P-020

Encapsulation of orange peel essential oil using ethanol as a cosurfactant

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INTRODUCTION AND OBJECTIVES

Microemulsions are homogeneous, clear solutions of different ratios of oil, surfactant, cosurfactant and water with nanoparticle sizes (Feng *et al*., 2009). Microemulsions can be used for coating of volatile compounds such as essential oils to increase their stability during storage or processing (Zhong *et al*., 2009), but their applications are restricted by the surfactant and cosurfactant type in the foods (Flanagan *et al*., 2006). The objective of this study was to evaluate the ability of different food grade surfactants for forming microemulsions with orange peel oil and ethanol and therefore encapsulation of orange peel oil. After being successful in making orange peel oil microemulsions, the characteristics of corresponding systems would be evaluated in the next steps.

MATERIALS AND METHODS

Materials

Orange peel oil was purchased from Giah Essance Company (Isfahan, Iran). Tween 20, Tween 60 and Tween 80 were purchased from Merck chemical company (Darmstadt, Germany). Commercial grade soy lecithin was purchased from Behpak Industruial Co. (Behshahr, Iran) and purified by deoiling with aceton, following by fractionation with ethanol.

Formation of microemulsions

Lecithin, Tween 20 (T20), Tween 60 (T60) and Tween 80 (T80) as surfactants in combination with ethanol as cosurfactant (surfactant : cosurfactant ratio 1:1) were used for preparation of microemulsions. The microemulsions were prepared by diluting water/surfactant–cosurfactant mixtures with orange peel oil (OPO), or by diluting oil/surfactant–cosurfactant mixtures with water. The optical transparency change of samples was evaluated by visual observation (Polizelli, 2006).

Phase diagrams

The phase diagrams were constructed with data from surfactant/cosurfactant (S/CS) titration measurements to find the points that represent transparent, one-phase systems (regions where OPO are capsulated by surfactant/cosurfactant with nanosizes). The surfactant with the largest area of microemulsification on phase diagram was chosen and its microemulsions with the ratio of 2:1 and 1:2 with ethanol were prepared to evaluate the effect of surfactant/cosurfactant ratios as well.

RESULTS AND DISCUSSION

Using microemulsion technique, the lipophilic compound of OPO was encapsulated with a surfactant compound in combination with cosurfactant (ethanol). The nano sizes of the capsules are confirmed by the transparency of the solution (Figure 1).

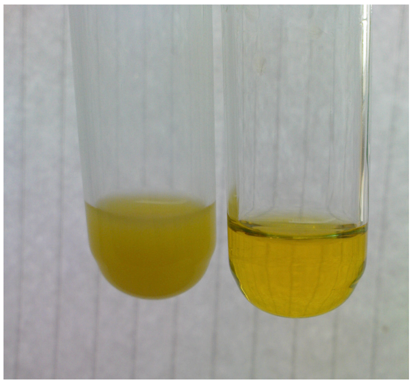
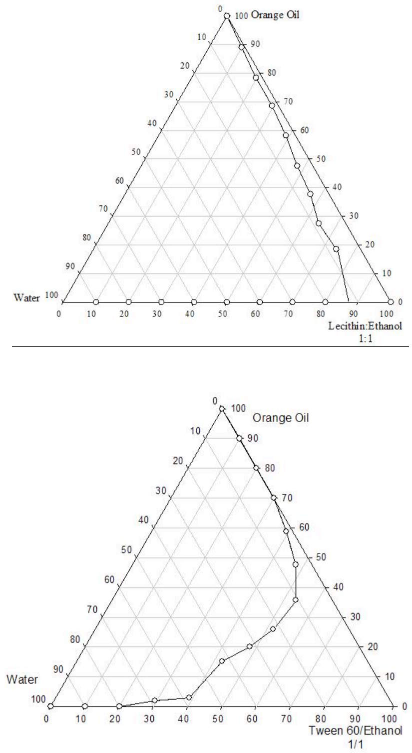
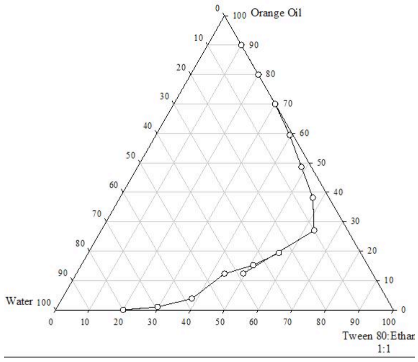


Figure 1: The comparison of turbid (left) and transparent, one phase OPO microemulsion prepared with T60/ ethanol / water (right)

The phase diagrams of OPO/surfactant/ethanol/water are shown in Figure 2.





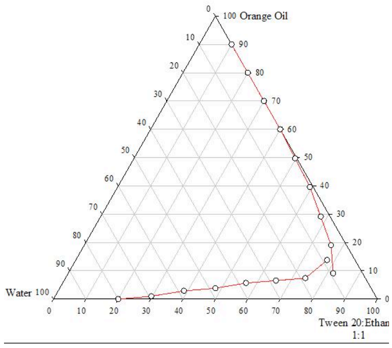
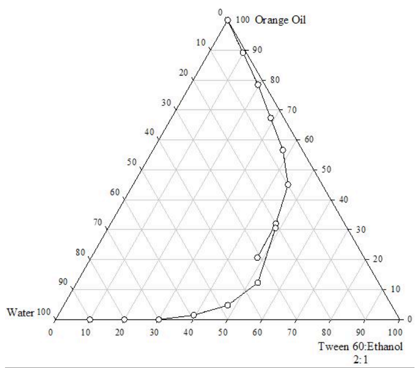


Figure 2: Effects of various surfactants on the formation and extent of one phase OPO microemulsion regions (surfactant:cosurfactant ratio, 1:1)

The results indicated that surfactant type was effective in the formation of OPO microemulsion and therefore encapsulation of the essential oil. Furthermore, the OPO microemulsion forming capabilities of T60 and T80 were much greater than that of T20 and Lecithin. Based on our findings, T60 was chosen as the most efficient surfactant and its phase diagrams for 2:1 and 1:2 ratios of T60:ethanol were constructed as well. However, our observations (Figure 3) showed that 1:1 surfactant: cosurfactant ratio induced the broadest region of one phase microemulsion.



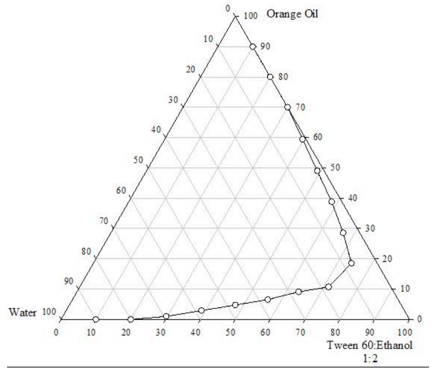


Figure 3: Effect of different ratios of tween 60:ethanol (2:1 and 1:2) on the formation regions of OPO microemulsions

CONCLUSIONS

Based on our observations, all the examined surfactants were able to form OPO microemulsion where the Tween 60 and ethanol, as commercial and food grade surfactant and cosurfactant, showed the highest capability in making OPO microemulsion. Moreover, any change in terms of the ratios of S:CS had some significant impact on the area of one phase microemulsion formation where the largest one was acheived at a ratio of 1:1.

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