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Formulation and development of anti-blemish preparation using microsponge technology

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ABSTRACT

Microsponges are highly porous micro-sized particles with a unique ability for entrapping actives. They are biologically safe, yet are Simple to produce making them attractive in the field of Cosmetics. They are consisting of 10-25 microns in diameter Loaded with active agent. Microsponge technology offers entrapment of ingredients & is believed to contribute towards increased elegance enhanced formulation flexibility & improved Stability. Microsponge technology is non-irritating, non-toxic, & Non-allergenic. Microsponge technology has been explored for applications like Anti-blemish Preparation.

Keywords: Sepiwhite™ MSH, Anti-blemish preparation, Microsponge technology.

INTRODUCTION

Microsponge is polymeric delivery Systems Consisting of Porous microspheres that can entrap a wide range of active ingredients such as emollients, fragrances, essential oils, and sunscreen, antifungal & anti-inflammatory agents. It is a unique technology for the controlled release of topical agents & consists of micro porous beads. These entrapped active agents can then be incorporated into many products form such as cream and Lotion. After the product is applied the entrapped material are then delivered to the skin in a controlled time release pattern through the use of several different “triggers”. Rubbing or pressing the microsponge after it has been applied to the skin elevating skin surface temperature, introducing solvent for the entrapped material such as water alcohol or even perspiration & controlling the rate of evaporation.

Delivery system comprised of a polymeric bead having network of pores with an active ingredient held within was developed to provide controlled release of active ingredients whose final target is skin itself[1]. The size of the microsponge can be varied usually from 5 to 300µm in diameter depending upon the degree of smoothness or after feel required for the end formula[2]. Microsponge systems are stable over range of pH 1 to 11, temperature up to 30^0C compatible with most vehicles & ingredients.

MATERIALS AND METHODS

Preparation[3]

Drug Loaded in Microsponges can take place in two ways one step process or by two step process, based on physio-chemical properties of drug to be loaded. If drug is typically an inert non-polar material, will create the porous structure it is called porogen. Porogen drug which neither hinders the polymerization nor become activated by it & stable to free radical is entrapped with one step process. There are two methods to prepare microsponge:

1) Liquid-Liquid Suspension Polymerization[3]

Microsponges are conveniently prepared by liquid-liquid suspension polymerization. Polymerization of styrene or methyl methacrylate is carried out in round bottom flask. A solution of non-polar drug is made in the monomer, to which aqueous phase usually containing Surfactant & dispersant to promote suspension is added. Polymerization is effected, once suspension with the discrete droplets of the desired size is established by activating the monomers either by catalysis or increased temperature. When the drug is sensitive to the polymerization conditions, two steps process is used.

2) Quasi-emulsion Solvent diffusion[3]

Microsponge can also be prepared by quasi-emulsion Solvent diffusion method using different polymer amounts. The procedure is as follows:

To prepare the inner phase, polymer was dissolved in solvent. Then drug can be then added to the solution & dissolved under ultrasonification at 35^0C. The inner phase was poured into PVA Solution in water (outer phase). Following 60 min of stirring, the mixture is filtered to separate the microsponge. The microsponges are dried in air heated oven at 40^0C for 12 hour and weighed to determine production yield.

Application of Microsponge[2]

Microsponge technology has been successfully applied to a large number of topical products including cosmetics, cosmoceuticals over the counter drugs & prescription drugs. Useful active materials for personal care are easy to load onto the Polymer because they simply require the addition of an active solutions or liquid to the polymer under controlled conditions. This technology is used for treatment of:

1) Treatment of acne vulgaris.
2) Treatment of actinic keratoses.
3) Treatment of post inflammatory hyperpigmentation & melasma.

The technology is currently employed in almost number of products sold by major cosmetic & toiletry companies worldwide. Among these products are skin cleansers, conditioners, oil control lotions, moisturizers, deodorants, lipsticks, makeup powder & eye shadows which offer several advantages including improved physical & chemical stability greater available concentration controlled release of active ingredients reduce skin irritation & sensitization & Unique tactile qualities.

