

Development and Invitro Evaluation of Gel Based Anti-Dandruff Shampoo Containing Povidone Iodine

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Povidone iodine is an iodophor complex containing iodine and polyvinyl pyrrolidone introduced to pharmaceutical market as a powerful antiseptic agent possessing broad spectrum action against disease causing micro organism. Medicated shampoos are recommended for the control and correction of dandruff. The abnormal condition of the scalp by bacteria and fungi, the predominating species being staphylococcus aureus and pityrosporum ovale. Concentration range of povidone iodine between 66ppm-2500ppm, kills the staphylococcus strain between 15-180 seconds. Gel shampoos rank sales wise next to the clear shampoos. Thick gel shampoo may be advantageous in reducing spillage (or) loss during application. Antidandruff gel shampoo were formulated using different concentration of povidone iodine 4%(w/v),dioctyl sodium sulfo succinate 14%(w/v),sodium lauryl sulphate 4%(w/v),polyvinyl alcohol 10%(w/v),glycerin 53%(w/v),preparation were evaluated for foam stability, cleaning action, microbial test , p^H, visual appearance ,available iodine and eye irritancy test

Keyword: Povidone Iodine, Dioctyl Sulfo Succinate, Sls, Anti Dandruff, Gel Shampoo.

INTRODUCTION

There are also reports available stating that povidone iodine is effective as an antiviral too. Numerous in-vitro studies made over two decades indicate the efficiency of povidone iodine as therapeutic agents for both humans and animals; eleven products containing pvp-iodine were tested for their ability to inactivate HIV virus in cell culture system. All of the products completely inactivated the virus at PVP iodine concentration greater than 0.5 per cent. Usage PVP iodine has significantly reduced the irritancy and toxicity associated with iodine use its being used worldwide effectively

Povidone iodine solution in water or alcohol is better tolerated than iodine solution. Povidone iodine is suitable for hand disinfection, surgical hand disinfection, burns, scalp condition, vaginal infection, throat infection and leg ulcers.

Elemental iodine has very broad anti-microbial spectrum against bacteria and viruses. Bacterial endospore fungi and protozoa are destroyed through oxidative interaction and iodination of biological macromolecules; however there have been reports of certain resistant germs.

Medicated shampoos are recommended for the control and correction of dandruff. Today a number of medicated dandruff shampoos enjoy a

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Reputation for appreciable effectiveness. One such product, obtainable only by prescription is a shampoo in the form of a 2.5% suspension of selenium sulphide in detergent base. Another contains (zinc pyridinethionezinc-2-pyridinethiol-1-oxide) as the antidandruff ingredient and sodium alkyl glyceryl ether sulfonate as the base detergent. A wide range and assortment of other antidandruff ingredient such as hexachlorophene, cadmium sulphite, tellurium oxide, hydroxyl quinolines, biphenamine Hcl, ketoconazole, biothionol, polythionates, allantoin and p-chloromethoxylenol are used in medicated dandruff shampoos.

Dandruff or scurf is the dry form of seborrhea capitis known as seborrhea sicca in which the epidermis is shed in dry flaky scales. It is generally considered that this is due to a functional disorder, which causes some alteration of the skin keratinization process. Cell division in the deeper layer of the epidermis being transformed into keratin. This results in the formation of an invisible film of dead cells which is continually being cast off at the surface of the skin. If for any reason the normal function do not synchronize properly and casting off of cells increase to an abnormal rate, the cells become visible and give the characteristic dry flaky scales of dandruff.

Another common form of seborrhea capitis is due to an abnormal secretion of sebum. This condition is known as seborrhea oleosa, for a sebaceous gland to secrete sebum the process of the epidermis and desquamation from the surface must also be in progress. The sebaceous glands develop from the surface must also be in progress. The sebaceous glands develop from the hair follicles and normal secretion of sebum is sufficient to oil the hair and lubricate the surface of the skin. An abnormal secretion of sebum therefore causes the hair become excessively greasy. In some cases excessive casting off of dead epidermal cell can occur together with abnormal secretion of sebum and when this take place the dead cells become entangled and matted by the sebum and remain on the scalp. The degree of itching in these cases is often quite severe and if the condition is not treated inflammation and seborrhea dermatitis can occur.

