

Formulation And Development of Bodywash Incorporated with Silicone Derivative

¹Shaily Rahangdale, ²S. Sahasrabuddhe

¹Student, ²Professor

Post-Graduation Department of Cosmetic Technology
L.A.D & Smt. R.P. College for Women
Seminary Hills, Nagpur, Maharashtra, India, 440006

Abstract- All types of Mild soaps and body wash both serve the purpose of removing dirt from the skin's surface, but they differ in terms of ingredients and dirt removal mechanisms. Body washes are formulated with ingredients that address common skin conditions such as dryness, clogged pores, and skin flaking. They also contain moisturizing agents to replenish skin moisture that may be lost during the cleansing process. Body washes have gained popularity in the cosmetic industry, replacing harsh soaps due to their added benefits. In the Indian market, body wash options with silicone as an ingredient are limited. Therefore, this study aimed to formulate a body wash using "SilSoft Silk Silicone" supplied by Momentive Performance Material Inc. as a research sample. The objective was to leverage the distressing properties of silicone as an active ingredient to provide skin softness and evaluate its physicochemical stability. The results indicated that the formulated Bodywash exhibited excellent conditioning performance. However, further research and development are required to enhance its quality and safety.

Keywords- Bodywash, SilSoft Silk Silicone, Physicochemical

1. INTRODUCTION

Cleansing is essential for both health and hygiene. Personal cleansing agents such as soaps, one of the earliest to be developed were initially expected to deliver only cleansing benefits. But consumer expectations came up with time to encompass health and cosmetic benefits. This demand led to the development of an array of milder cleansing agents with broader spectrum of application. One such important cosmetic constitutes Bodywash.

"BODY WASH IS A BOON TO THE COSMETIC WORLD WHICH HAS OVERTAKEN THE HARSHNESS CAUSED BY OLD SOAPS."

Skin is the most delicate and exposed part of human body & requires enough care. Bath products market has undergone considerable change in recent years in both volume & range of products available. Range of bath preparation include, body wash, bath oils, after bath preparation etc.

Body wash are undoubtedly most popular bath preparation. Body cleaning is primary function of bath which is very well performed by body wash. Soaps are harsh on skin whereas body wash are much milder. A good body wash should

1) Cleanse the skin surface.

2) Condition the skin

3) Deodorize.

4) Perfume the body & bathroom.

5) Stimulate the senses.

6) Promote relaxation.

7) Provide copious foam at minimal detergent concentration

Other from these properties mentioned above in the additional property which is been provided by body washes of today's cosmetic world. Silicone body wash will act as an icing on the cake as it will not only provide cleansing but will keep the skin fresh and glowing.[1]

2. INTRODUCTION TO SILICONE

Silicon is the second most abundant element on earth, exceeded only by oxygen. Also, it is the third most abundant trace element in the human body. [2]

On the skin, it is suggested that silicon is important for optimal synthesis of collagen and for activating the hydroxylation enzymes, improving skin strength and elasticity. It was shown that physiological concentrations of orthosilicic acid (OSA) stimulate fibroblasts to secrete collagen type I. [3][4]

In the case of skin, it is suggested that silicon content in the product give smooth and conditioning agent. Nails are also affected by the presence of silicon, since this is the predominant mineral in their composition.[5]

Silicone is widely recognized as a safe and non-toxic material suitable for a range of applications, such as medical devices, personal care items, and food packaging.[6]

Momentive Performance Material Inc. is an American chemical company. Its products include silicones and quartz. SilSoft and SilSoft Silk are trademarks of Momentive Performance Materials Inc. Many types of Silicones are derived by this company and marketed to Cosmetic Industries for various uses.

The above material was provided by Momentive Performance Material Inc. as a research sample. Therefore, it was decided to carry the below mentioned project with the incorporation of this material.

INCI Name: Silicone Quaternium-18 (and) Trideceth-6 (and) Deceth-7 (and) Cocamidopropyl Betaine (and) Dipropylene Glycol 157344.

It's also called **SilSoft Silk Silicone**. The Silicon was developed as a lightweight conditioning additive and provides easy formulation and dilution stability. SilSoft Silk conditioning agent's high actives level and quat density can make it more efficient than other conditioning polymers. It is a versatile candidate to consider for broad range of skin care applications.