Advantages of Microsponge[4]

* Advanced Oil control absorb up to 6 times its weight without drying.
* Extended release continuous action upto 12 hours.
* Reduced irritation.
* Improved product aesthetics-give product an elegant feel.
* Improves stability thermal, physical & chemical.
* Allows for novel product forms.

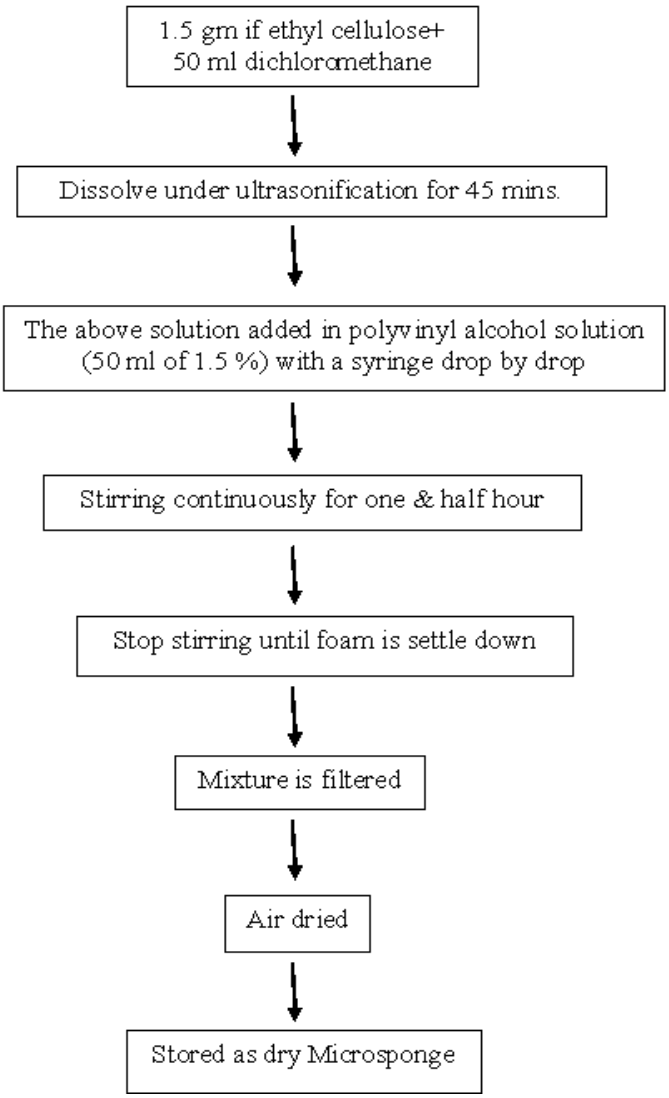
Components: Actives & formulation aids

Actives: Examples of Microsponge based delivery Systems includes incorporation of active such as Sepiwhite ^{TM} MSH.

Formulation Aids: Ethylcellulose, Dichloromethane, Carbomer 940, Triethanolamine, Mineral oil, Cetyl alcohol, Stearic acid, Glyceryl monostearate, Lanolin, Isopropylmyristate, Petrolatum, Propylene glycol, Glycerine, Sesame oil, Span 80, Emulsifying wax, Poly vinyl alcohol, Cocoa Butter, Almond oil, Propyl paraben, Methyl Paraben.

