Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

Der Pharmacia Sinica, 2011, 2 (5): 81-87

Der Pharmacia Sinica
ISSN: 0976-8688
CODEN (USA): PSHIBD

Physical characteristics of three component creams containing span (60, 80) as surfactants

Sudarshan S. Joshi* and Shashikant D. Barhate

Department of Pharmaceutics, Smt.Sharadchandrika Suresh Patil College of Pharmacy, Chopda, Maharashtra, India

---

ABSTRACT

The objective of present study was to analysed microstructure, stability and rheology of model emulsion cream prepared with distilled water, shata-dhauta-ghrita and different span (60, 80) as emulsifiers. The spans 60, 80 which are different from each other in length or structure of fatty acid side chain. The effect of water content and spans concentration were studied. The centrifugation is believed to be an excellent tool for evaluation of accelerated deterioration of cream. The rheological studies performed on Brookfield LVDV-3 ultra viscometer. The generated data of shear stress, shear rate and viscosity of formulations were used to understand the rheological characteristic of cream. The result of rheological study indicates that formulation were non-Newtonian system because shear rate changes the formulation show change in viscosity. The creaming stability decreased with increasing water content and enhanced with higher span 60 concentrations. Microscopic evaluation of cream showed that using single surfactant (span 60) and decreasing its concentration did not affect emulsion stability.

Keywords: Sorbitan monostearate, Sorbitan monooleate, microscopy, stability, centrifugation.

INTRODUCTION

To develop a cream, at least three components are needed; oil, water and surfactant. Surfactants possessing both polar and non-polar regions on the same molecule adsorb to the phase interfaces and decrease the interfacial free energy. Usually creams contain surfactants more than is required to form monomolecular interfacial films [1]. Excess amount of surfactant interacts with other components either at droplet interfaces or in the continuous phase to produce complex multiphase formulations. The characters and concentrations of surfactants are important factors affecting the structure and the rheological properties of creams [2]. Stability is a very important

parameter to know the applicability of an emulsion to produce more complex system. Because the emulsion studied in this work are wanted to do used in the formulation of reduced lipid content foods, a relatively high stability is needed to get a product of invariable quality during the required time[3]. The objective of this work was to obtained w/o cream emulsion and to investigate how the component used and ration of the components of cream that influenced the structure and rheological properties of the creams.

MATERIALS AND METHODS

Material

Sorbitan monostearate, Sorbitan monooleate were received from S.D. Fine Chemicals Ltd., Mumbai. All the other solvents and chemicals used were of analytical grade.

Preparation of transdermal acyclovir cream

Different proportion by weight of oil and corresponding span were manually mixed. To allow homogenization of mixture, solid span 60 was previously melted at 60^0C, whereas for liquid span 80, only a slight manual mixing at room temperature was enough. Cream was prepared by melting the oil phase consisting of shata-dhauta-ghrita, sorbitan monostearate and Sorbitan monooleate at 70^oc in porcelain dish placed on water bath. Add aqueous phase through beaker to oil phase with constant stirring and maintaining temperature 70^oc for 10 minutes (total sample weight 50g). Cool down to 50^oc with mixing. Continuous mixing for 15 minute at temperature of 45^oc. Cool down to 25^oc to 30^oc. in emulsion prepared with span 60, the emulsifier concentration was varied from 2-3% w/w and water content from 10-40% w/w. in emulsion containing span 80, the emulsifier concentration was maintained at 3%.

Evaluation of transdermal acyclovir cream

Physical parameters

The physical evaluation of formulation is important as physical characteristics of formulation are directly related with patient acceptance. Thus various physical parameters were checked at initially and also at each stability time point. The physical parameters involved- Colour, Smoothness, Homogeneity.The result is given in the Table No. 4

Optimization of cream base for consistency

Different trials were taken by using different concentration of *shata-dhauta-ghrita* to determine the consistency of formulation given in Table no.1.

Table No. 1 Trials with different concentration of *Shata-dhauta-ghrita*

Sr. No.	Ingredients	Conc. in (%w/w)			
		B1	**B2**	**B3**	**B4**
1	*Shata-dhauta-ghrita*	60	70	80	85

The viscosities of these trials were measured by Brookfield LVDV-III ultra viscometer at 20 RPM for 15 seconds at 25°C [4] given in Table no. 3

Concentration of surfactants for stabilization of emulsion (B4, B5, B6)
In the trial batches, two surfactants span 60 and span 80 were used. Both the surfactants used are hydrophobic.

HLB of Sorbitan monostearate (span 60) = 4.7

HLB of Sorbitan monooleate (span 80) = 4.3

As the formulation to be prepared was w/o emulsion with oil as external phase, the surfactant used must have lower HLB value between 3-8.

