Surfactant Influence on the Preparation of Olive Oil Self-Nanoemulsifying System

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1. INTRODUCTION

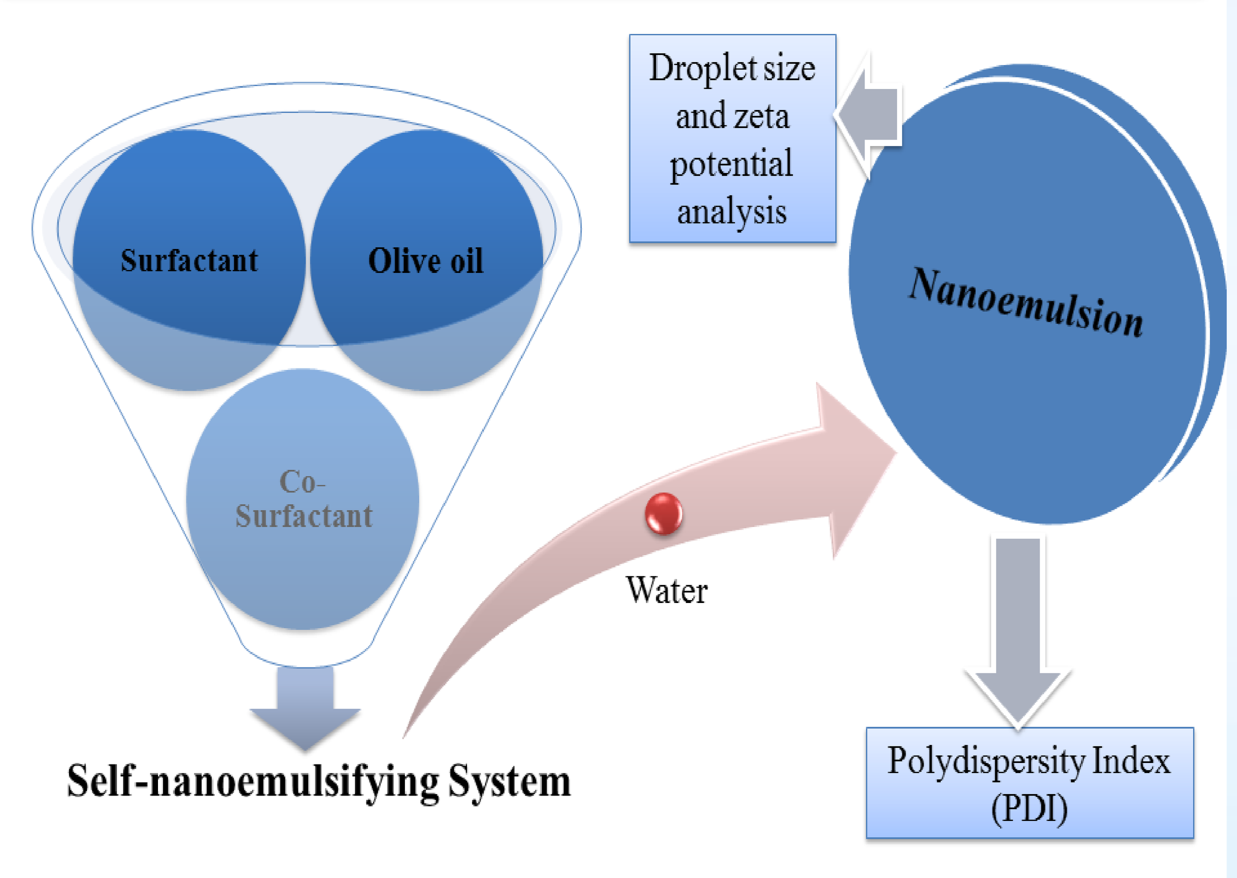
Nanoemulsion is named according to its droplet sizes that ranging in the nanometers between 20 nm to 200 nm [1,2]. Its high kinetic stability, low viscosity and optical transparency make them very attractive systems for many industrial applications. Recently, nanoemulsion has been highlighted as one of the most promising drug delivery system by reason of drug delivery with unique ability [3].