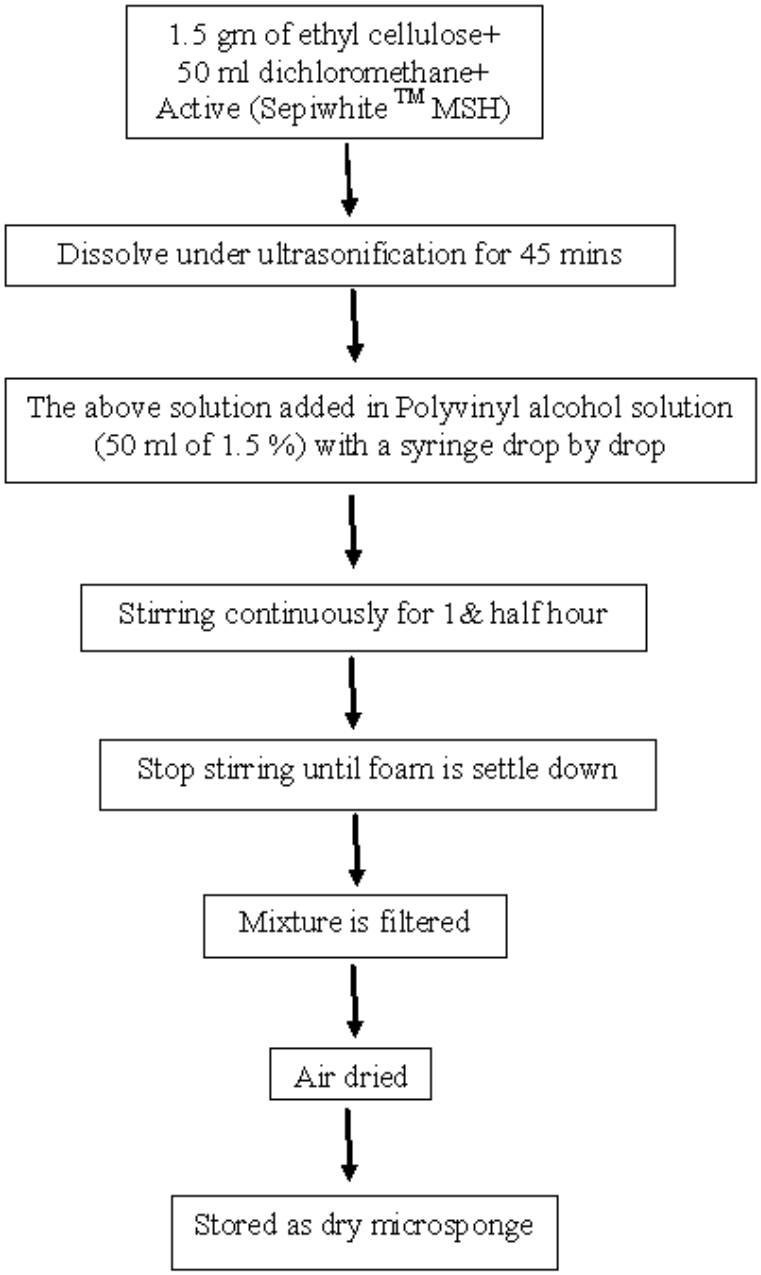
Methods:

1) Preparation of Microsponges (Unloaded)



Flow chart for preparation of Microsponges (Unloaded)

2) Preparation of microsponges (loaded with Sepiwhite™ MSH)



Flow chart for preparation of Microsponges containing sepiwhite ™ MSH.

Formulation of Various Cosmetics

Cream: The ingredients of oil & aqueous phase were heated separately in beaker to 75-80^{0}C. As soon as temperature was reached the oil phase was added to the aqueous phase & mixed well with stirrer. The perfume was added when product was cooled to 40^{0}C. The selected formula for cream containing microsponge loaded with sepiwhite ™ MSH is given in Table 1.

Lotion: The lotion was prepared by the conventional method. The oil & aqueous phase were heated separately in beakers to 75-80^{0}C. As soon as temperature was reached the oil phase was added to the aqueous phase & mixed well with stirrer. The perfume was added when product was cooled to 40^{0}C. The microsponge loaded with sepiwhite™MSH incorporated in all above

products in the concentration of 1%, 2% & 3%. The selected formula for lotion containing microsponge loaded with sepiwhite™ MSH is given in Table 2.