Key Features And Typical Benefits: - [7]

- Silicone also reduces trans-epidermal water loss. This means it creates a barrier on the skin that prevents water loss and traps moisture. Preventing water loss helps promote hydration in the skin.
- But non greasy skin effects
- No discoloration in the formulation and after application of the product
- Produced without the use of paraben

Toxicity

Silicone is generally considered to be non-toxic and safe for use in various applications, including medical devices, personal care products, and food packaging. However, it is important to note that the toxicity of silicone can vary depending on the specific type of silicone, its formulation, and the intended use.[6]

Published Work

- Momentive Performance Material (Nantong) Co. Ltd., Certificate of analysis Page.no 7 [7]

3. MATERIAL AND METHODS

3.1 Formulation and Development of Bodywash

Clear Bodywash is one of the most popular types of Bodywash sold in the market. They are often sold in the market for their decorative properties. As mentioned above Articles are published using the given silicone in the bodywash with the Sodium Laureth Sulfate. In this study the clear Bodywash base has been chosen using Sodium Lauryl Ether Sulphate, in such a way that silicone can be seen in action through the bodywash, thereby increasing the product's appeal and promoting new products on the market shelves. Therefore, The SilSoft Silk Silicone has been added into different concentration.

It is been added in the concentrations of 0.5%, 1%, 1.5% as per the literature, Shown in **Table No.1** [7]

Table 1 - Formulation Table of Clear Liquid Bodywash in which SilSoft Silk Silicone is been incorporated

Sr. No	Ingredients	Quantity For 100 %			Uses
		0.5% Active (F1)	1%Active(F2)	1.5%Active (F3)	
1	Ethylenediaminetetraacetic (E.D.T. A)	0.06	0.06	0.06	Chelating Agent
2	Coco Betaine	7	7	7	Emulsifying Agent
3	Sodium lauryl ether sulphate (S.L.E. S)	52	52	52	Surfactant
4	Cocamide Mono Ethanol Amide	2	2	2	Foaming Agent
5	Nacl	0.4	0.4	0.4	Thickener
6	Citric Acid	0.2	0.2	0.2	Neutralizer
7	Propylene Glycol	1	1	1	Humectant

8	Water	Upto 100 ml	Upto 100 ml	Upto 100 ml	Diluent
9	Methyl Paraben	0.5	0.5	0.5	Preservative
10	Silsoft Silk Silicone	0.5	1	1.5	Active

4. EVALUATION OF BODYWASH

It was done by following methods

1. Product Characteristics

(Product analysis as per Bureau of Indian Standard Specifications)

- a) Color
 - b) Odor
 - c) Consistency
- ##### 2. Accelerated stability studies
- ##### 3. Product analysis as per Bureau of Indian Standard Specifications
- a) Determination of pH
 - b) Determination of Foam Height
 - c) Heavy Metal test
- ##### 4. Performance Properties
- a) Dirt Dispersion Test
 - b) Determination of Moisture Content with the Help of Corneometer

4.1 Product Characteristics

➤ Observations of Organoleptic Properties of Bodywash

Table 2 - Organoleptic properties of Bodywash incorporated with SilSoft Silk Silicone

Sr. No	Parameter	Formulation			
		Base	F1	F2	F3
1	Color	CL	CL	CL	CL
2	Transparency	E	G	E	E
3	Texture	G	S	S	S
4	Foaming	G	G	E	E

B= Base, CL= Colorless, G= Good, E= Excellent, S= Soft, Smooth, BL= Bodywash Like

➤ Conclusion

Based on the observation of the parameter the formulated Bodywash with different concentration of silicone in it (i.e., at 0.5%, 1%, 1.5%), was found to be stable with respect to transparency, color, odor, texture and foam producing ability. The Bodywash obtained in the formulation of F3 has desired consistency and was selected for future study. The selected base was suitable and hence the observed result was found acceptable.

4.2 Accelerated stability studies

The purpose of stability testing is to provide evidence of how the general values of the product vary over time under the influence of various environmental factors, such as temperature, humidity, and light. Furthermore, stability is affected by product-related factors, including the chemical and physical properties of the active ingredients, the ingredients and composition of the product, the production process, the nature of the closing-bag system, and the properties of the packaging. Additionally, the stability of materials that may contain or produce artificial degradation products is taken into consideration. Following the stability test, a test period for active ingredients or a shelf life for cosmetic products can be established, along with safety conditions.

For a manufacturer, creating a good, effective, and stable product is an exceptionally challenging task. After developing a successful process, it becomes crucial to assess the product's performance under various environmental conditions throughout its lifespan.