Self-nanoemulsifying system is an hydrous isotropic mixture of oil surfactant(s) and co-surfactant(s) [4]. Olive oil has been used to treat chronic diseases such as atherosclerosis, diabetes, asthma, colon cancer, arthritis and hypertension [5]. It also promotes the accumulation of HLD cholesterol that gives health benefits to the cardio vascular system [6]. In addition to that, it is useful as anti-inflammatory agent [7] and in cancer prevention [8]. This study aimed to prepare Self-nanoemulsion containing olive oil for systemic and topical applications.

2. METHOD AND MATERIALS

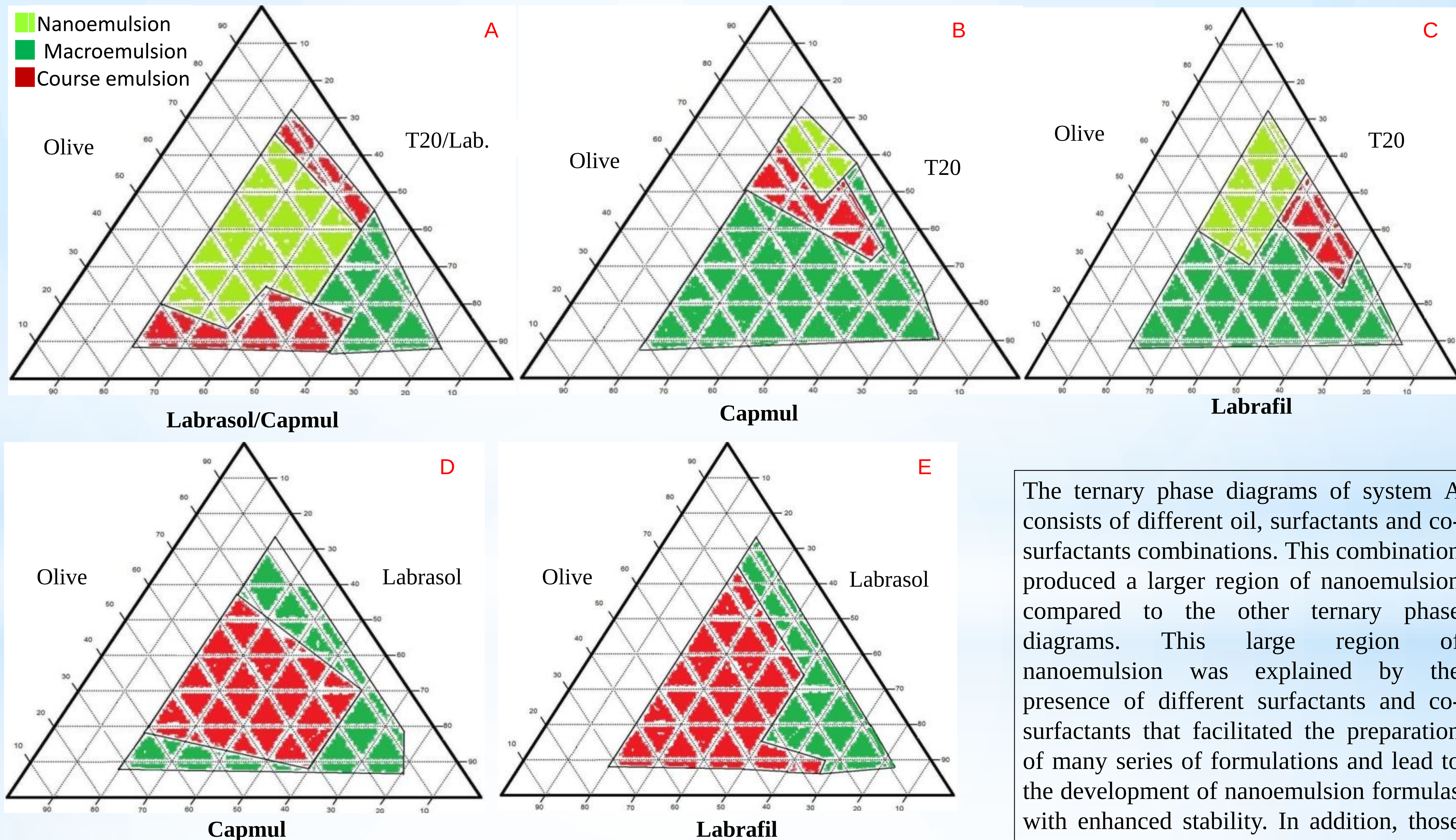
Olive oil (Organic Corporation). Labrasol, Labrasol and Labrafil were obtained from Gattefosse SAS (France). Capmul was purchased from the Abitec Corporation (USA) and Tween 20 was a product of Sigma-Aldrich (USA).