Evaluation of MicroSponges:

Microsponge was evaluated by using different methods such as determination of particle size, photomicrographic valuation, and assay for maximum drug loading of microsponges.

Evaluation of cream and Lotion:

Cream and lotion was evaluated by using different methods such as accelerated stability studies, determination of pH, total fatty substances content, determination of water content, determination of viscosity & determination of thermal stability.[5]

Table 1: Formulation of O/W Cream

S.N.	Ingredients	Quantity taken for 100%		
		F_1	F_2	F_3
1	Stearic Acid	3.0%	3.0%	3.0%
2	Carbopol	0.1%	0.1%	0.1%
3	cetyl alcohol	1.5 %	1.5 %	1.5 %
4	Cocoa Butter	0.5%	0.5%	0.5%
5	Glyceryl Monostearate	6.0%	6.0%	6.0%
6	Emulsifying wax	1.0%	1.0%	1.0%
7	Isopropyl Myristate	12.0%	12.0%	12.0%
8	Sesame Oil	3.0%	3.0%	3.0%
9	Mineral Oil	8.9%	8.9%	8.9%
10	Almond Oil	2.0%	2.0%	2.0%
11	Propyl Paraben	0.15%	0.15%	0.15%
12	Methyl Paraben	0.05%	0.05%	0.05%
13	Glycerine	6.0%	6.0%	6.0%
14	Perfume	q.s.	q.s.	q.s.
15	Color	q.s.	q.s.	q.s.
16	Water	54.8%	53.8%	52.8%
17	Microsponge Loaded with Sepiwhith ™ MSH	1.0%	2.0%	3.0%

Table No. 2: Formulation of Lotion

S.N.	Ingredients	Quantity taken for 100%		
		F_1	F_2	F_3
1	Stearic Acid	2.0%	2.0%	2.0%
2	Cetyl alcohol	1.5%	1.5%	1.5%
3	Petrolatum	4.0%	4.0%	4.0%
4	Lanolin	5.0%	5.0%	5.0%
5	Glycerine	2.0%	2.0%	2.0%
6	Span80	2.0%	2.0%	2.0%
7	Propylene glycol	5.0%	5.0%	5.0%
8	Polyethylene glycol-4000	3.0%	3.0%	3.0%
9	Triethanolamine	1.0%	1.0%	1.0%
10	Propyl Paraben	0.15%	0.15%	0.15%
11	Methyl paraben	0.05%	0.05%	0.05%
12	Perfume	q.s.	q.s.	q.s.
13	Color	q.s.	q.s.	q.s.
14	Water	73.3%	71.3%	70.3%
15	Microsponge loaded with sepiwhite ™ MSH	1.0%	2.0%	3.0%

RESULTS AND DISCUSSION

Two different cosmetic products of different characteristics were chosen as a base or career. They include cream & lotion which is the bases for preparation of various sepiwhite^{TM} MSH inoculated products & all variable parameters in the formulation procedure were optimized in each care. Therefore they were elevated as per respected ISO Accelerated stability studies. These carriers are having more advantage when studied various parameters.

Accelerated Stability Studies:

Table No.3: Effect of pH on Cream at Room Temperature

S.No.	Days	Cream containing Active		
		F_1	F_2	F_3
		1%	2%	3%
1	0 days	7.3	7.3	7.2
2	8 days	7.2	7.2	7.2
3	16 days	7.3	7.3	7.3
4	24 days	7.3	7.3	7.3
5	30 days	7.4	7.4	7.4

