C119

Advancements Towards Improvement of Oxidative Stability in O/W Nanoemulsions

(Univ. Tsukuba/NFRI)○(Stu.) Neves M.A., (NFRI) (Reg.) Kobayashi I., (Univ. Tsukuba/NFRI) (Reg.) Nakajima M.*

Introduction

Lipid oxidation, a major concern for the food industry, is directly associated with undesirable changes in flavor, texture, shelf life, and nutritional quality of food emulsions. Indeed, although oxidative susceptibility has been widely investigated in bulk oils, relevant mechanisms are not yet completely elucidated in dispersed systems. Most recently, incorporating lipids into structured oil-in-water (O/W) nanoemulsions (< 500 nm) has been revealed as a strategy to avoid lipid autoxidation, which generally involves phase transition [1]. This research was focused on the design of an oxidatively stable emulsion delivery system of lipids high in bioactive PUFA.

Material and Methods

Menhaden fish oil (Sigma; *c.a.* 14 % EPA and 10 % DHA) was used as disperse phase, and phosphate buffer (50 mM, pH 7) containing 1 wt% ML750 (decaglycerol monolaurate), as continuous phase. In case of structured emulsions, fish oil was partially replaced (1:1) with tripalmitin (TP).The oil:water weight ratio was 1:9. Each pre-mixture (40 mL) was initially homogenized using a rotor-stator (Polytron; 5,000 rpm/5 min), followed by high pressure homogenization (Nanomizer II, Yoshida Co., Japan) at 150 MPa (1 cycle). For TP-based emulsions, the homogenization was conducted at 70°C. Otherwise, temperature was kept bellow 10°C. All samples were stored at 5 or 30 °C, in dark. Hydroperoxides were analyzed by the ferric thiocyanate method [2].

Results and Discussion

The droplet size distributions of emulsions formulated using fish oil freshly produced is shown in Fig. 1a. The results indicated that fish O/W nanoemulsions structured with tripalmitin had monomodal size distribution. Moreover, TP-based emulsions stored at 5 °C showed a peak with droplets smaller than 100 nm (Fig. 1b), which may have been caused by recrystallization during storage. On the other hand, the storage of TP-based samples at 30°C likely caused droplets to coalesce (Fig. 1c).

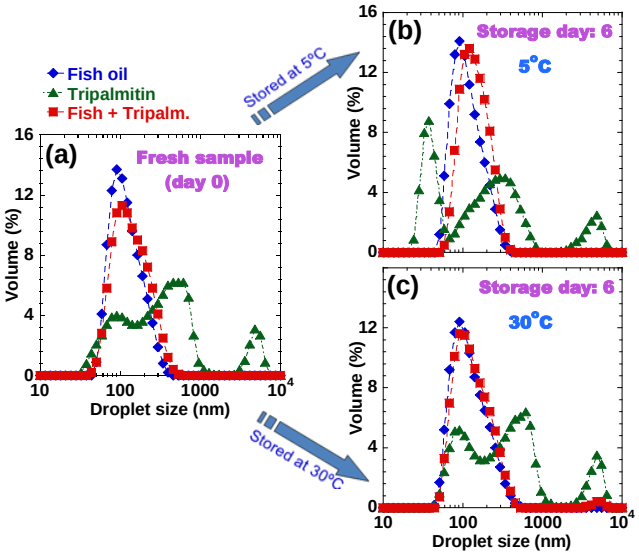

Fig. 1 Droplet size distribution of O/W nanoemulsions freshly prepared (left), or stored at different temperatures for 6 days (right).

The oxidative stability of O/W nanoemulsions stored at different temperatures is shown in Fig. 2.

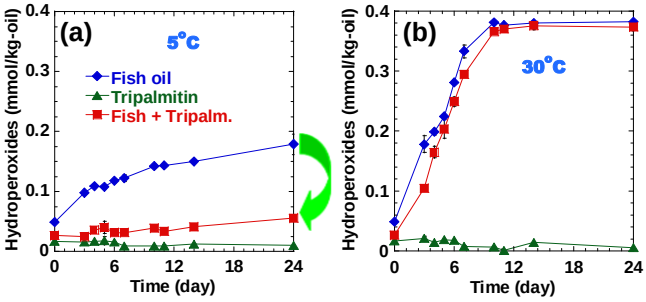

Fig. 2 Oxidative stability of O/W nanoemulsions stored either at 5 °C (left) or 30 °C (right).

Structuring fish O/W nanoemulsion with tripalmitin resulted in nearly 70 % lower lipid hydroperoxides content, compared to fish oil-based emulsion (indicated by an arrow in Fig. 2a).

Acknowledgements

This work was financially supported by the MAFF, *Project Food Nanotechnology*.

References

1] Garti & Sato. *Crystallization Processes in Fats and Lipids Systems* (2001).
[2] McClements *et al* (2000) *J.Food Sci*, 65, 1325.