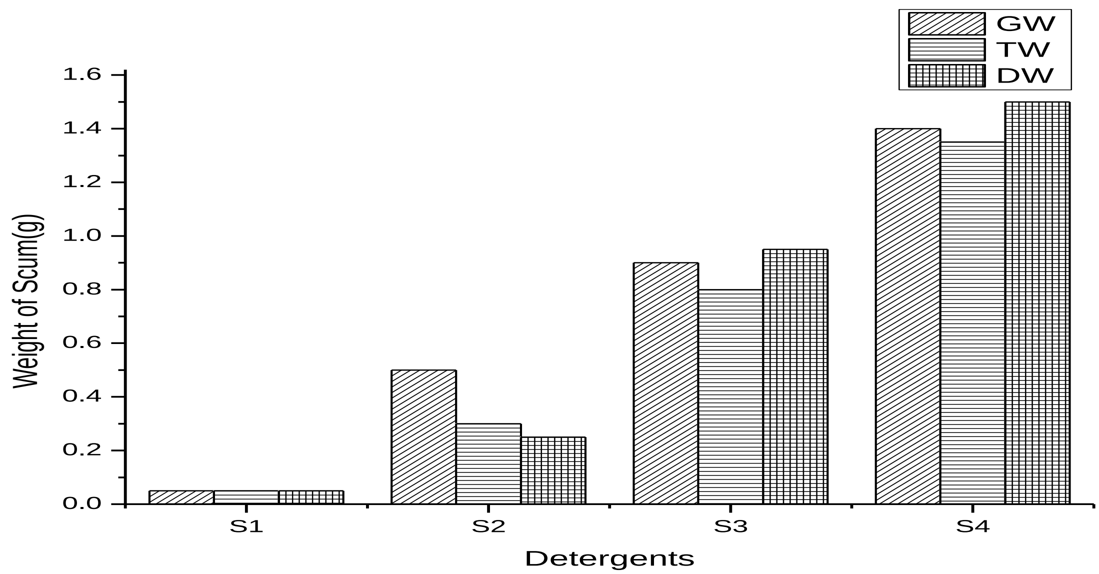

Fig.5. Weight of scum formed after addition of 5% $CaCl_2$ solution in 2% w/v detergent solution

Fig.6. shows the weight of scum vs. different detergents in MgCl2 solution. Precipitate formation order of the detergents: S4> S3> S2> S1. We know that minimum precipitate formation shows greater cleansing action. Cleansing order of our experimental detergents: S1> S2> S3> S4.

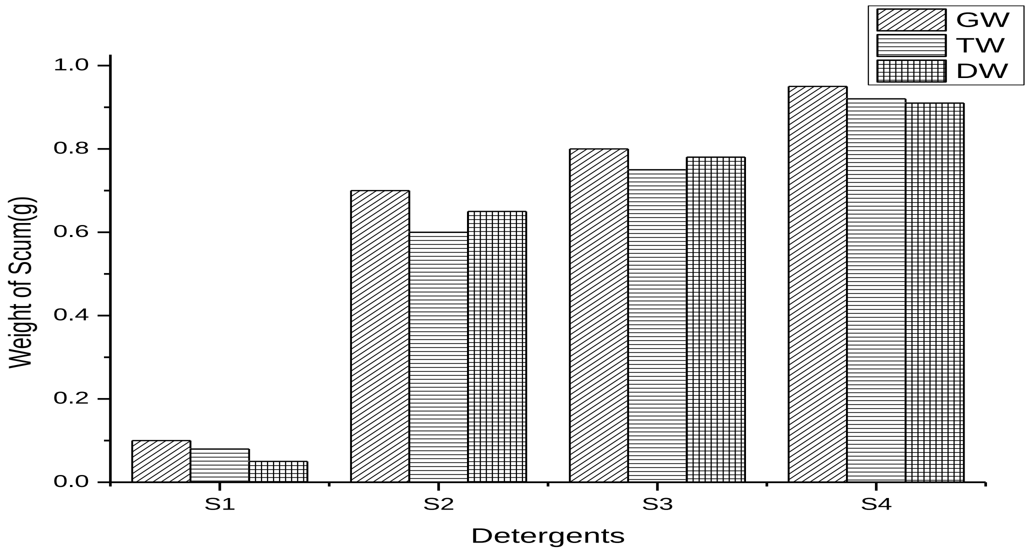

Fig.6. Weight of scum formed after addition of 5% $MgCl_2$ solution in 2% w/v detergent solution

Fig.7. shows the weight of scum vs. different detergent solution in different aqueous medium. At first we add 10 drops of 5% $FeCl_3$ in the detergent solutions S1, S2, S3 and S4 . Then after the formation of scum we plot the Fig.7. We know that minimum precipitate formation shows greater cleansing action. Cleansing order of our experimental detergents: S1> S2> S3> S4.