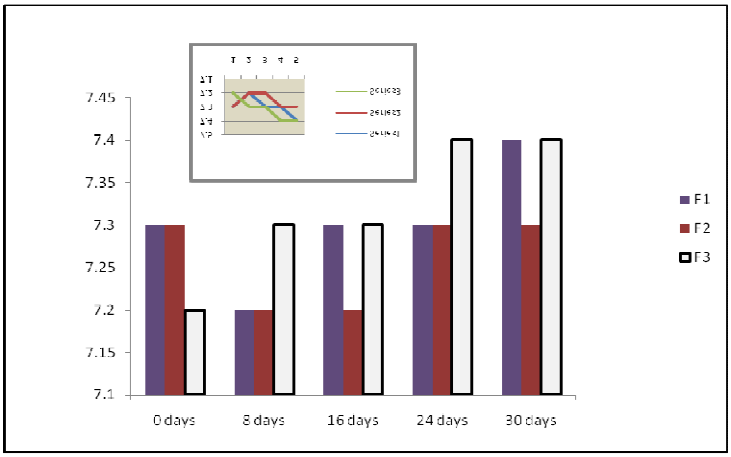


Table No.4: Effect of Viscosity on Cream:

S.No.	Days	Cream containing Active		
		F_1	F_2	F_3
		1%	2%	3%
1	Initial	44328	44600	44711
2	16 days	44401	44650	44801
3	30 days	44450	44706	44861

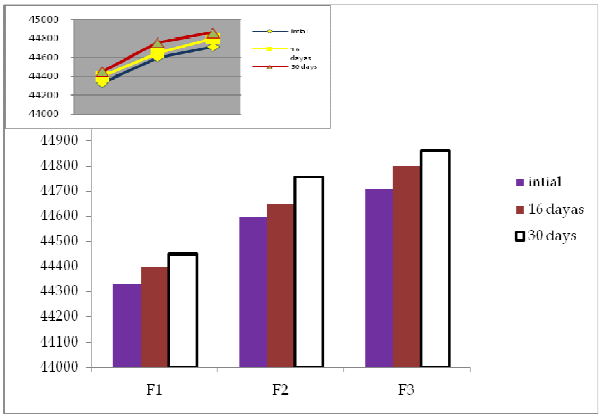


Table 5 : Effect of pH on Lotion at Room Temperature

S.No.	Days	Cream containing Active		
		F_1	F_2	F_3
		1%	2%	3%
1	0 days	6.6	6.8	7.0
2	8 days	7.0	6.8	7.0
3	16 days	6.9	7.0	7.1
4	24 days	6.9	6.9	7.1
5	30 days	6.8	7.0	7.1

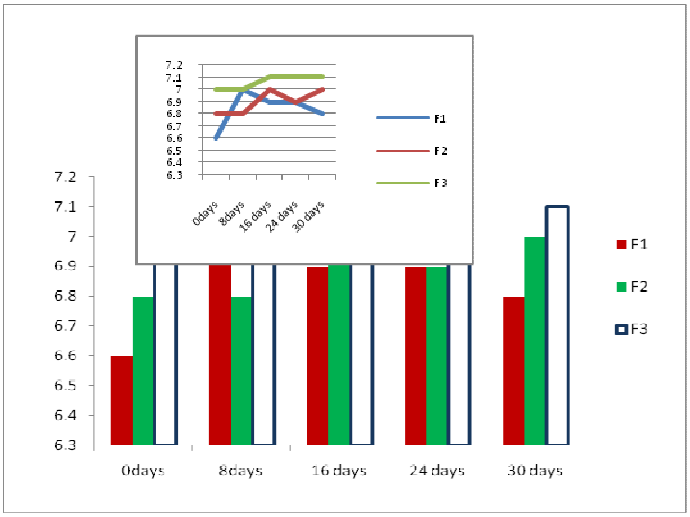
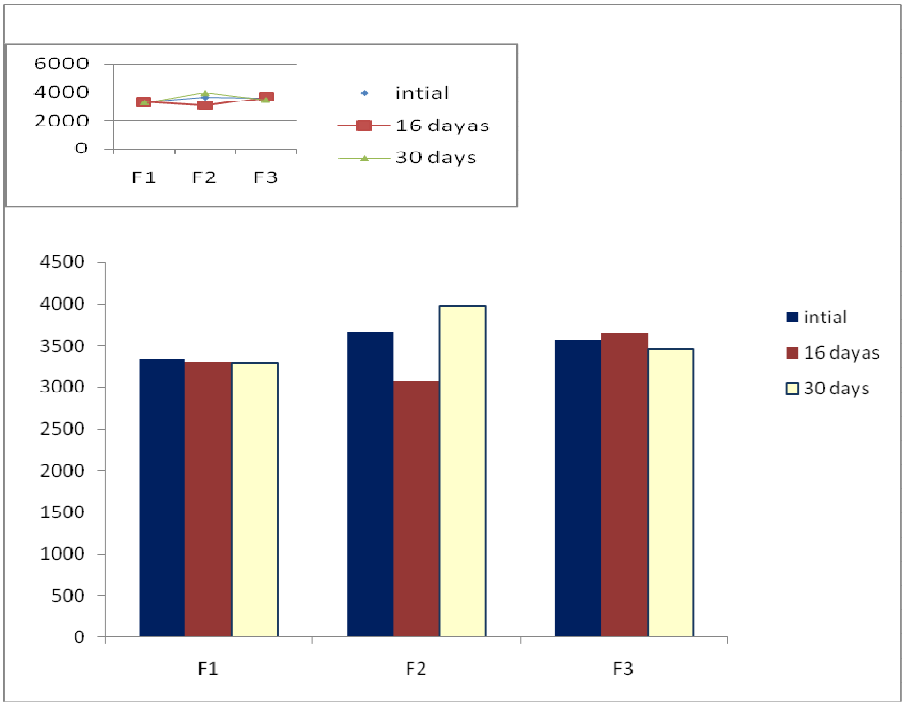