Table No. 2 Trials with different ratio of surfactants

Sr. No	Ingredients	Conc. in (%w/w)					
		B1	B2	B3	B4	B5	B6
1	Sorbitan monostearate(span 60)	2	2	2	2	3	2
2	Sorbitan monooleate (span 80)	3	3	3	3	--	--

All the previous batches were formulated with both the surfactants. Consistency was found good but the drug was not uniformly dispersed. Trial batch with single surfactant was also formulated. Stability of emulsion was also checked by decreasing the concentration of surfactant. Microscopic evaluation of cream showed that using single surfactant (span 60) and decreasing its concentration did not affect the emulsion stability given in Table no. 2

Rheological studies
Rheological studies were carried out on Brookfield LVDV-III ultra viscometer using small sample adopter and SCW-7 spindle. The choice of accessories was based upon the requirement of small sample of acyclovir cream. The data at 10, 20, 30, 40, 50 and 70 RPM was accumulated with respect to % torque, viscosity, shear stress and shear rate at 25 ^{0}C for characterization of the prepared systems [5, 6, 7, 8, and 9].

Microscopic Evaluation
Microscopic evaluation of all formulated batches was done by using Compound microscope with the help of MOTIC software. Evaluation of the sample was carried initially and after each stability condition. Clean and dry glass slide and cover slip was taken. Very small quantity of sample was taken on glass slide. Sample was covered by placing cover slip on it. Precaution was taken that there was no entrapment of air. Cover slip was slightly pressed to spread the sample uniformly to prepare the thin film. It was observed under microscope with different power of lenses like 10x, 40x and 100x.

Centrifugation
Centrifugation is believed to be an excellent tool for the evaluation of accelerated deterioration of cream. Stability of formulated cream to centrifugation was determined in 10ml graduated cylinder at 10,000 rpm for 10min using a research centrifuge [10].

RESULTS AND DISCUSSION

Six formulations were prepared using two different Sorbitan monoesters as a surfactant. The formulations were selected based on comprehensive preliminary test on each surfactant(Table No. 01- 04 & Figure No. 01-02)

.

Optimization of cream base for consistency

From Table No 1, base selection was carried out in B1, B2, B3 and B4. First batch was formulated and drug was incorporated in aqueous phase, this aqueous phase was slowly added to oil phase with constant stirring, consistency suddenly found to be dropped and drug phase was not dispersed uniformly. In next batch B2, the concentration of shata-dhauta-ghrita was increased up to 70%, it gave smooth texture to cream but consistency again found to be dropped. After that to improve the consistency, 80% w/w of shata-dhauta-ghrita was incorporated in oil phase, it not only gave smooth texture to cream but also having good consistency and homogeneity; viscosity was still found low and it showed tackiness. In next trial (B4) the quantity of shata-dhauta-ghrita was further increased to 85%. After evaluation it was found that B4 having good consistency and viscosity.

Table No.3 Initial evaluation of formulation batches

parameter	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**
Viscosity (Centi-poise)	8645	8765	9013	9645	8514	8856

Table No. 4 Determination of physical parameters of formulation

Batch	**Color**	**Consistency**	**Smoothness**	**Homogeneity**
B1	White	Need to improve	-	Need to improve
B2	White	Need to improve	-	Need to improve
B3	White	Consistent	smooth	Homogeneous
B4	White	Consistent	smooth	Homogeneous
B5	White	Consistent	smooth	Homogeneous
B6	White	Consistent	smooth	Homogeneous

Selection of surfactants for stabilization of emulsion

After the cream base selection and optimization, trials with different surfactants were taken to check the stability of emulsion by using different surfactants. All the previous batches up to B4 were formulated with combination of span 60 and span 80. Next trial was carried out with only span 60 and B6 with reduced concentration of span 60 (Table No.2). Microscopic evaluation of B4, B5 and B6 showed that all trials exhibited stable emulsion with uniform particle size (Fig No.1). Hence it was concluded that formulation with single surfactant could be formulated without affecting the stability.

