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Comparative Studies of Locally Synthesized Detergents and SDS, for their Foaming and Cleaning Activities

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Research Article

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ABSTRACT

A research project was carried out by BS students regarding foaming and cleaning activities of various detergents of different companies. Facile and robust strategies were employed for the analysis and different related activities of locally synthesized detergents and known sodium dodecyl sulphate (SDS) surfactant. Four different detergents A (Arial), B (Bunas), C (Bahu) and D (Axel) of different companies and one sodium dodecyl sulphate (SDS) from Sigma Aldrich were studied for their foaming stability and also knowing the efficiency of these detergents for general cleaning purposes. In this work a comparative study was done to know the efficiency of locally made products as well as internationally synthesized products. The results of locally used detergents and standard SDS surfactant were compared. The results confirm that SDS have more efficiency both in cleaning as well as in foaming as compared to the other locally available detergent used for cleaning purposes. The excessive uses of locally detergents have adverse effect on soil fertility as well as on environment. In this regard, concentration may be needed to synthesize such detergents which have locally available low cost and have environmental friendly.

INTRODUCTION

Pure water is lack of foaming ability. When it mixed with some reagents like salt, acids, bases etc, it forms foaming by shaking it dynamically. This foam plays a vital role in many aspects like cleaning, stability of solution and maintaining of a quality of a matter. Usually soaps and detergents are used for formation of foam for different purposes. But not only detergents give the formation of soap in water but the nature of solvent, other components like electrolyte, temperature, pressure also increased or decreased the foaming ability as well as their stability. Foaming are dispersed phenomena of enormous realistic significance, either in their low density media or they depressed by some unfavorable effect[1-3]. Different methods and techniques are made to explain and evaluate the formation and stability of foaming but there is no theory to elucidate the mechanism of foaming stability or a common acceptable test enabling a consistent determination and assessment of foams formed by different detergents/surfactants. Actually, foam is a complex gas/liquid dispersed system whose performances are determined. The most commonly applied simple tests are the Bartsch (shaking) and the Ross-Miles (pouring test) for the comparison of foam ability of detergent solutions [4-7]. In Bartsch shaking technique, a definite amount of detergent solution is shaken vigorously in a closed container for a specific time where is in the Ross-Miles method, a certain amount of detergent solution is poured from the upper container to the lower one at a definite distance to produce maximum foaming of the solutions. The foam formation and their stability are measured by calculating the height of the foam in the vessel and the specific time period of existence[8-11].

The Bartsch and Ross-Miles methods have wide applications and advantages due to their simplicity. They are improved and modified for standardization for getting precise and accurate results in foaming abilities and stabilities. Pinazo and their co-workers have recently projected an attractive modification[12-17]. Unlike the Ross-miles pouring technique, they kept the amount of solution in container constant by continuously pumping back the dropped solution. The solution was flowed for about 1 minute and measured the initial height of the foam. After that the changes occurred in the foam with the time of flow of solution were measured. Both the Ross-Miles and Bartsch methods have some fundamental disadvantages due to uncontrolled introduction of gas in system for the production of foams. In foaming studies, different methods are applied in which the amount and velocity of gas introduced into the system are well controlled, for example, pneumatic methods. However, these methods are more complicated, laborious and can hardly be applied in standard procedure for systems giving foams of very different stabilities. There is no standard technique/method which is applied for all types of foams formation stabilities and their characteristics using same parameters and conditions[18-22]. In this research article, a new and a simple method is presented to evaluate and determine the foaming and cleaning capabilities of four different locally synthesized detergents names shown in the abstract and one standard sodium dododecyl sulphate (SDS). The simple apparatus are used, the procedure for analysis and measurements are described. The results for different locally synthesized detergents and sodium dodecyl sulfate (SDS) are presented.

EXPERIMENTAL

Materials and Chemicals

Four different detergents A, B, C and D of different local companies and one sodium dodecyl sulphate (SDS) from Sigma Aldrich (99.9 % pure) were purchased and used as received. Special apparent reagent bottles of 150 ml were used to studies the foaming and cleaning activities of these locally and standard products. Different concentrations solutions were prepared by dissolving the detergents in 50ml tape as well as in distilled water. The solutions were shaken uniformly for about 5-10 minutes that produce well define foam above the solution surface level. The bottles were kept tight by lid to prevent air and dust particles. After foaming, the bottles of various detergent solutions were kept for analysis at smooth surface and then took their pictures with digital camera and also noted their foaming height with a scale. These tests were noted at regular interval of time.

