

Formulation and Evaluation of Synthetic Anti-dandruff Shampoo

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Abstract

Aim: This study aims to formulate and evaluate synthetic anti-dandruff shampoo. **Materials and Methods:** The anti-dandruff agents used in the present study are sulfur and benzoic acid. The other ingredients include sodium lauryl sulfate (surfactant), urea (solubilizing agent), citric acid (sequestering agent), sodium ethylenediaminetetraacetic acid (chelating agent), guar gum (foam stabilizing agent and thickening agent), tween 80, and distilled water (vehicle). All ingredients were purchased from SD fine chemicals, boisar. **Results and Discussions:** The prepared anti-dandruff shampoo was evaluated for physical appearance/visual inspection, determination of pH, determine % of solid contents, rheological evaluation, surface tension measurement, foam ability, and antimicrobial activity. The pH range was 6.1–6.7, physical appearance was pale yellow, the percentage of solid contents ranges from 26.9 to 28.1%, viscosity was in the range of 1289–1712, surface tension was found to be 31.08–34.12, and foam volume ranges from 144 to 178. The antimicrobial activity was done using *Staphylococcus aureus*, and the zone of inhibition was observed using 1% solution of sulfur, salicylic acid, and benzoic acid in the ratio of 0.75:2:0.25, which has shown 3.4 mm inhibitory action. **Conclusion:** Study indicates zone of inhibition for F1 obtained was best compared to other formulations against *S. aureus* after incubating for 24 h. It may have fair anti-dandruff activity efficiency.

Key words: Anti-dandruff shampoo, *Pityrosporum ovale*, salicylic acid and benzoic acid, sulfur

INTRODUCTION

Dandruff represents one of the most common dermatological skin conditions and is a chronic, non-inflammatory condition of the scalp that is characterized by excessive scaling of scalp tissue. Various antifungal agents are employed in hair care preparations for the treatment of dandruff. These products show many side effects such as loss of hair, increased scaling, itching, irritation, nausea, and headache. Hence, an attempt was made to formulate synthetic anti-dandruff shampoo which is effective in terms of safety and treating the dandruff condition. Dandruff is apparently caused by a fungus called *Malassezia restricta* and *Malassezia globosa*. *Malassezia* formerly called *Pityrosporum* is a yeast causing infection of skin and scalp. It often causes itching. Warm and humid atmosphere, overcrowding, and poor personal hygiene are ideally suited for the growth of *Malassezia*. Dandruff affects 5% of the population and mostly occurs after puberty, between 20 and 30 years and dandruff affects males more than females. Dandruff occurs exclusively on skin in areas with high levels of sebum. Symptoms of

dandruff mainly include itching, flakes, and redness of scalp. Dandruff can be treated in two ways, using herbal-based anti-dandruff shampoo and using chemical-based anti-dandruff shampoo. A shampoo is a preparation containing surfactant (i.e., surface active material) in a suitable form – liquid, solid, or powder – which when used under the specified conditions will remove surface grease, dirt, and skin debris from the hair shaft and scalp without adversely affecting the user. Most shampoos contain water, a detergent (cleaning agent), surfactant (lather making agent), salt, fragrance (natural and artificial), preservative, and food coloring. With the exception of water and salt (sodium chloride), different chemical compounds are used depending on the desired result of the shampoo. Many shampoos also contain vitamins

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and moisturizing alcohols to prevent too much of the hair and scalp's natural oils from being stripped away during cleansing.^[1-4]

Composition of Shampoos

The following are the ingredients used for the preparation of shampoos. They include three anti-dandruff agents such as sulfur, salicylic acid and benzoic acid, sodium lauryl sulfate as surfactant, urea as solubilizing agent, citric acid as sequestering agent, sodium ethylenediaminetetraacetic acid (EDTA) as chelating agent, guar gum as foam stabilizing agent and thickening agent, tween 80, and distilled water as vehicle.

MATERIALS AND METHODS

The anti-dandruff agents used in present study are sulfur and benzoic acid. The other ingredients include sodium lauryl sulfate (surfactant), urea (solubilizing agent), citric acid (sequestering agent), sodium EDTA (chelating agent), guar gum (foam stabilizing agent and thickening agent), tween 80, and distilled water (vehicle). All ingredients were purchased from SD fine chemicals, boisar.

Preparation of anti-dandruff shampoo

The anti-dandruff shampoo was formulated using simple mixing process. Formulations were made using two anti-dandruff agents such as sulfur and benzoic acid. The other ingredients used are sodium lauryl sulfate as surfactant, urea as solubilizing agent, citric acid as sequestering agent, sodium ethylene diamine ethylene diamine tetra acetic acid as chelating agent, guar gum as foam stabilizing agent and thickening agent, tween 80, and distilled water as vehicle [Table 1].