For the Bodywash, a rapid stability study has been done 7 days keeping samples under these conditions' temperature: -

- Room temperature ($32 \pm 3^\circ\text{C}$)
- Hot and dry - oven temperature ($45 \pm 2^\circ\text{C}$)
- Cold - refrigerator ($4 \pm 2^\circ\text{C}$)

Limits for stability studies:

- Color
- Odor
- Consistency

A Bodywash like any other cosmetic preparation should have good appealing physical appearance. The formulated Bodywash with different concentration of silicone were evaluated for physical characteristics such as color, odor and consistency. No significant difference was observed in terms of odor, color & transparency in formulated Bodywash except for consistency as per the **Table No 3,4,5,6.**

➤ **Observation Table**

Table 3 - Stability study results for bodywash base

Temperature	Color							Odor							Consistency						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5°C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	G C	G C	G C	G C	G C	G C	G C
45°C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	G C	G C	G C	G C	G C	G C	G C
Room Temperature	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	G C	G C	G C	G C	G C	G C	G C

NC = No Change, GC = Good Consistency, LC = Light Consistency, TC = Thick Consistency

Table 4 - Stability study results for bodywash having 0.5% of silicone

Temperature	Color							Odor							Consistency						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5°C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	G C	G C	G C	G C	G C	G C	G C
45°C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	G C	G C	L C	L C	L C	L C	L C
Room Temperature	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	G C	G C	G C	L C	L C	L C	L C

Table 5 - Stability study results for bodywash having 1% of silicone

Temperature	Color							Odor							Consistency						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5°C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	G C	G C	G C	G C	G C	G C	G C
45°C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	G C	G C	G C	G C	L C	L C	L C
Room Temperature	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	G C	G C	G C	G C	G C	L C	L C

Table 6 - Stability study results for bodywash having 1.5 % of silicone

Temperature	Color							Odor							Consistency						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5°C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	G C	G C	G C	G C	G C	G C	G C

45°C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	G C	G C	G C	G C	G C	G C	G C
Room Temperature	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	N C	G C	G C	G C	G C	G C	G C	G C

➤ **Conclusion**

It was concluded that, the Bodywash having 1.5% concentration of silicone incorporated and base product is more stable, hence more acceptable. The consistency of product is good. From the above result, it can be observed that the changes in the consistency of formulations F1 and F2 can be attributed to the variations in environmental temperature.

4.3 Experiment Analysis of product as per BIS [8]

The **Table No 7** shows the requirements for Bodywash given by IS and the observation of Formulated Bodywash with different concentrations of Silicone

- Determination of PH
- Determination of Foam Height
- Test for Heavy Metals

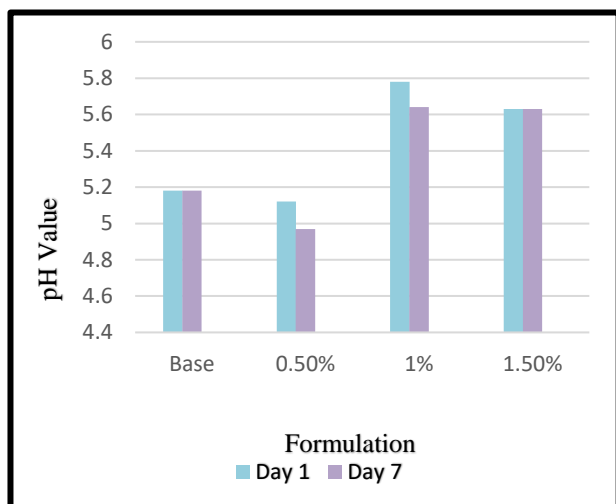
➤ **Observation Table**

Table 7 - Observation table of Experiment Analysis of product as per BIS

Sr. No	Characteristics		Requirement	Obtained Result In Base	Obtained Result (0.5% Concentration Of Silicone)	Obtained Result (1% Concentration Of Silicone)	Obtained Result (1.5% Concentration Of Silicone)
1	pH at 35±2 °C	Day 1	5-9	5.18	5.12	5.78	5.63
		Day 7		5.15	5.6	5.64	5.63
2	Foam Height for 1% solution (minimum)		150mm	159mm	164mm	173mm	180mm
3	Heavy Metal Test		No Colour produced	No colour produced by formulation when compared to the standard lead solution	The colour produced by formulation were less when compared to the standard lead solution	The colour produced by formulation were less when compared to the standard lead solution	No colour produced by formulation were less when compared to the standard lead solution