Foaming Activity

Solutions of different amount were prepared by dissolving the detergents in tape as well as in distilled water. 50 ml solutions of the known concentration of different detergents were put in 150 ml apparent reagent bottles. These solutions were shaken uniformly for about 5-10 minutes that produce well define foam above the solution surface level. After foaming, the bottles of various detergent solutions were kept for analysis at smooth surface and then took their pictures with camera and also noted their height with scale. These tests were noted at regular interval of time.

Cleaning Analysis

In cleaning analysis, cotton pieces of same size and length were soaked in oil dirt solution for some time and then removed and kept for dryness. After dryness, the cotton pieces were hanged in the detergent solutions for 12 hours. Then, these cotton pieces were removed from the detergent solutions and placed for dryness. The dry cotton pieces were examined for cleanness activity.

RESULTS AND DISCUSSION

Foaming Test

Foaming Test 1

In performing test 1 for foaming stability, the bottle were labeled as A1, B1, C1 and D1 for detergent solution prepared in distilled water and A2, B2, C2 and D2 for detergent solution made in tape water as shown in table 1 and their camera pictures in figure 1. 0.01 g of detergents A, B, C and D were dissolved in tape as well as in distilled water to prepare their solutions. The solutions then shake for 5-10 minutes for uniform foaming and complete solubility of the detergents in water. The bottles were kept tight by lid to prevent air and dust particles. The solutions bottles were placed on smooth surface for observation and taking pictures at regular interval of time. The time interval is kept 30 minute and last picture is taken after 24 hours for study the foaming stability in form of bubble foam and noting height of the foam and bubbles above solution surface. From the studying and thorough observations of the foaming and height of the bubbles and foaming above solution surfaces, it reveals that detergent A and B show good foaming stability than the other two as shown in

figure and table 1 respectively. The literature survey also depict that those detergents having excellent foaming ability and maintained height are better detergents for cleaning purposes and economic point of views[1-5].

Figure 1. Showing foaming stability using 0.01 g of various detergents solutions w.r.t time (T1-T9)

S.No	Type of detergent	Amount	Distilled water	Tap water	T1 Intial	T2	T3	T4	T5	T6	T7	T8	T9 After 24 hr
1	A	0.01gm	A1	A2	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	10:00
2	B	0.01gm	B1	B2	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	10:00
3	C	0.01gm	C1	C2	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	10:00
4	D	0.01gm	D1	D2	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	10:00

Table 1. Showing foaming stability of different (0.01g) detergent solution at different interval

Foaming Test 2

In performing test 2 for foaming stability, the bottle were labeled as A1, B1, C1 and D1 for detergent solution prepared in distilled water and A2, B2, C2 and D2 for detergent solution made in tape water as shown in table 2 and their camera pictures in Figure 2. 0.02 g of detergents A, B. C and D were dissolved in tape as well as in distilled water to prepare their solutions. The solutions then shake for 5-10 minutes for uniform foaming and

complete solubility of the detergents in water. The bottles were kept tight by lid to prevent air and dust particles. The solutions bottles were placed on smooth surface for observation and taking pictures at regular interval. The time interval is kept 30 minute and last picture is taken after 24 hours for study the foaming stability in form of bubble foam and noting height of the foam and bubbles above solution surface. From the studying and thorough observations of the foaming and height of the bubbles and foaming above solution surfaces, it reveals that detergent A and B show good foaming stability than the other two as shown in Figure 2 and Table 2. The literature survey also depict that those detergents having excellent foaming ability and maintained height are better detergents for cleaning purposes and economic point of views.