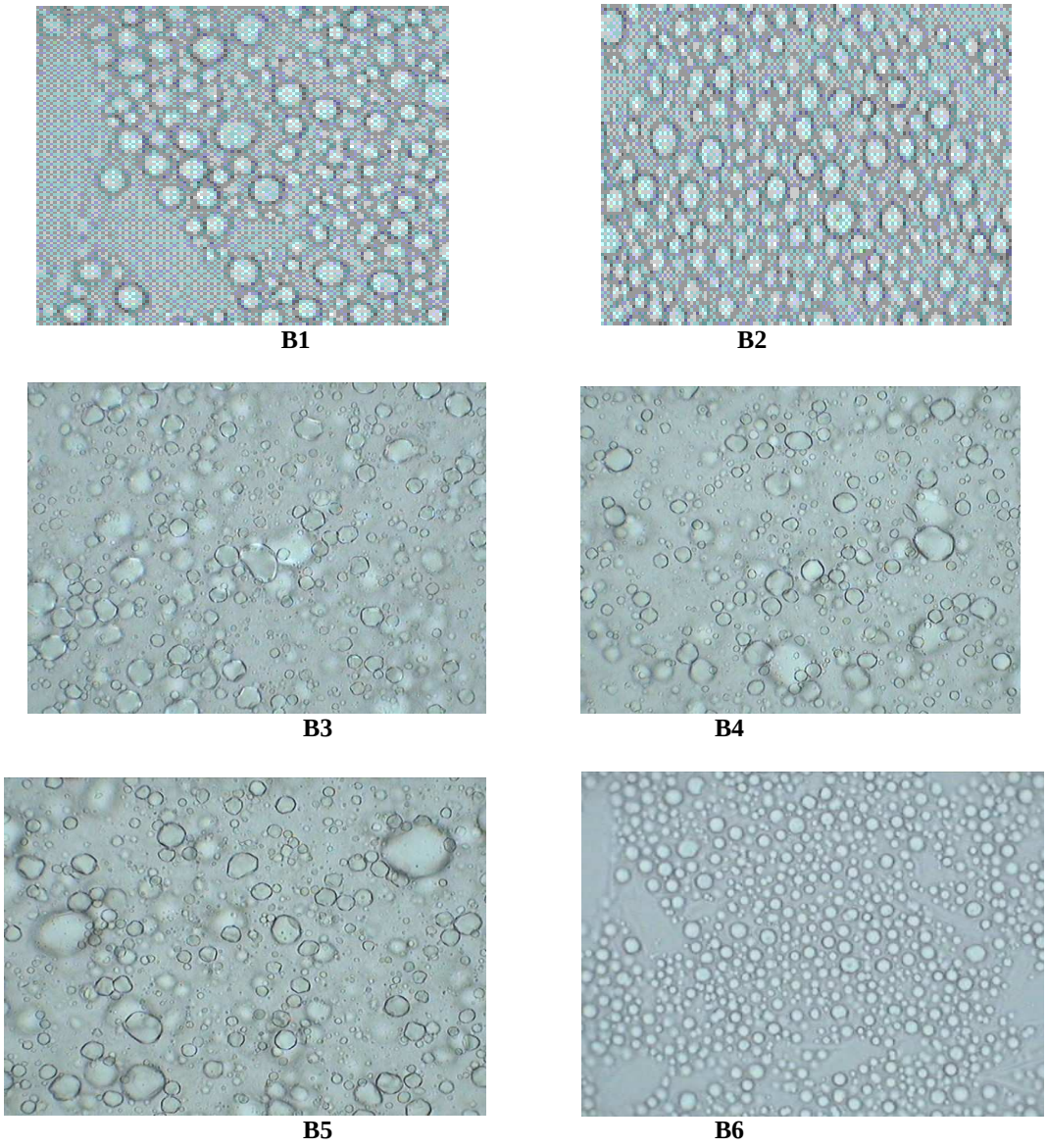

Figure No.1 Microscopy of Formulation batch

In the viscosity test, w/o cream behaved thixotrophy (fig no. 2). The creams were thixotropic and shear-thickening dilatant. Formulation B1 and B2 had similar flow curves. Formulation B3 and B4 had grater thixotropical loops than formulations B1 and B2. Up curves of formulation B5 and B6 indicates shear thickening, down curves slightly shear thinning properties. The thixotrophy system is very advantageous and is more convenient than ideal viscous system from technological viewpoint of formulation.

There was no any evidence of phase separation during centrifugation in five different formulation of cream. From microscopy it was observed that the uniform sized globules were distributed throughout emulsion (Figure no.2). A visual analysis of microstructure indicates that

the number of internal water droplet per oil surface is decreased with increasing water content within range of 10-40% distilled water.