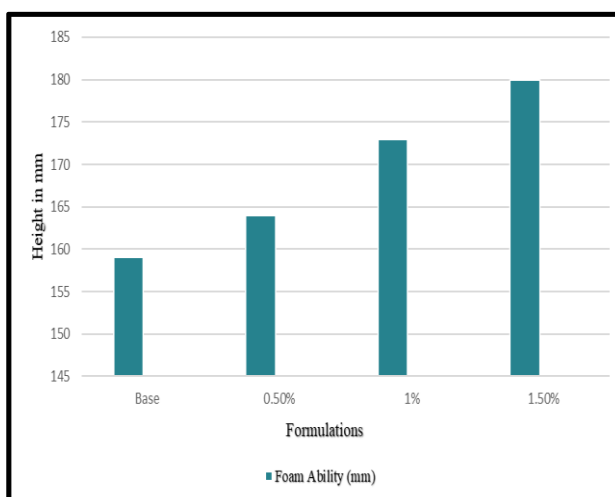
➤ **Graphical Representation**

1) **Determination of pH**



Graph 1 - pH of formulations

2) **Determination of Foam Height**



Graph 2 - Foam Height of formulations

➤ **Conclusion**

As per result it is conclude that, all the formulations meet the parameters specified by the Bureau of Indian Standards (BIS) for bodywash. However, there were slight variations among the bodywash, which can be attributed to the different concentrations of silicone incorporated in each formulation. Among the formulations, F3 exhibited an acceptable result of pH, foam height, and heavy metal meeting the BIS requirements for bodywash. The selected base was found to be acceptable.

4.4 Product Evaluation

4.4.1 Dirt Dispersion Test [9]

Two drops of Bodywash were added in a large test tube contain 10 ml of distilled water. 1 drop of India ink was added; the test tube was stoppered and shakes it ten times. Shown in **Fig .1**. The amount of ink in the foam was estimated as None, Light, Moderate, or Heavy Result shown in **Table no.8**.

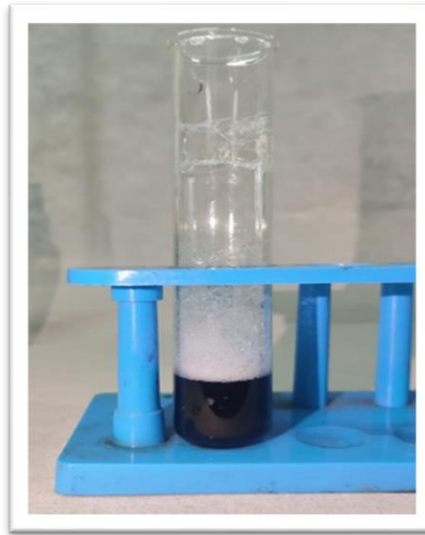


Fig .1: Dirt Dispersion Test

➤ **Observation Table**

Table 8 - Determination OF Dirt Dispersion

Sr. No	Formulation	Result
1	Base	None
2	F1(0.5%)	None
3	F2(1%)	None
4	F3(1.5%)	None

➤ **Conclusion**

From the above result, it can be concluded that the formulation with silicone provides good result for dirt dispersion as no ink has been deposited in the foam. All the formulation passes the dirt dispersion test. The selected base for clear bodywash was suitable and hence the observed result was also found acceptable was selected for next test.

4.4.2 Determination of Moisture Content with the Help of Corneometer [10]

Principle: -The measurement of the skin moisture was based on the internationally recognized Corneometer- method, a capacitance method. This measurement was based on the completely different dielectric constant of water (81) and other substances (mostly <7). Shown in **Fig .2**. The measuring capacitor shows changes of the capacitance according to the moisture content of the samples. A glass lamina separates the metallic track (gold) in the probe head from the skin in order to prevent current conduction in the sample. An electric field between the tracks with alternating attraction develops. One track builds up a surplus of electrons (minus charge) the other a lack of electrons (plus charge). The scatter field penetrates the very first layer of the skin during the measurement and the capacitance was determined. Unlike the impedance measurement no galvanic relation between the device and the measuring object or polarization effects exists Shown in **Fig .3**. [10]