Evaluation of prepared anti-dandruffSS shampoo

Physical appearance/visual inspection

The formulations prepared were evaluated in terms of their clarity, foam producing ability, and fluidity.^[5,6]

Determination of pH

The pH of 10% shampoo solution in distilled water was determined at room temperature 25°C.^[7,8]

Determine percent of solid contents

A clean dry evaporating dish was weighed and added 4 g of shampoo to the evaporating dish. The dish and shampoo was weighed. The exact weight of the shampoo was calculated (only solids) and evaporating dish with shampoo was placed on hot plate until the liquid portion was evaporated. The weight of the shampoo (only solids) after drying was calculated.

Rheological evaluation

The viscosity of the shampoos was determined using Brookfield viscometer by setting different spindle speeds from 0.3 to 10 rpm. The viscosity of the shampoos was measured using spindle T95. The temperature and sample container's size was kept constant during the study.

Surface tension measurement

Measurements were carried out with a 10% shampoo dilution in distilled water at room temperature. Thoroughly clean the stalagmometer using chromic acid and purified water. Because surface tension is highly affected with grease or other lubricants.^[9,10] The data calculated by following equation given below:

$$R_2 = (W_3 - W_1)n_1 / (W_2 - W_1)n_2 \times R_1$$

Table 1: Composition of synthetic anti-dandruff shampoo

Ingredients	F1 (g)	F2 (g)	F3 (g)	F4 (g)	F5 (g)	F6 (g)	F7 (g)	F8 (g)
Sulfur	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Salicylic acid	0.25	0.5	0.75	1	1.25	1.5	1.75	2
Benzoic acid	2	1.75	1.5	1.25	1	0.75	0.5	0.25
Sodium lauryl Sulfate	22	22	22	22	22	22	22	22
Urea	1	1	1	1	1	1	1	1
Citric acid	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Sodium EDTA	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Guar gum	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
Tween-80	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Distilled water	Up to 100 ml							

EDTA: Ethylenediaminetetraacetic acid



Figure 1: Different formulations of anti-dandruff shampoo



Figure 2: Brookfield viscometer

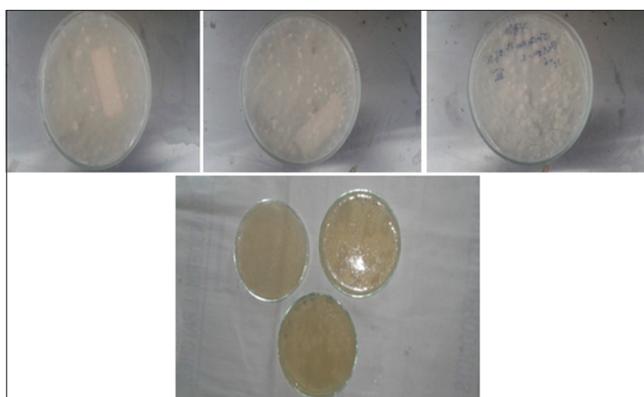


Figure 3: Antimicrobial activity of synthetic anti-dandruff shampoo

Where, W_1 is weight of empty beaker.

W_2 is weight of beaker with distilled water.

W_3 is weight of beaker with shampoo solution.

n_1 is number of drops of distilled water.

n_2 is number of drops of shampoo solution.

R_1 is surface tension of distilled water at room temperature.

R_2 is surface tension of shampoo solution.

Foaming ability and foam stability

Cylinder shake method was used for determining foaming ability. 50 ml of 1% shampoo solution was put into a 250 ml graduated cylinder and is shaken for 10 times. The total volumes of foam contents after 1 min shaking were recorded. The foam value was calculated immediately after shaking the volume of foam at 1 min intervals for 4 min was recorded.^[11,12]

Antimicrobial activity against *Staphylococcus aureus*

The prepared anti-dandruff shampoo formulations F1 to F8 were subjected to antimicrobial activity by cup-plate method using the agar medium. 1% anti-dandruff shampoo was used to study this antimicrobial activity. The Petri plates were then sealed using Parafilm and incubated at 37°C for 24 h. The zone of inhibition was observed successfully for formulation F4 than other formulations.^[12]

RESULTS AND DISCUSSIONS

The aim of the present work is to prepare anti-dandruff shampoo using three anti-dandruff agents such as benzoic acid, salicylic acid, and sulfur by various combinations.

The prepared anti-dandruff shampoo was evaluated for physical appearance/visual inspection, determination of pH, determine % of solid contents, rheological evaluation, surface tension measurement, foamability, and antimicrobial activity.

Physical appearance/visual inspection

The formulations prepared were appeared pale yellow color.

Determination of pH

The pH of 10% shampoo solution in distilled water was determined at room temperature 25°C and the range of pH was found to be 6.1–6.7 [Table 2].

Determine percent of solid contents

The weight of the shampoo (only solids) after drying was calculated for all the formulations and the range was found to be 26.9–28.1% [Table 2].

