P-038

Rheological properties of sesame oil emulsions

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INTRODUCTION AND OBJECTIVES

Oil-in-water (O/W) or water-in-oil (W/O) emulsions used in personal care applications need to satisfy a number of criteria including the right consistency for skin application, good skin feel, good spreading and good delivery of actives (Tadros 2004). Therefore, the physical characteristics of the cosmetic or pharmaceutical product, and particularly its rheological properties and the size of the droplets of oil dispersed in the water, play also an important role in the current drug administration (Tadros 2004; Roland 2003). The knowledge of the rheological properties of such products is also important in the processing, the handling, the process design and the product development. The median size as well as the distribution of sizes are very important since they determine the safety of the preparation in the case of intravenous preparations or the release properties of the active ingredient in topical formulations (Roland 2003). This work aims to develop and to analyse a W/O emulsion formulation with potential application in cosmetic industry.

MATERIALS AND METHODS

Phase diagrams were built by visual inspection of ternary systems made of surfactant (S) and co-surfactant (CS) admixtures [Tween® 20 - Vetec Química fina Ltda, Brazil (S) and Span® 80 Vetec Química fina Ltda, Brazil (CS)] at the proportion from 10:0 to 0:10, Sesame oil (Vital Âtman Ltda, Brazil), as oil phase, at proportions from 1:9 to 9:1, respectively and distilled water (Figure 1).

The dispersed systems obtained during the performance of the phase diagrams were classified according to their physical and chemical aspects, like ME (microemulsion), LEM (liquid emulsion), CEM (cream emulsion) and PS (phase separation). After the construction of the phase diagram, seven CEM formulations were obtained from a certain region of these pseudo-ternary diagrams.

These emulsions were produced varying the HLB (hydrophilic-lipophilic balance) value and the concentration of surfactants (Table 1). The emulsions were made by the phase inversion method. The aqueous and oily phases were separately heated at 70 ± 2° C and then the aqueous phase was slowly added to the oil phase under constant stirring (Ultra-Turrax, T18, Ika, German at 13000 rpm) for ten minutes.

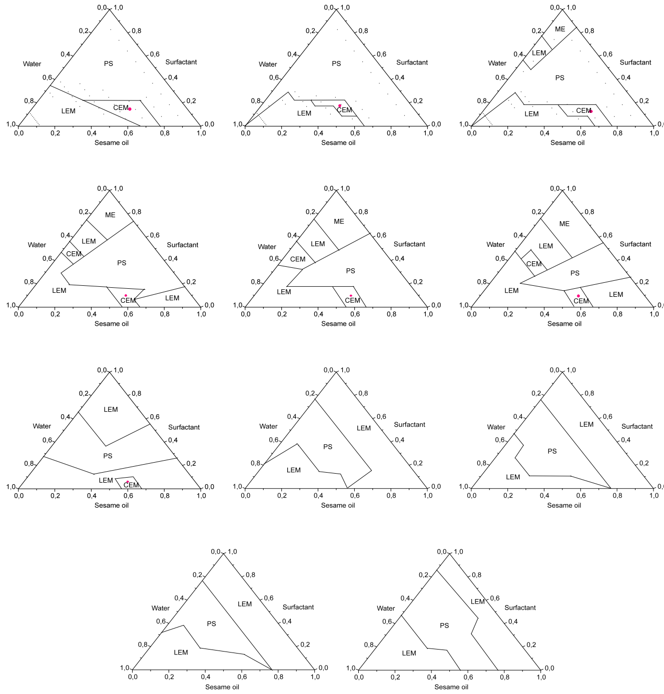

Figure 1: Phase diagrams.

Table 1: Composition of the emulsion formulations.

Formulation	Formulation composition ($\%_{w/w}$)				
	HLB	Oil	Span 80	Tween 20	Water
F1	16.70	54.00	-	14.00	32.00
F2	15.46	43.00	1.70	15.30	40.00
F3	14.22	59.00	2.60	10.40	28.00
F4	12.98	54.00	3.00	7.00	36.00
F5	11.74	53.00	4.00	6.00	37.00
F6	10.50	54.00	5.00	5.00	36.00
F7	9.26	57.00	3.60	2.40	37.00

Rheological studies were performed on a Haake RS600 rheometer equipped with a stainless steel cone/plate measurement device of 35 mm in diameter, a cone angle of 2° and a gap of 105 µm.

Particle size analysis was performed by using a laser diffractometer Mastersizer 2000 with the Hydrosizer 2000S module (Malvern Instruments, UK). The sample was extemporaneously dispersed in purified water at 2500 rpm until an obscuration rate of 5–18% was achieved. Background and sample were measured for 12 s. Each sample was measured in triplicate.

