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STABILITY OF EMULSIONS OF REFINED PALM OIL AND ITS LOW MELTING POINT FRACTION WITH EGG PHOSPHOLIPID

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Emulsions of high melting point refined, bleached and deodorized palm oil (PO36) and its low melting point fraction (PO15) were prepared using egg yolk phospholipid. Their stability after 24 hr storage were compared to that of soybean oil. The low melting point palm oil fraction (PO15) formed stable emulsions similar to that of soybean oil. However, emulsions of the high melting point refined palm oil (PO36) were unstable and phase separation occurred immediately.

INTRODUCTION

Palm oil (PO) has been used widely in the food industry. It may be fractionated to give various fractions of different melting points. The ability of these fractions to form stable emulsions is an important factor in determining their uses particularly in preparing food emulsions such as mayonnaise and salad dressing. High melting fats solidify (crystallize) at temperatures below their melting points. Solidification of fats may lead to breaking of emulsions (Adamson, 1990) and subsequently, shorten the shelf life of the food. The problem occurs in frozen ice-cream where destabilization of fat emulsion causes fat and ice to separate (Noraini *et al.*, 1990). Hence, low melting point oils which do not crystallize at low temperatures are commonly used in the manufacture of such foods, particularly mayonnaise because the product needs to withstand freezing and frozen storage (Noraini *et al.*, 1993). The melting temperature of refined, bleached and deodorized (RBD) palm oil is rather high, about 36°C (Timms, 1985) and it solidifies easily at ambient temperature (25°C in Malaysia). A blend of single and double fractionated palm oleins (mp. 22°C - 24°C and 13°C - 16°C respectively) with other vegetable oils had been used in a study to find the best blend for the preparation of mayonnaise and salad dressing (Noraini *et al.*, 1993). Asbi *et al.* (1991) have shown that emulsion of palm olein using food proteins performed better than those of corn and soybean oils in respect to emulsification capacity and emulsifying activity. However, studies on emulsion of low melting point palm oil fraction has never been performed before. In this study, the ability of RBD palm oil, (PO36) and its low melting point fraction, (PO15) to form stable emulsions were investigated and the results were compared to that of soybean oil. The stability of emulsions were judged by their phase separation, creaming, flocculation and changing of droplet size after 24 hr of storage at constant temperature (25°C). Egg yolk phospholipid (PL-30) was used as an emulsifier.

EXPERIMENTAL PROCEDURES

Materials

RBD palm oil and soybean oil were obtained from Southern Edible Oil Industries, Klang, Malaysia and from local the market respectively. Fresh egg yolk phospholipid, PL-30 (emulsifier) was supplied by Q.P. Corporation, Tokyo with the following specifications: moisture content 2.18%, PL 31.8%, acid value 6.9 and iodine value 74.8. The lipid composition of the emulsifier was phosphatidyl choline 28.2%, phophatidyl ethanolamine 3.3%, sphingomyelin 0.3%, lysophosphatidyl choline 0.3% and triglyceride 65.8%. The water was deionized.

Preparation of low melting point palm oil fraction.

Low melting palm oil fraction was prepared from RBD palm oil by fractional crystallization process (Tan *et al.*, 1981). RBD palm oil was homogenised by heating at 70 °C until it melted completely. After dissolving in hexane (1:4; v:v) the resulting oil solution was cooled to 0°C and left over night to crystallize. The crystals were then removed by filtration and the hexane layer was evaporated to dryness to obtain a low melting palm oil fraction (PO15). Analysis showed that this fraction had an iodine value 65 and a melting point of 15°C.

Emulsion preparation and stability assessment.

Emulsions of PO36, PO15 and soybean oil of varying oil:water ratios and with emulsifier concentrations from 0.1 to 4% were prepared. The emulsifier was first dispersed in the oil phase in a small flask using IKA Ultra-Turrax T25 disperser. The emulsifier solution was then added dropwise to the water phase and dispersed for 2 min at 15000 rpm. The emulsion formed was transferred to a graduated cylinder and kept at constant temperature (25°C) for 24 hr. The emulsion stability was judged by measuring the ratio of the separated aqueous layer to the total emulsion volume, and by observing the change in droplet sizes immediately and 24 hr after preparation. The droplet sizes were estimated using a callibrated Will Wetzlar microscope (100X). Coalescence and creaming were examined visually and under the microscope equipped with polarising filter. The emulsion type was confirmed by staining the water phase with methylene blue.

RESULTS AND DISCUSSIONS

Figures 1(A,B,C) showed the regions of oil separation, stable and unstable emulsions as well as the mean sizes of the estimated droplet observed in the palm and soybean oils emulsions. The o/w-emulsions were formed in all systems studied. A low melting palm oil fraction, PO15 (*Figure 1A*) formed stable emulsions at emulsifier concentration ranges from about 0.5 to 4 wt%. In this region the oil and water did not separate within 24 hr. A similar stability was observed for SBO emulsions (*Figure 1B*), except that the oil began to form stable emulsions at a slightly lower emulsifier concentrations than those of PO15. At oil-to-water ratios exceeding 0.6 , the emulsions of PO15 changed to cream in the region of high emulsifier concentrations (above 2%). The SBO emulsions were, however stable up to oil-to-water ratio of 0.9 before turning into cream. The stability of PO15 and SBO emulsions in these regions were further supported by observing the droplets sizes. The change in the emulsion droplets for PO15, estimated immediately and after 24 hr of preparation was modest. This suggested that the coalescence of droplets has not taken place. Again, a similar trend was observed in the SBO emulsions (*Figure 1B*), where the mean sizes of estimated droplets were the same.