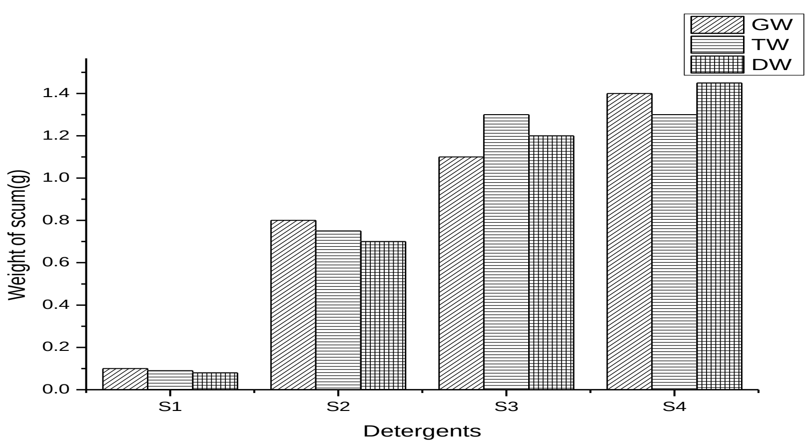

Fig.7. Weight of scum formed after addition of 5% $FeCl_3$ solution in 2% w/v detergent solution.

1.4. Emulsion Stability Test

Fig.8. shows the plot of emulsion stability time vs. different detergent solution in different aqueous medium. We know that if the stability time of the emulsion formation increases then the cleansing action of the soap or detergents increases. From the graph it was observed that emulsion stability time increases in case of S1 (Surf Excel) in distilled water than the other three. The order of the detergents: S1> S2> S3> S4 and the order of the medium: DW> TW> GW.

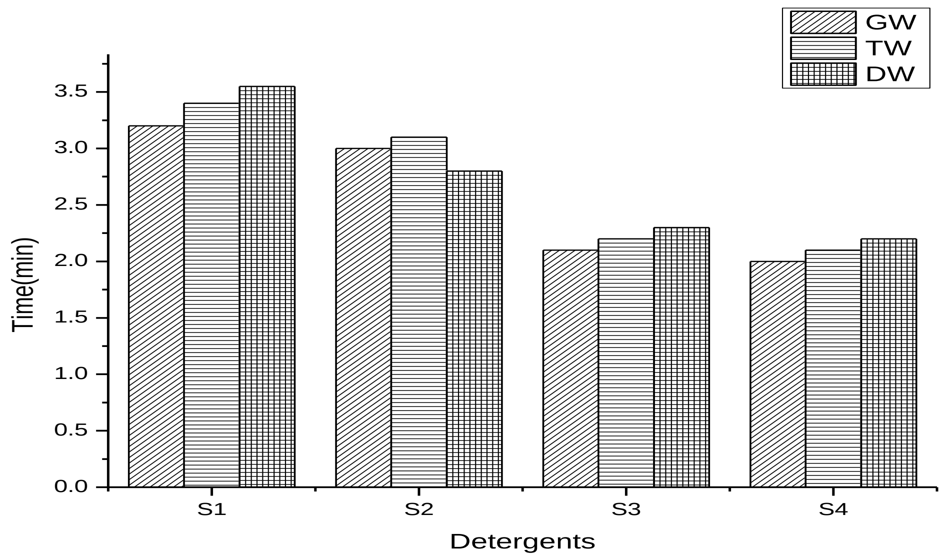

Fig.8. Emulsification of 1% w/v of detergent solutions on addition of 0.5 ml mustard oil

Fig.9. shows the emulsion stability time vs. different detergent solution in different medium. In case of petrol, emulsion stability time is greater than mustard oil for S1. So, S1 (Surf Excel) shows better cleansing performance than the other three. The cleansing order of the detergents: S1> S2> S3> S4.

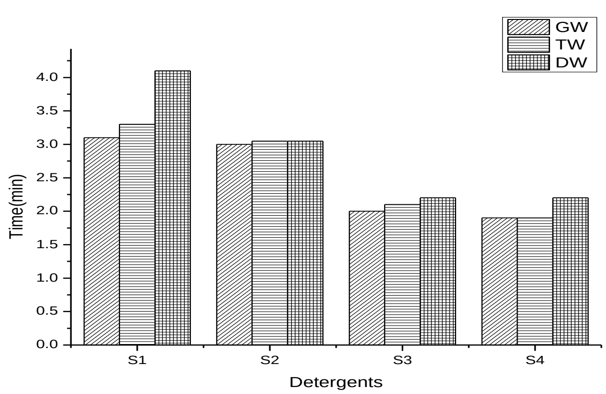

Fig.9. Emulsification of 1% w/v of detergent solutions on addition of 0.5 ml petrol

2. CONCLUSION

For this experiment different detergents like S1(Surf Excel), S2 (Sunlight), S3 (Safed) and S4 (Sayni) were used for different physicochemical parameters like Surface tension, CMC, pH, hard water test, emulsion stability test for different aqueous medium like Distilled Water (DW), Tap Water (TW) and Ground Water (GW). From this experiment it was observed that decrease in surface tension, CMC in case of Surf Excel (S1). Among the three medium Distilled water medium shows better cleansing property than the other two.

From the pH test it was found that cleansing property of S1 is better. From the hard water test it was also observed that minimum precipitate formation shows greater cleansing action. Cleansing order of our experimental detergents: S1> S2> S3> S4.

We know that if the stability time of the emulsion formation increases then the cleansing action of the soap or detergents increases. From the graph it was observed that emulsion stability time increases in case of S1 (Surf Excel) in distilled water than the other three. The order of the detergents: S1> S2> S3> S4 and the order of the medium: DW> TW> GW.

3. ACKNOWLEDGEMENT

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