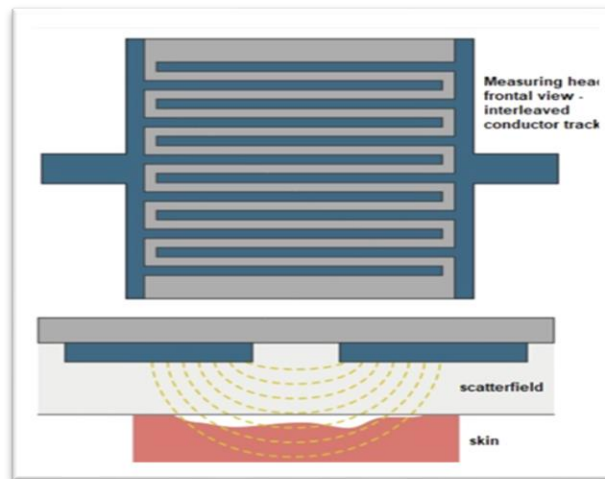


Fig .2: Working Principle of Corneometer



Fig .3: Corneometer

Method of Analysis

The Corneometer CM 825 is a highly sensitive measurement instrument. For exact and reproducible measurement values it is important to follow the following instructions.

Preparation of the Room

For all measurements of skin parameters, it was important to maintain constant ambient conditions. The temperature and relative humidity were kept constant. This was crucial for the comparison of long-term measurements. The optimum room conditions were set at 20°C and 40-60% relative humidity. Measurements were not taken under direct lamp light or direct sunlight to avoid measurement inaccuracies caused by heat radiation. In a series of tests, measurements were always taken at the same time of the day and under the same light conditions.

Preparation of Volunteers

The test subjects were allowed to rest for at least 10-20 minutes to allow their blood circulation to return to a normal level after any physical exercise. The skin area to be measured was not covered with clothes during the acclimatization time. It was ensured that the acclimatization room was clean. If possible, measurements were taken on hairless skin areas. It was recommended to shave the respective area some time (1-2 days) before the measurements or trim the hair very short with a pair of scissors.

Moisture Measurements

- The Corneometer was selected by clicking on the button at the right margin of the screen. A display mode for the measurements (bar, digital display, curve, or numeric table) was chosen as well.
- The probe head was placed vertically on the skin area to be measured, applying the pressure of the spring in the probe. It was ensured that the skin area was not hairy, as shown in Fig .4.
- The Corneometer probe initiated the measurement upon contact with the skin. A beep signaled the successful completion of the measurement, and the measuring value was displayed on the screen.
- The same procedure was followed for subsequent measurements. The average value of all measurements was displayed and could be stored along with temperature, air humidity, skin site, key, and comment.
- To perform continuous measurements instead of single measurements (where measurement values were taken continuously as long as the probe was on the skin or until a certain stop event was reached), the setting in the "options" menu was changed.



Fig .4: Determination of moisture level by Corneometer

The interpretation of the results

The following values are valid for healthy skin and normal room conditions (20°C and 40-60% air humidity) and will help too to determine the skin type shown in **Table no-8:**

In arbitrary units between 0 and 130

Table 8 - Values As per Standard

Sr. No	Skin condition	Inner Forearm
1	Very Dry	<30
2	Dry	30-45
3	Sufficient Moisturized	>45

The Corneometer indicates the hydration level of the superficial layers of the skin (stratum corneum) via measurement of skin dielectric properties. The measurements are performed by the application of a probe to the skin surface.

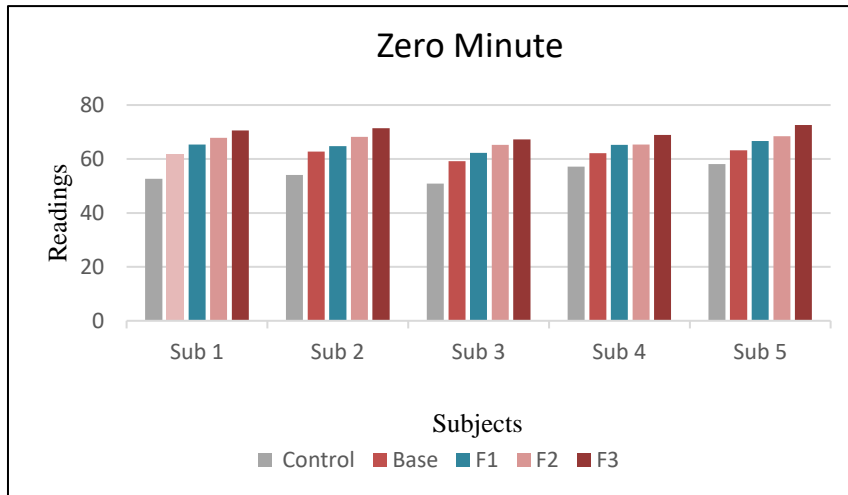
Note – The observation table is given below, the sample readings were taken after every 30 minutes. But only the initial and final reading has been shown in the **Table no -9.**