The abnormal conditions of the scalp, which have been mentioned, are accompanied by an increase in growth or bacteria and fungi, the predominating species being staphylococcus aureus and pityrosporum ovale. There is also evidence to suggest that a greater variety of yeasts are present than in normal conditions, but it is not known whether these are in any way responsible for altered condition. Although the etiology various form of the disease has not been clearly defined several suggestions have been made. Some of these are:

- Disturbance of hormonal balance.
- Biochemical changes in the epidermis or dermis of the scalp.
- Excessive use of strong alcoholic lotion or strong alkalis.
- Excessive or abusive use of other irritating hair preparations, such as cold wave preparations and hair dyes.
- Vitamin and mineral deficiencies.

Whatever the cause of the disturbance may be clear that if it is due to any physiological condition, this cannot be removed simply by use of a preparation which is applied externally. Nevertheless, it should be remembered that through and regular cleansing is essential to maintain the skin in a healthy condition and it is

also essential to maintain the scalp in good condition in order to have a healthy skin.

Treatment of seborrhea capitis is important because it is frequently associated with a predisposition to some other skin disease. Dandruff is associated with loss of hair, excluding male and female pattern baldness for which there is as yet no specific treatment with acne, which is a general term denoting inflammation of the sebaceous glands, and psoriasis are often attributed to a hereditary disturbance in the metabolism of fat, even though they are frequently confined to the scalp. Infantile eczema is generally considered to be of an allergic origin and yet this condition is also associated with the scalp condition known as 'cradle cap'. Cosmetic treatment preparations are those containing 'active' ingredients like povidone iodine for the treatment of impaired skin conditions.

MATERIALS AND METHODS

Materials: Povidone iodine was gifted from ISP technologies inc.US, Dioctyl sodium sulfo succinate was obtained from Otto kemi, Mumbai, sodium lauryl sulphate and polyvinyl alcohol was provided by Qualigens fine chemicals Glaxo, Mumbai. Jasmine perfume supplied by aromatic (India), Bangalore. All the other chemicals were used of analytical grade.

Preparation of Shampoo

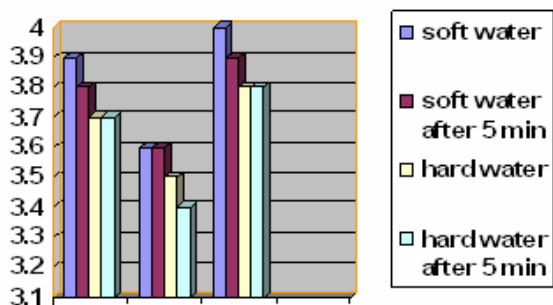
Step 1: Required quantities of dioctyl sodium sulfosuccinate and glycerin are heated together in a water bath at 95.c until a clear solution is formed. Step 2: Required quantities of sodium lauryl sulphate is dissolved in water and left overnight in a closed vessel. Step 3: The above solutions are mixed together. To this povidone iodine is added and gently stirred for 15 min. Step 4: polyvinyl alcohol and water are mixed together and mixture is heated in a water bath to form a viscous gel. Povidone iodine mixture is slowly incorporated into the gel; care is taken to avoid formation of air bubbles. This transparent gel packed into the tube and sealed.