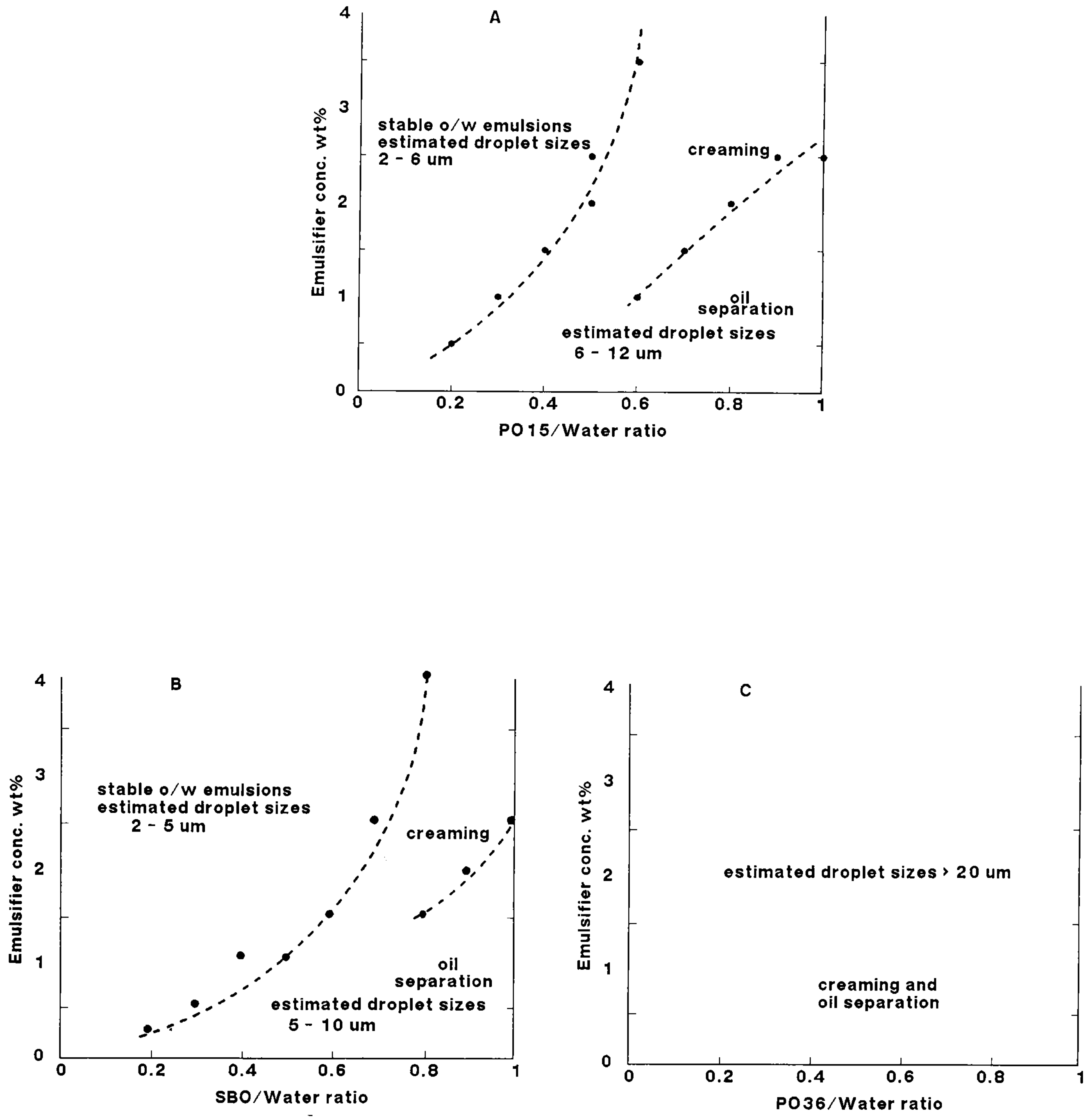

Figure 1. Emulsions of PO15(A), SBO(B) and PO36(C) with varying oil-to-water ratios and different concentrations of emulsifier (PL). Regions of oil separation, creaming, stable and unstable emulsions were also shown. The emulsion stability was determined after 24 hr storage at 25°C.

At oil-to-water ratios between 0.5 to 0.8, coalescence of droplets occurred in both PO15 and SBO emulsions particularly at low emulsifier concentrations. This is evident by larger emulsion sizes observed. The instability of emulsions in these regions was mainly due to the presence of low emulsifier concentration at the water-oil interface. Consequently, the films separating the droplets were broken and droplets coalesced. As the oil content further increased the emulsions became unstable and oil separation occurred in both SBO and PO15 samples. Therefore, with respect to creaming and coalescence, emulsions of PO15 were comparable to those of SBO.

On the contrary, the high melting refined palm oil, PO36 did not form stable emulsions (*Figure 1C*). Oil separation and creaming were observed at all oil-to-water ratios, regardless of emulsifier concentrations. In some cases, instantaneous separation of phases occurred. The mean globule sizes observed were larger, *i.e.* > 20 µm. The reason for the instability was evidently due to solidification of PO36 at 25°C. The results of this investigation suggested that a low melting palm oil fraction formed a stable o/w-emulsion similar to that of SBO. On the other hand, RBD palm oil (PO36) did not give stable emulsions.

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