

Effect of Partial Glycerides on Equilibrium Data for the System Black Cumin Seed Oil +Fatty Acids + Ethanol + Water at 298.2 K

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Because of several drawbacks of conventional methods, there is considerable interest in using liquid–liquid extraction as one of the promising alternative for deacidification of vegetable oils. For designing extraction processes phase equilibrium data are necessary. However, most of the data reported on the liquid–liquid equilibrium for systems containing vegetable oils, FFAs, and solvents have been obtained by using model fatty systems, which were prepared by the addition of known quantities FFAs to refined oils. Since partial glycerides in crude vegetable oils are also removed during the deacidification, liquid–liquid equilibrium data obtained by using model fatty systems may not reflect the real situation for the design of extraction processes. In the present study, experiments were planned in order to investigate the effect of partial glycerides on the liquid–liquid equilibrium data. Because of increasing activity of the lipase enzyme in ground black cumin seeds, acidity of the seed oil increases with increasing holding time of seeds at ambient conditions. The oils with varying acidity and matching partial glyceride content were obtained directly by extraction of ground black cumin seeds which were held at ambient conditions for varying periods of time. The so obtained unrefined oils were mixed with the ethanolic solvent (18% water), in the volume ratio oil/solvent 1:2. After 24 h contact time in a thermostatic shaker at 298.2 (0.1) K, mixtures were centrifuged for 1 h at 3500 rpm, and left to rest for 1 h at constant temperature of 298.2 K. The FFA concentrations of clear phases were measured by titration (AOCS Method Ca 5a-40) with an automatic buret. The total solvent concentration was determined by evaporation at 354.2 K in a rotary evaporator. The triglyceride concentrations were obtained by difference. The experimental compositions of the phases and the corresponding tie-lines for the systems of interest were compared with those obtained by using model fatty systems. The preliminary results of this work showed that the presence of partial glycerides narrows the two-phase region and changes the slope of tie-lines, thereby the design of extraction processes.