Table I: Formulation formula for shampoo

Sl. No	Ingredients(w/w)	G-1	G-2	G-3	G-4	G-5	G-6
1.	PVP -iodine	4	4	4	4	4	4
2.	dioctyl sodium sulfosuccinate	10	11	13	14	14	14
3.	sodium lauryl sulphate	2	2.5	3	4	4	4
4.	polyvinyl alcohol	1	1	1.5	2	5	10
5.	glycerin	8	9	10	11	53	37.5
6.	Jasmine perfume	0.2	0.2	0.2	0.2	0.2	0.2
7.	water	q.s	q.s	q.s	10	20	30

Foam and Foam Stability

The Ross-Miles foam column methods used to measure foam height and stability. In this test 200 ml of 0.1% liquid shampoo solution falls through an orifice into a glass column containing 500 cc of the same solution. After a specified period of time at once and after five minutes, the height of foam



Graph 1 Effect of foam in shampoo

is measured.

Cleaning Action

Cleansing power is evaluated by the method of Barnet and Powers, 5gm sample of soiled human hair is placed at 35°C in 200 cc of water containing 1 gm of shampoo. The flask is shaken 50 times a minute for 4 minutes. Then washed once again with sufficient amount of water, then after filter the hair dried and weighed. The amount of soil is removed under these condition is calculated.

Collection of Hair

Uniform size of human hairs was collected. Then hairs washed with sufficient amount of water and dried. The Accurate amount of hair (5g) soiled with standard soil then weighed. These hairs taken for cleaning action.

Preparation of Standard Soil

Combination of carbon black and mineral oil.

Conditioning Action

Conditioning action is a difficult property to assess. This is because it is basically dependent on subjective appraisal. No method has been published for measuring conditioning action. The degree of conditioning given to hair is ultimately judged by shampoo user who is making the evaluation on the basis of past experience, present expectations, and continuing change is the individual scalp and hair situation. Conditioned hair should be soft, lustrous, easily combined and coiffures.

Evaluation of Conditioning Action

The prepared shampoo formulations were given to volunteers and they were asked to give their opinion, on the conditioning ability of preparation.

After two weeks volunteers were of the opinion that the shampoo gives the hair a lustrous look, softness and hair is easily styled.

formulation	% of Available iodine
G-1	98.2
G-2	98.7
G-3	97.4
G-4	98.5
G-5	98.7
G-6	98.7

Table II: Assay of Iodine shampoo formulation

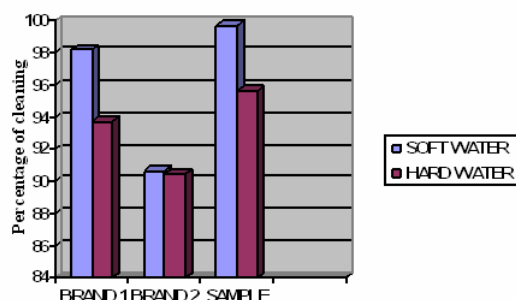
Viscosity

Viscosity of the liquid shampoo was determined using a Brooke field (model-TVTP) spindle (No.4 type) at 20 rpm. 200 grams of the

shampoo was taken in a beaker and the spindle was dipped in it for about 5 min and then the reading was taken.

Preparation of Pre-Inoculum

Take the loopful culture of staphylococcus aureus (ATCC6532) aseptically and transfer to sterilized and cooled 100 ml SCDM (broth). Mix well. Incubate the broth at 37°C for 24 hrs.



Graph II: Effect of cleaning for shampoo

Preparation of media

Soya bean casein digests medium, soya bean casein digest agar and nutrient agar.

Preparation of Pour Plates

Sterilized SCD agar (100 ml) is cooled to 40°C and mixed with 5 ml of 24hrs old pre inoculated culture. This is immediately poured in plates (340 ml each) and allowed for setting.

Making the Wells on Agar Plates

The wells are dig on agar plates with sterilized well digger aseptically.

Take 100µml of each sample, add to well aseptically. Incubate the plates at 37°C for 24 hrs to 48 hrs. Observe the effectiveness of sample on culture growing on the agar plate and we can see the effectiveness of sample in the form of zone of inhibition around each well containing different sample.