Rheological evaluation

The viscosity of the shampoo was determined using Brookfield Viscometer by setting different spindle speeds from 0.3 to 10 rpm and the range of cps obtained was 1289–1712 [Table 3].

Surface tension measurement

Measurements were carried out with a 10% shampoo dilution in distilled water at room temperature and the range was found to be 31.08–34.12 [Table 3].

Foaming ability

Cylinder shake method was used for determining foaming ability. 50 ml of 1% shampoo solution was put into a 250 ml graduated cylinder and covered the cylinder with hand and shaken for 10 times and the range of values obtained was found to be 144–178 [Table 3].

Table 2: Evaluation of formulation for physical appearance, pH, and solids

Formulation	Physical appearance	Ph	Solids (%)
F1	Pale yellow	6.5	27.9
F2	Pale yellow	6.3	27.3
F3	Pale yellow	6.1	27.5
F4	Pale yellow	6.5	28.1
F5	Pale yellow	6.6	26.9
F6	Pale yellow	6.7	28.0
F7	Pale yellow	6.5	27.6
F8	Pale yellow	6.4	27.8

Antimicrobial activity against *S. aureus*

The prepared anti-dandruff shampoo formulations F1 to F8 were subjected to antimicrobial activity using cup-plate method using agar medium. 1% antidandruff shampoo was used to study this antimicrobial activity. The zone of inhibition was observed successfully for formulation F1 than other formulations [Table 4].

CONCLUSION

In the present work, efforts have been made to prepare and evaluate anti-dandruff shampoo using three anti-dandruff agents such as benzoic acid, salicylic acid, and sulfur by various combinations. Zone of inhibition for F1 obtained was best compared to other formulations against *S. aureus* after incubating for 24 h. It may have fair anti-dandruff activity efficiency. Hence, the formulation F1 has met the objectives.

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Table 3: Evaluation of formulation for viscosity, surface tension, and foamability

Formulation	Viscosity (cps)	Surface tension (dynes/cm)	Foam volume (ml)
F1	1618	33.2	178
F2	1712	31.8	154
F3	1309	34.12	151
F4	1415	33.09	161
F5	1328	31.08	152
F6	1611	32.12	147
F7	1289	33.11	144
F8	1296	31.98	148

Table 4: Evaluation of formulations for zone of inhibition

Formulation	Concentration (g)			Zone of inhibition (mm)
	Sulfur	Benzoic acid	Salicylic acid	<i>Staphylococcus aureus</i>
F1	0.75	2	0.25	3.4
F2	0.75	1.75	0.5	2.85
F3	0.75	1.5	0.75	2.60
F4	0.75	1.25	1	2.75
F5	0.75	1	1.25	2.80
F6	0.75	0.75	1.5	2.7
F7	0.75	0.5	1.75	2.6
F8	0.75	0.25	2	2.7

REFERENCES

1. Chandrani D, Lubaina SZ, Soosamma M. A review of antifungal effect of plant extract vs. Chemical substances against *Malassezia* spp. Int J Pharm Bio Sci 2012;3(3):773-80.
2. Wuthi-udomlert M, Chotipatoomwan P, Panyadee S, Gritsanapan W. Inhibitory effect of formulated lemongrass shampoo on *Malassezia furfur*: A yeast associated with dandruff. S East Asian J Trop Med Public Health 2011;42:363-9.
3. Naveen S, Karthika S, Sentila R, Mahenthiran R, Michael A. *In-vitro* evaluation of herbal and chemical agents in the management of Dandruff. J Microbiol Biotech Res 2012;2:916-21.
4. Harish AP, Pragathi Kumar GB. Formulation and evaluation of herbal anti-dandruff shampoo. Indian J Res Pharm Biotechnol 2013;1:835-9.
5. Aghel N, Mohimpour B, Dana RA. Iran J Pharm Res 2007;6:167-72.
6. Mainkar AR, Jolly CI. Evaluation of commercial herbal shampoos. Int J Cosmet Sci 2000;22:385-91.
7. Sharma PP. Cosmetic Formulation Manufacturing and Quality Control. 3rd ed. New Delhi: C.B.S. Publisher and Distributer; 2001. p. 644-647.
8. Hadkar UB, Ravindra RP. Indian J Pharm Educ Res 2009;4.
9. Gaud RS, Gupta GD. Practical Physical Pharmacy. 1st ed. New Delhi: C.B.S. Publisher and Distributer; 2001. p. 81-105.
10. Klein K. Cosmetics and Toiletries Magazine. 2004;119:32-5.
11. Umbach W. Cosmetics and Toiletries Development. Production and Use. Chichester: Ellis Horwood; 1991. p. 26. Barel AO, Paye M, Maibach HI. Handbook of Cosmetic Science and Technology. New York: Marcel Dekker; 2001. p. 423, 583-8, 773-5.
12. Patil SS, Mane YJ, Mohite SK. Formulation and evaluations of herbal shampoo powder. Int J Adv Res 2015;3:939-46.

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