Self-emulsifying formulations were prepared by combining olive oil with different surfactants and co-surfactants. System A was composed of a mixture of oil, Tween 20/Labrafil (2:1), and Labrasol/Capmul (1:2). System B consisted of Swietenia oil, Tween 20 and Capmul. System C was a mixture of Swietenia oil, Tween 20 and Labrafil whereas System D combined oil, Labrasol and Capmul. Finally System E was comprised of a mixture of oil, Tween 20 and Capmul. Each formulation was prepared by weighing olive oil and surfactants. The oil/surfactants mixtures were self-emulsified with water to produce nanoemulsion.



3. RESULTS AND DISCUSSION

The ternary phase diagram constructed and presented in fig 1, was used to aid in finding the concentration range of nano-emulsions components [4]. Tween has good emulsification property, which may be due to its excellent miscibility between components in the system. Szuts and Szabo-Revesz; Leong *et al.*, found that nanoemulsion that used high HLB value like Tween as surfactant has good emulsification properties. The formation of self-nanoemulsifying system is critical because it depends on the selection of surfactant mixtures. Usually there is a specific HLB value for each surfactant and oil. The selection of the right HLB for a surfactant or blend of surfactants which match the oil HLB, will lead to provide the lowest interface tension between the oil and water phases.



The ternary phase diagrams of system A consists of different oil, surfactants and co-surfactants combinations. This combination produced a larger region of nanoemulsion compared to the other ternary phase diagrams. This large region of nanoemulsion was explained by the presence of different surfactants and co-surfactants that facilitated the preparation of many series of formulations and lead to the development of nanoemulsion formulas with enhanced stability. In addition, those systems which contain Tween 20 as one of their surfactants were capable of producing nanoemulsion.

Formulation	Tween 20 /Labrafil (%)	Labrasol/ Capmul (%)	Olive oil (%)	Droplet size (nm) ± SD	Uniformity ± SD	Zeta-Potential (mV)
A	32.0	48.0	20.0	167 ± 1.1	0.291 ± 0.003	-30.9
B	40.0	40.0	20.0	164 ± 0.5	0.226 ± 0.006	-28.2
C	32.0	32.0	36.0	174 ± 0.9	0.332 ± 0.001	-25.3
D	40.0	10.0	50.0	180 ± 2.1	0.210 ± 0.005	-30.1
E	48.0	32.0	20.0	173 ± 2.0	0.402 ± 0.008	-21.2
F	38.4	25.6	36.0	165 ± 1.3	0.378 ± 0.007	-22.2
G	56.0	24.0	20.0	137 ± 0.9	0.340 ± 0.002	-29.8
H	44.8	19.2	36.0	185 ± 1.2	0.428 ± 0.001	-29.4
I	**35.0**	**15.0**	**50.0**	**121 ± 2.1**	**0.128 ± 0.003**	**-35.4**
J	64.0	16.0	20.0	192 ± 1.8	0.450 ± 0.004	-28.0

All data are presented as mean ± SD, (n= 3)

The ternary phase diagram of System A shows that System A had the smallest droplets size compared to Systems. Ten formulations were found to produce droplets size below 200 nm as showed in the table. The smallest droplet size formulation was 121 nm with 0.128 PDI and it shows zeta potential -35.4, which indicates good stability of the formulation.

4. CONCLUSION

Self nanoemulsifying formulations containing olive oil were successfully prepared by mixing the oil with various types of surfactant and co-surfactants. The self nano-emulsifying systems were sensitive to the oil/surfactant/co-surfactant ratios and the properties of the surfactant/co-surfactant phase. The use of surfactant/co-surfactant mixtures help to reduce the oil droplet size when compare to the use of single surfactant. Also the formulation greatly improved the nanoemulsion and show better nanoemulsion properties when Tween 20 is present in the surfactants mixtures.

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