Figure 2. Showing foaming stability using 0.02 g of various detergents solutions w.r.t time (T1-T9)

S.No	Type of	Amount	Distilled	Tap	T1	T2	T3	T4	T5	T6	T7	T8	T9 After

	detergent		**water**	**water**	**Intial**								**24 hr**
1	A	0.02gm	B1	B2	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	10:00
2	B	0.02gm	H1	H2	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	10:00
3	C	0.02gm	Aq1	Aq2	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	10:00
4	D	0.02gm	Ar1	Ar2	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	10:00

Table 2. Showing foaming stability of different (0.02g) detergent solution at different interval

Foaming Test 3

In performing test 3 for foaming stability, the bottle were labeled as A1, B1, C1 and D1 for detergent solution prepared in distilled water and A2, B2, C2 and D2 for detergent solution made in tape water as shown in table 3 and their camera pictures in figure 3. 0.03 g of detergents A, B. C and D were dissolved in tape as well as in distilled water to prepare solutions. The solutions then shake for 5-10 minutes for uniform foaming and complete solubility of the detergents in water. The bottles were kept tight by lid to prevent air and dust particles. The solutions bottles were placed on smooth surface for observation and taking pictures at regular interval. The time interval is kept 30 minute and last picture is taken after 24 hours for study the foaming stability in form of bubble foam and noting height of the foam and bubbles above solution surface. From the studying and thorough observations of the foaming and height of the bubbles and foaming above solution surfaces, it reveals that detergent A and B show good foaming stability than the other two as shown in Figure 3 and Table 3.

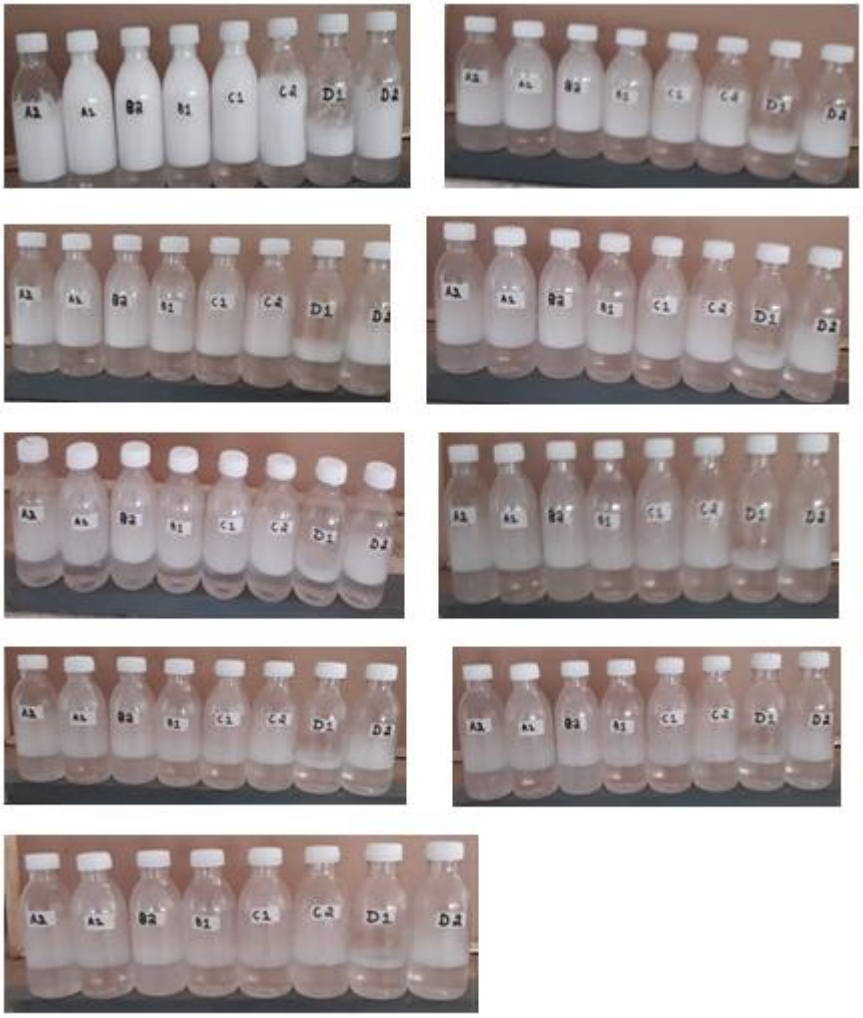

Figure 3. Showing foaming stability using 0.03 g of various detergents solutions w.r.t time (T1-T9)