Eye Irritancy Test

The test calls for dropping 0.1 ml of liquid shampoo the test substance in the conjunctiva sac of one eye of the rabbit, the other eye serving as control. In the case of the first three animals, the treated eye remains unwashed. Since washing the eye may or may not alleviate symptoms of injury. The six remaining animals are divided into two equal groups in the first of these groups eyes instilled with the substances are washed with 20 ml of lukewarm water two seconds after treatment and in the second group after instillation. The

washing is regarded as significant since it is important to know the effect of such a procedure that is, whether it is detrimental or beneficial and if beneficial, to ascertain the extent of the benefit of the made at 24, 48 and 72 hr and again four and seven days after treatment. If the lesions have not cleared up in seven days the test material is considered as severe irritant.

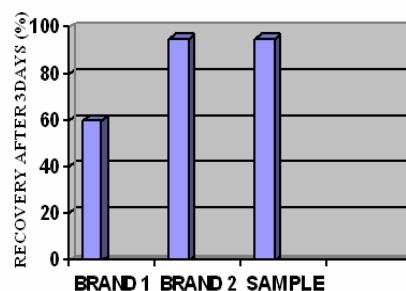
Available Iodine

Weigh accurately about 5 gm of Povidone Iodine liquid shampoo into a round bottom Stoppered Iodine flask containing 150 ml of water and stir for 1 hour. Add 0.1 ml of dilute acetic acid and titrate against 0.1M sodium thiosulphate using starch solution as indicator towards the end.

Each ml of 0.1M sodium thiosulphate is equivalent to 0.01269 gm.

$$\frac{\text{Titre volume} \times \text{molarity factor of sodium thiosulphate} \times \text{equivalent factor} \times 100}{\text{Weight taken in gram (sample)}} = \% \text{ gm of available Iodine.}$$

100gm of Povidone Iodine contain 11.9 gm of available Iodine, 4% of Povidone Iodine shampoo contain 0.476 % of available Iodine.



Graph III: Comparative eye irritancy test for shampoo.

RESULTS AND DISCUSSION

Povidone iodine gel shampoo formulation was compared with the marketed preparation brand 1 and brand 2. The comparison was made on the basis of following parameters.

Foam and Foam Stability

The preparation was compared with brand 1 and brand 2. It is found that foam and foam stability of the preparation was better than brand 1 and brand 2, so it can be concluded on the basis of

the above observations that the sample has good foam stability as given in graph 1.

Available iodine and appearance:

There is no significant change in available iodine content. Further stability study need to carry out for the G-5 and G-6 as shown in table 2 and 3.

PARAMETER	RESULTS
Visual appearance	Transparent
PH	4.55-4.6
Viscosity(cps)	57000-58000
Phase separation	NO
Leakage	NO
Nature	smooth

Table III: Physicochemical parameters of Shampoo

Cleaning Action

Povidone iodine gel shampoo preparation has better cleaning action than brand 1 and brand 2. This shows that the preparation has the desired cleaning action which is even superior to the marketed preparation as given in graph 2.

Anti Microbial Action

Microbial action of the gel preparation was compared with that of brand 1 and brand 2 using the standard procedures for studying antimicrobial activity. It was found out after carrying out the studies that the preparation has antimicrobial activity equal to brand 2 and more than brand 1. It is expected that the prepared shampoo will have similar action as compared to the marketed formulation.

Eye Irritancy Test

There was slight irritation on application of preparation. The animal recovered well within 3 days as the case with brand 2.

CONCLUSION

Povidone iodine is a proven broad spectrum anti bacterial agent. Since no shampoo formulation is available in Indian market, present study was to formulate a stable formulation.

Clear gel shampoo formulations were prepared and evaluated. It was found the preparations are having good antidandruff activity which is comparable to some selected marketed medicated shampoo. The preparation was found to stable and was having good properties such as anti dandruff, foam stability, cleaning action, conditioning action; it does not have any irritancy also. Since the shampoo preparations were elegant and stable.

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