Table 6: Effect of Viscosity on Lotion

S.No.	Days	Cream containing Active		
		F_1	F_2	F_3
		1%	2%	3%
1	Initial	3345	3670	3580
2	16 days	3310	3073	3650
3	30 days	3298	3976	3464



Stability Study of Microsponge:

The present stability is carried out according to guidelines given by International Council of Harmonization (ICH giddiness). In view of the potential Utility of coated & uncoated & ethylcellulose microsponge formulation stability Studies were carried out. The formulation was tested for stability at 5 ± 2^0 C, 25 ± 2^0 C, 40 ± 2^0 C temperature. Formulations were stored in glassed bottles/Vials & them they were evaluated after 15, 30, 45 days for change.

Formulation and Evaluation:

Three different batches of Cream & Lotion with different ingredients were formulated & Formulation 3 (**F_3**) as given in Table 1 and 2 respectively was selected on the basis of optimization.

***In-vivo* studies:**

For Cream and Lotion:

Patch test/ Photographic Evaluation:

i) Material: Product Containing active

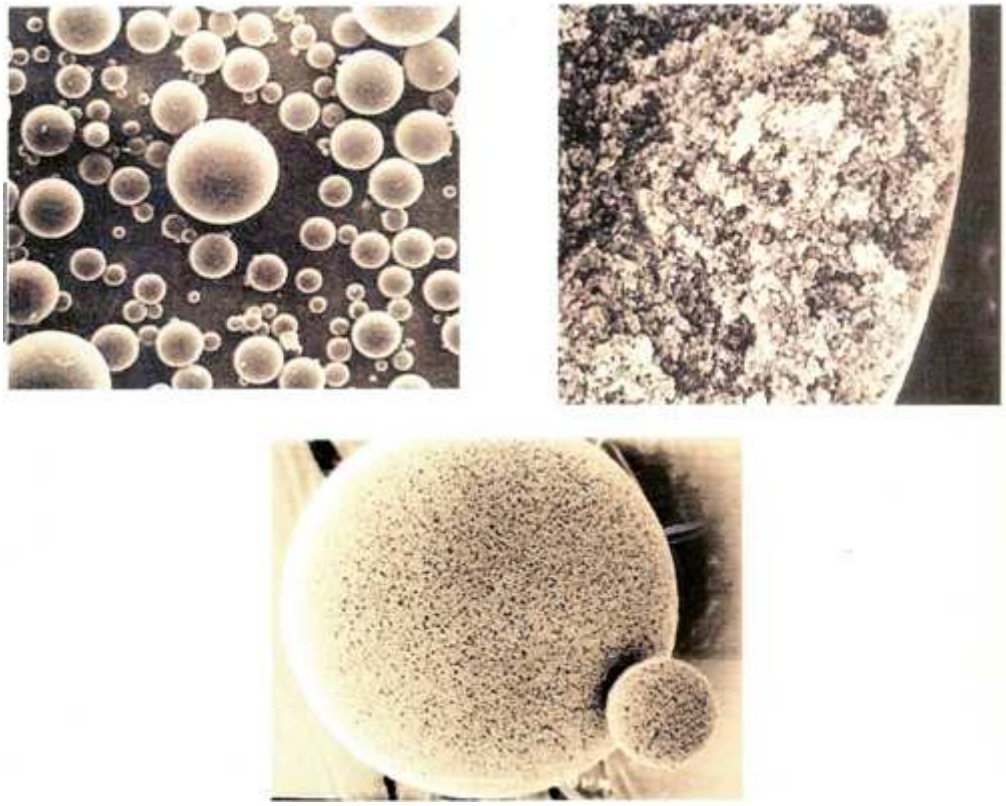
ii)Preparation of Sample : Sample of Product Containing active was prepared with known concentration.

iii)Selection of volunteers: The healthy Subjects were selected.

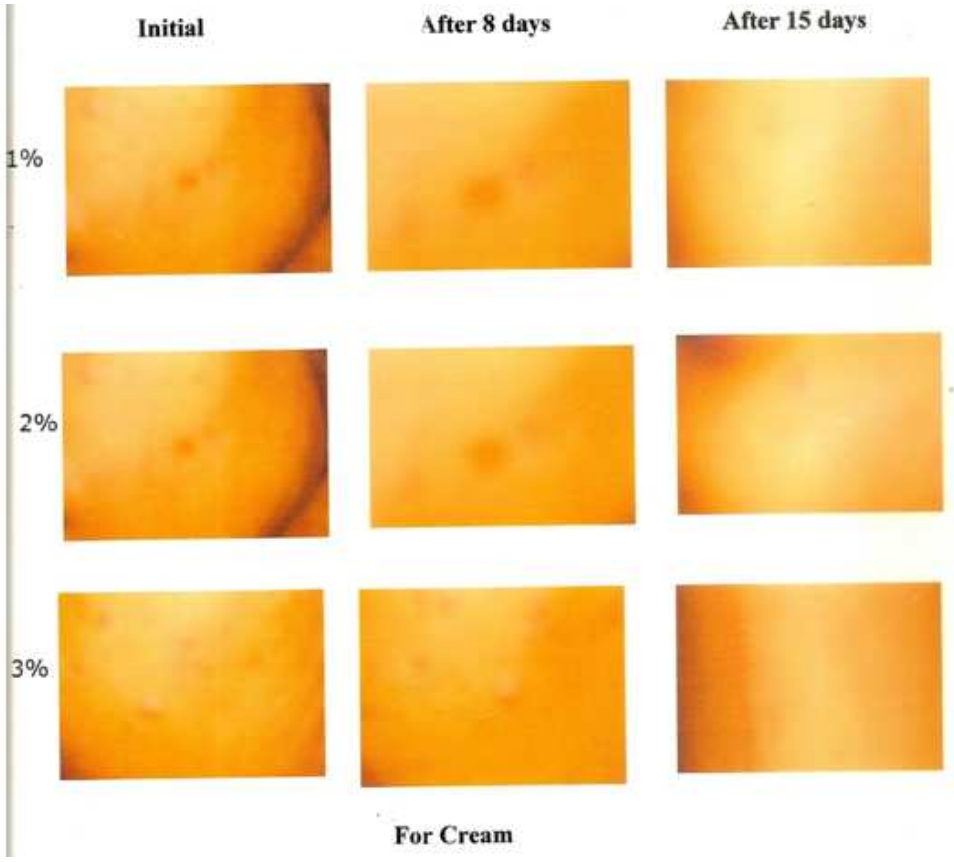
iv) Mode of Execution.