S.No	Type of detergent	Amount	Distilled water	Tap water	T1 Intial	T2	T3	T4	T5	T6	T7	T8	T9 After 24 hr
1	A	0.03gm	B1	B2	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	10:00
2	B	0.03gm	C1	C1	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	10:00
3	C	0.03gm	D1	D2	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	10:00
4	D	0.03gm	A1	A2	10:00	10:30	11:00	11:30	12:00	12:30	1:00	1:30	10:00

Table 3. Showing foaming stability of different (0.03g) detergent solution at different interval

Foaming Test 4

In performing test 4 for foaming stability, the bottle were labeled as I-A,II-A, III-A and IV-A for detergent solution prepared in distilled water and I-B,II-B, III-B and IV-B for detergent solution made in tape water as shown in table 4 and their camera pictures in figure 4. 1.00 g of detergents I, II. III and IV were dissolved in tape as well as in distilled water to prepare their solutions. The solutions then shake for 5-10 minutes for uniform foaming and complete solubility of the detergents in water. The bottles were kept tight by lid to prevent air and dust particles. The solutions bottles were placed on smooth surface for observation and taking pictures at regular interval. The time interval is kept 30 minute and last picture is taken after 24 hours for study the foaming stability in form of bubble foam and noting height of the foam and bubbles above solution surface. From the studying and thorough observations of the foaming and height of the bubbles and foaming above solution surfaces, it reveals that detergent A and B show good foaming stability than the other two as shown in figure 4 and table 4.

Distilled Water (T1)

Tape Water (T1)

Distilled Water (T2)

Tape Water (T2)

Distilled Water (T3)

Tape Water (T3)

Figure 4. Showing foaming stability using 1.00 g of various detergents solutions w.r.t time (T1-T7)

S.No	Type of detergent	Amount	Distilled water	Tap water	T1 Intial	T2	T3	T4	T5	T6	T7After 24 hr
1	A	1.00gm	1A	1B	10:00	10:30	11:00	11:30	12:00	12:30	10:00
2	B	1.00gm	2A	2B	10:00	10:30	11:00	11:30	12:00	12:30	10:00
3	C	1.00gm	3A	3B	10:00	10:30	11:00	11:30	12:00	12:30	10:00
4	D	1.00gm	4A	4B	10:00	10:30	11:00	11:30	12:00	12:30	10:00

Table 4. Showing foaming stability of different (1.00g) detergent solution at different interval.

Foaming Test 5

The solution of different concentration of SDS of 0.01g, 0.02g, 0.03g and 0.04g of SDS were prepared in 50 ml tape water as well as in distilled water respectively. The solutions were shaked for about 5-10 minutes to produced uniform foaming above the solution surface and the whole quantity of the SDS was made to dissolve

by thorough shaking. The bottles were kept tight by lid to minimize the air effect as well as dust dissolution in the foam. The foaming stability was thoroughly examined by using digital camera picturing after 30 minutes interval and also by measuring the foam height. It is clearly indicates that the foaming stability as well as the height of SDS foaming remain stable for a long interval of time and the foaming even continue after 24 hours as shown in Figure 5 and Table 5. These results explain that a small amount of SDS solution give a stable foaming rather than locally synthesized detergents.

Figure 5. Showing foaming stability of SDS (0.01g, 0.02g, 0.03g and 0.04g) solution at different interval (T1-T7)

S.No	Type of detergent	Amount	Distilled water	Tap water	T1 Intial	T2	T3	T4	T5	T6	T7After 24 hr
1	SDS	0.01g	D H_2O	T H_2O	10:00	10:30	11:00	11:30	12:00	12:30	10:00
2	SDS	0.02g	D H_2O	T H_2O	10:00	10:30	11:00	11:30	12:00	12:30	10:00
3	SDS	0.03g	D H_2O	T H_2O	10:00	10:30	11:00	11:30	12:00	12:30	10:00
4	SDS	0.04g	D H_2O	T H_2O	10:00	10:30	11:00	11:30	12:00	12:30	10:00

Table 5. showing foaming stability of SDS (0.01g, 0.02g, 0.03g and 0.04g) solution at different interval

