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Stability and rheological properties of fat-reduced mayonnaises by using sodium octenyl succinate starch as fat replacer

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Abstract

Sodium octenyl succinate starch (SOS) was used as fat replacer in 25, 50 and 75% fat-reduced mayonnaise (FR). The stability of mayonnaises: mean droplet size diameter (d_{43}), phase separation by centrifugal technique, brightness (L^*), color different index (ΔE), storage and loss moduli (G' and G''), consistency index (K), apparent viscosity (η), and thixotropic loop were examined, compared with a full fat mayonnaise (FF). There was no effect of fat substitution on d_{43} and phase separation. L^* value of FR was significantly higher than those of FF. All samples showed gel-like structure ($G' > G''$) and exhibited the thixotropic shear thinning behavior. G' , K , η , and thixotropic loop of FR tended to decrease when the fat substitution level increased. The d_{43} and ΔE of 50% FR did not significantly change throughout a storage time while the others did. Thus, 50% fat-substituted with SOS could be applied as a fat replacer to stabilize and increase the storage time of such mayonnaise.

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1. Introduction

The relationship between dietary fat and the development of cardiovascular disease and hypertension has prompted consumers to be more aware of the amount of fat in their diet. Therefore, food manufacturers have responded to that of consumer demands, resulting in a rapid market growth of products with a healthy image. However, as a major of food component, fat contributes to some sensory and physiological properties in the products. Those properties could be related to flavor, mouthfeel, texture, and stability of fat-based product such as emulsion. Modification of this product by using fat replacers is often viewed as an effective way to overcome such problems due to the reduction in fat content [1-3] but those properties might be changed.

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Mayonnaise is an O/W emulsion, typically containing high oil content (70-80%), egg yolk, vinegar and additives. To produce fat-reduced mayonnaise, it is necessary to decrease the dispersed phase and to increase the water content. Modified starches are common used as fat replacer because of their low cost, tasteless, and uniqueness providing creamy texture. Modified starches are also used as a thickening agent [4] to prevent phase separation during the storage of mayonnaise [2,5]. Some of modified starches have been found highly suitable for obtaining desirable organoleptic as well as physical properties of various food products.

Sodium octenyl succinate starch (E1450) is a product by substituting hydroxyl groups in the polysaccharide chains by octenyl succinic acid [6,7]. This polysaccharide exhibits amphiphilic character which enhances its emulsifying property. E1450 are also used as thickening agent by forming network with other polymer in aqueous solution through hydrophobic interaction. This increases the viscosity of the system and can stabilize droplet particles [8].

However, so far, there is less information about the effects of E1450 on functional properties of fat-reduced mayonnaises as a function of storage time. Thus, the objective of this research was to study the rheological properties and stability of such mayonnaise including mean droplet size diameter (d_{43}), phase separation under centrifugal technique, lightness (L^*), color different index (ΔE) and rheological properties during 12 week-storage time at 25°C.

2. Materials and Methods

2.1 Mayonnaise preparation

The recipe and method of mayonnaise preparation were modified from Lui et al. [1] as showed in table 1. The mayonnaise samples were prepared using food mixer (Moulinex, France). Water, sugar, salts, egg yolk and 0.5 % benzoic acid were mixed together at the mixer speed 1 for 5 min. Then, E1450, purchased from Siam modified starch Co., Ltd., was dispersed in oil and vinegar and gradually added into the mixer blow at speed 4 within 5 min. Samples were homogenized using Moulinex portable homogenizer (speed 4) for 10 min. The samples were kept in glass container with hermitical seal and wrapped with aluminum foil to protect light. Then, they were stored at 25°C overnight before analysis.

Table 1. Mayonnaise formulations based on 1.5 kg for each formulation

Ingredients (g)	FF ¹	25FR ¹	50FR ¹	75FR ¹
Oil	1200	900	600	300
Vinegar	120	120	120	120
Egg yolk	120	120	120	120
Sugar	10	10	10	10
Salt	10	10	10	10
Water	20	290	560	830
E1450	0	30	60	90

Remark: ¹FF, 25FR, 50FR and 75FR referred to full fat, 25, 50 and 75% fat-substituted mayonnaise, respectively.

2.2 Rheological properties

Rheological properties of mayonnaise were carried out using a controlled stress Rheometer (GR-2 TA instruments, New Castle, DE, US) with 40 mm diameter parallel plates. The measurements were

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