Table 9 - Observation Table of Moisture Determination by Corneometer

Sr. No	Subject	Time	Formulations				
			Control	Base	F1	F2	F3
1	Subject 1 (Normal Skin)	Blank	52.7	61.2	65.3	67.8	70.6
		150 min	55.5	67.7	66.7	69.3	72.3
2	Subject 2 (Oily Skin)	Blank	54.1	62.7	64.8	68.2	71.4
		150 min	56.2	63.3	67.2	69.4	74.7
3	Subject 3 (Very Dry Skin)	Blank	50.9	59.2	62.3	65.2	67.3
		150 min	53.1	60.2	63.5	66.1	68.4
4	Subject 4 (Normal Skin)	Blank	57.2	62.2	65.2	65.4	68.9
		150 min	57.9	63.9	66.5	67.5	69.5
5	Subject 5 (Oily Skin)	Blank	58.1	63.2	66.6	68.4	72.6
		150 min	59	64.2	68.7	68.9	73.1

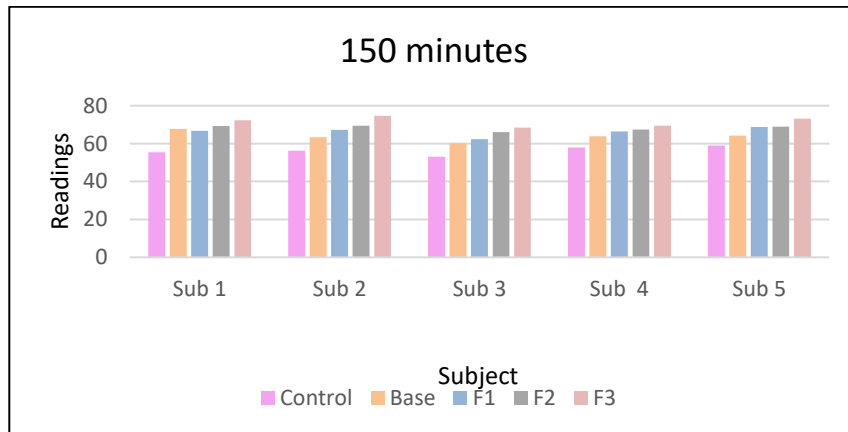
➤ **Graphical Representation**

3) **Determination of Moisture Level at zero minute**



Graph 3 - Determination of Moisture Level using Corneometer at zero minute

4) **Determination of Moisture Level after 150 minutes**



Graph 4 - Determination of Moisture Level using Corneometer after 150 minutes

➤ **Conclusion**

According to the observation the formulation of Bodywash provide proper moisture to the skin. From the result it can be concluded that the F3 formulated Bodywash are more capable of trapping moisture on skin. All the value observed are according to standard more than 45 that give desirable moisture to the skin. Hence the active Silicone is much effective in trapping the moisture leading to increase in moisture content.

5 CONCLUSION

The main objective of this project was to develop a bodywash that effectively cleanses the skin, produces abundant foam, conditions the skin, and provides a refreshing sensation. Multiple experiments were conducted to formulate the bodywash using different combinations of silicone to achieve the desired properties.

The results led to the following justifications. The visual inspection of body wash formulations with varying silicone concentrations confirmed the acceptability of color and odor. It was concluded that the bodywash with 1.5% silicone concentration [F3] exhibited stability and good consistency. Additionally, this formulation met the requirements for pH, heavy metal tests, foam height, dirt dispersion, and skin moisture content that give desirable moisture to the skin. Overall, the formulation with 1.5% silicone (specifically Silsoft Silk Silicone) proved to be the most effective and optimal choice for enhancing the bodywash.

In summary, this study demonstrated that incorporating 1.5% silicone into the bodywash formulation yielded the best results in terms of various factors, making it the most acceptable and effective choice. Future research can focus on exploring novel silicone formulations, investigating their long-term effects, and considering sustainability aspects to further advance silicone-based bodywash formulations.

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