RESULTS AND DISCUSSION

The rheograms of all emulsions revealed a pseudo plastic-type behaviour (Figure 2). For the same shear rate, the emulsions showed an adequate viscosity value, predicting a good topic application. The ascending and descending flow curves of Sample F1 showed hysteresis, usually referred as a 'thixotropic loop'(Figure 3).

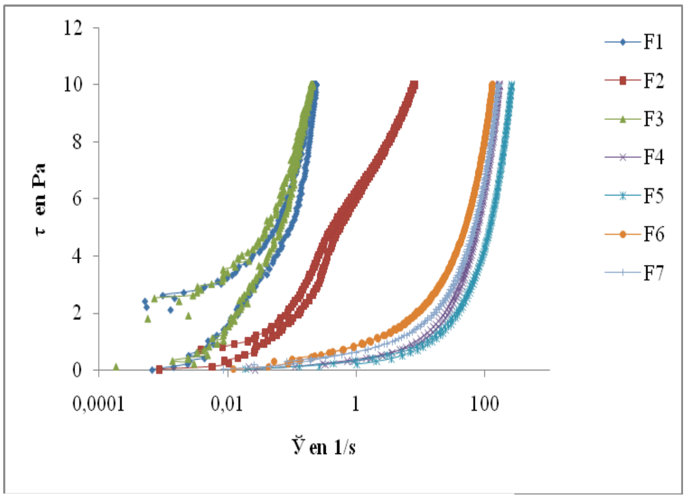

Figure 2: Rheograms of all formulations.

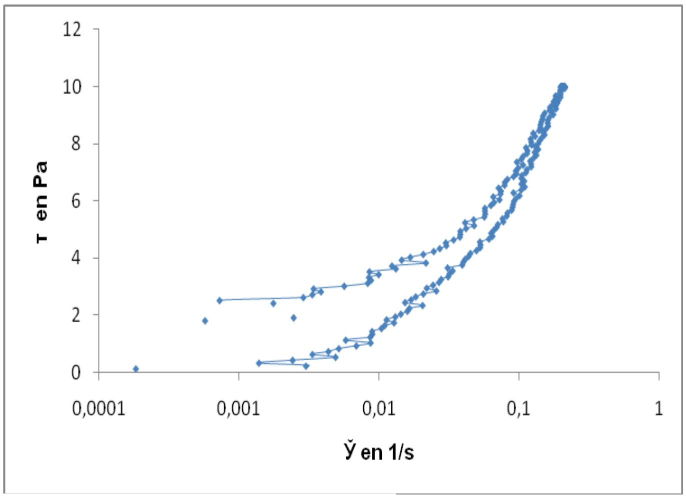

Figure 3: Sample F3 rheogram.

Thixotropy is wanted in topical formulations because they are deformed during application and become fluid, then, facilitating the spreading process. The recovery of the initial viscosity after application prevents the product from dripping. Knowledge of rheological properties of topical treatments is essential because the determination of their viscoelastic parameters, critical stress value and hysteresis index is a good technological tool to predict their spreading ability on the skin.

As expected for the method applied to production, the formulations showed small droplet size. However, there was variation in the average size according to the composition of each formulation (Figure 4). The better results were found to formulation F1 and F3 (0.482 ± 0.007 and 0.469 ± 0.003, respectively).

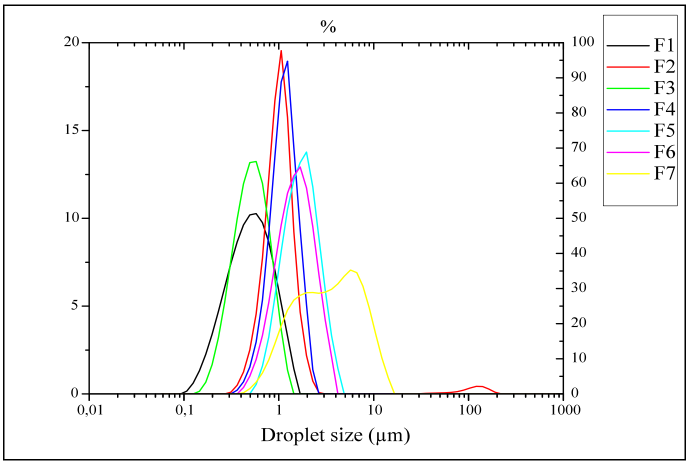

Figure 4: Droplet size of all formulations.

Increasing on surfactant concentration increased the viscosity. This occurs because increasing the concentration of surfactant decreases the size of oil droplets and increases the viscosity and emulsion stability. Thus, the type and concentration of surfactant influence the stabilization and rheological properties of emulsions.

CONCLUSION

The rheological characterization and the size analysis presented in this study is of great relevance for further development studies on cosmetic products using Sesame oils as oil base. Therefore, in accordance with the intended aim related to the industrial production, to the physical stability, and to the application and/or the cosmetic effect, certain formulations with specific rheological features can be more suitable.

REFERENCES

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