Different blemish areas are marked on skin & labelled as controlled product. Sample is applied daily twice and observations are noted. Photographs were taken after interval of weeks.

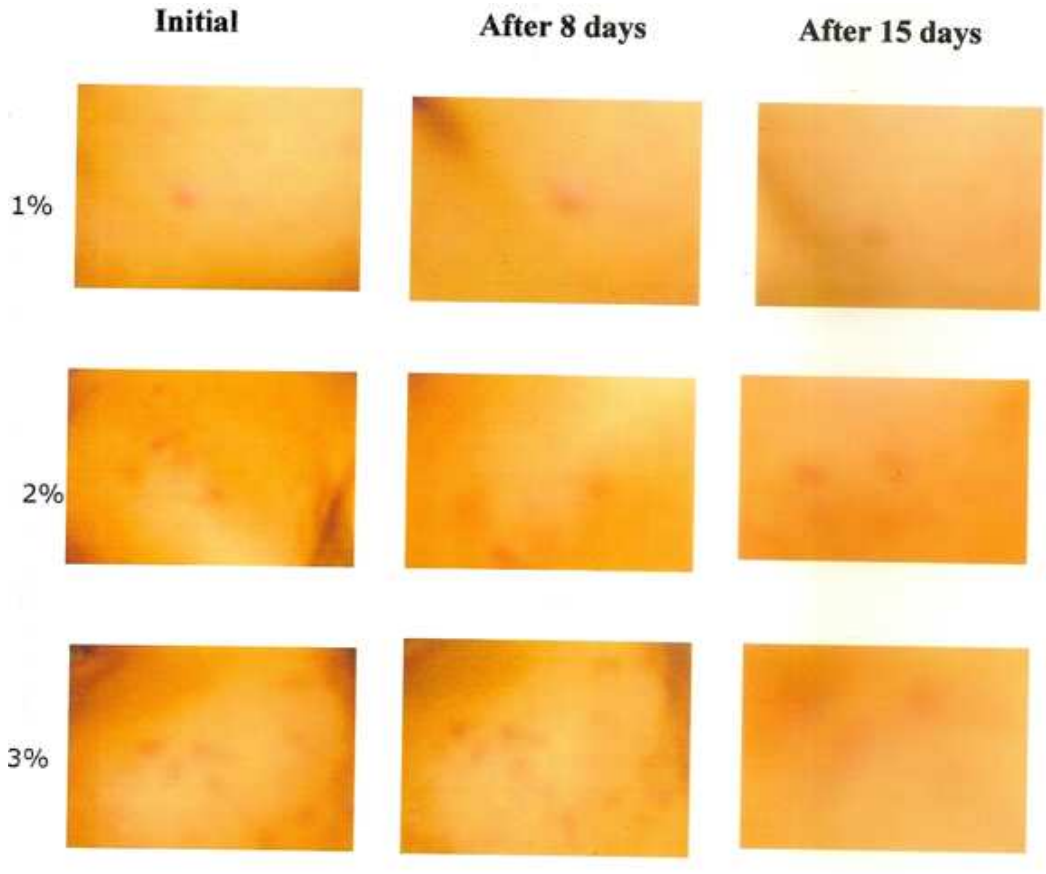
Photographic evaluation of microsponges



***In-vivo* testing for anti-blemish property**



For Cream



For Lotion

CONCLUSION

The microsponge delivery system originally developed for topical delivery of drugs provides a wide range of formulating advantages. The formulation **F_3** of Cream and Lotion after incorporation of Microsponge were satisfied all desired characteristics and acts as a novel cosmetic product. The microsponge delivery System increases the safety of irritating and sensitizing drug and programmed released can control the amount of drug release to the targeted site.

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