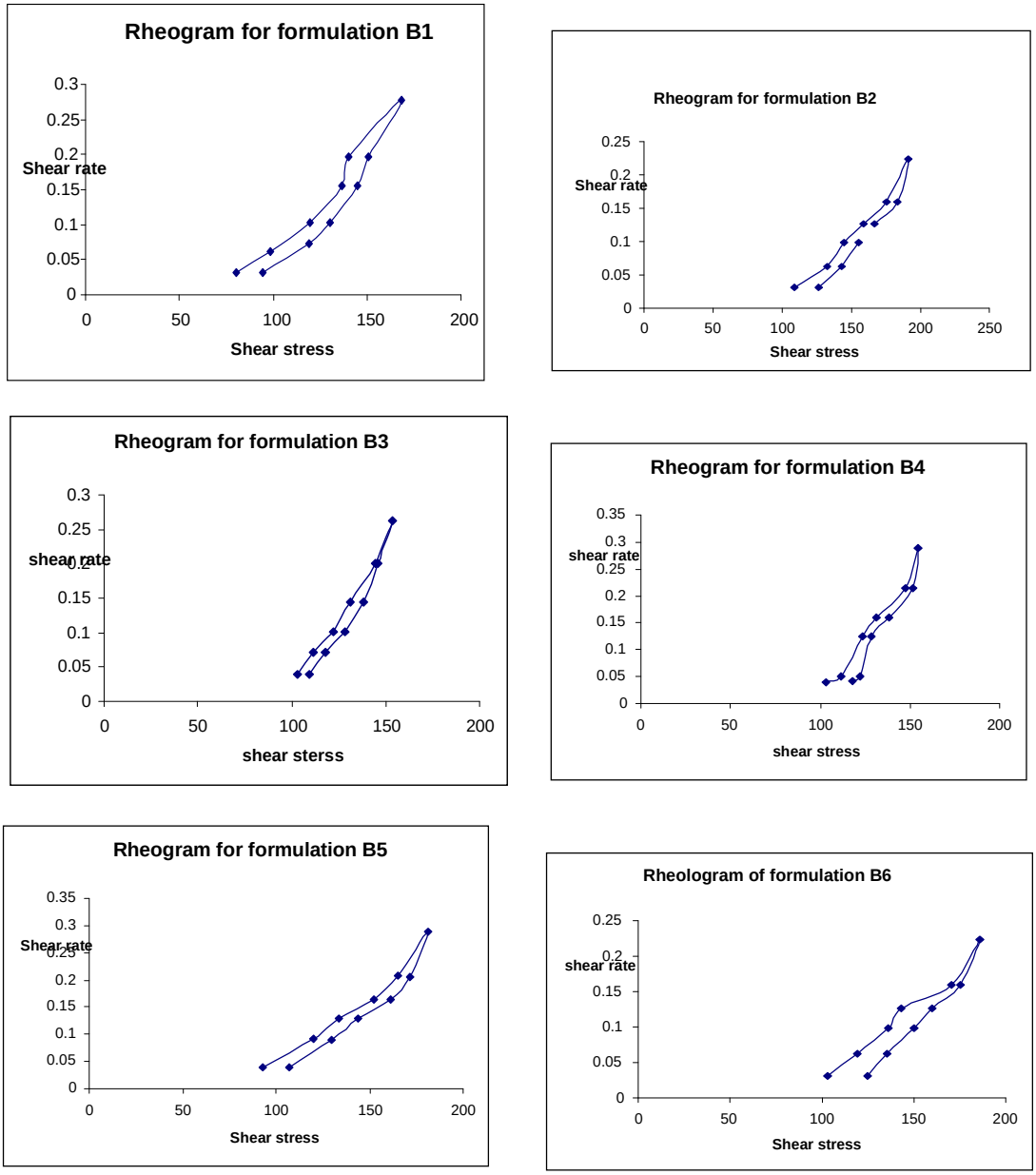

Figure No.2 Rheogram of formulation B1 to B6

CONCLUSION

W/o emulsion were formed with percentage of water between 10 and 40%. It was determined that the higher the water content, lower the amount of internal water droplets. Among the formulation, it was found that B4 showed good consistency and homogenicity. Microscopic

evaluation of cream showed that using single surfactant (span 60) and decreasing its concentration did not affect emulsion stability.

Acknowledgements
The authors are thankful to Smt. S.S.Patil College of pharmacy chopda, Maharashtra for all facilities and encouragement provided by them.

REFERENCES

[1] Andres L.Morquez, Gonzalo G. Palazolo, *Colloid polyscience* **2007**.285 1119-1128.
[2] Martin, A., **1993**. Rheology. In: Martin, A. (Ed.), Physical Pharmacy, fourth ed. Lea and Febiger, Philadelphia, pp. 453-476.
[3] Mirka Korhonen, Johanna Lehtonen, *International journal of pharmaceutics* **2002**. 247,103-114.
[4] Pourushotham Rao K., Khalia K., *International journal of Pharma and bioscience* **2010**. 1, 1-11.
[5] Barnes, H.A., *Colloid. Surf.* **1994** 91, 89-95.
[6] Barry, B.W., Warburton, B., *Cosmetics. J. Soc. Cosmet. Chem*. **1968** 19, 725-744.
[7] Shashikant D. Barhate. *Der Pharmacia Sinica*, **2011**, 2 (2): 185-189
[8] Ankur Jain, Surya P Gautam, Yashwant Gupta, *Der Pharmacia Sinica*, **2010**, 1 (3): 221-231
[9] Sayyed Nazim, M.H.G Dehghan, Siraj Shaikh and Afsar Shaikh. *Der Pharmacia Sinica*, **2011**, 2 (2): 227- 235.
[10] Vuru Prasad, A.K.Dorle. *Journal of ethanopharmacology*. **2006,** 107. 38-47.