Leaning activity

The cotton pieces of same size and length were soaked in oil dirt for some time and then removed for dryness. After dryness, the dry cotton pieces were suspended in different concentration detergent solution and kept the samples for some time to check the cleaning effect of the various detergents. The cotton pieces were then take out of the solution and again placed for dryness. Thorough checking and observation of these cotton pieces, it is found that the detergent solution have washed out all the oil dirt from cotton pieces. The detergent solution in bottles also changed their colour by removing the oil dirt from cotton pieces. The detergents A and B and specially SDS have greater cleaning activity than the others detergents used for experimental analysis. It is also noted that increasing concentration of the detergent will give better cleaning effect but excessive use of detergent is not economical as compare to some detergents and not environmental friendly. Cleaning activity and analysis of given detergents were depicted in Figure 6.

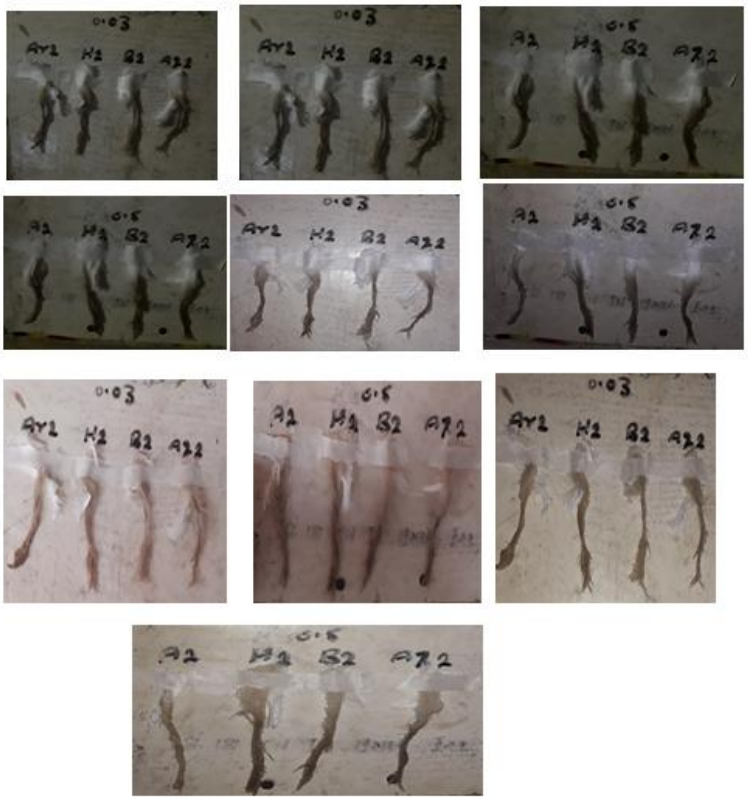

Figure 6. Showing cleaning activity of different detergent using cotton pieces

Comparative Study

The results of locally synthesized detergents and internationally synthesized SDS were compared. It clearly indicate that SDS have more efficiency both in cleaning as well as in foaming as compared to the other locally

available detergent used for cleaning purposes. It also showed that excessive amount of locally synthesized detergents well be used for cleaning as compared to SDS. The excessive uses of locally detergents have adverse effect on soil fertility as well as on environment. In this regard, concentration may be needed to synthesize such detergents which have locally available low cost and have environmental friendly.

CONCLUSION

Four different detergents A, B, C and D of different companies and one sodium dodecyl sulphate (SDS) from Sigma Aldrich was studied for their foaming stability and also knowing the efficiency of these detergents for general cleaning purposes. In this BS students project a comparative study was done to know the efficiency of locally made products as well as internationally synthesized products. The results of locally synthesized detergents and internationally synthesized SDS detergent were compared. It clearly indicate that SDS have more efficiency both in cleaning as well as in foaming as compared to the other locally available detergent used for cleaning purposes. It also showed that excessive amount of locally synthesized detergents well be used for cleaning as compared to SDS. The excessive uses of locally detergents have adverse effect on soil fertility as well as on environment. In this regard, concentration may be needed to synthesize such detergents which have locally available low cost and have environmental friendly.

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