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Total Dissolved Solids on Turmeric Emulsion (*Curcuma longa* L.) Affected by Iota and Kappa Carrageenan

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Abstract

The quality of emulsion such as total dissolved solids, may be determined by type of emulsifier. Carrageenan is a polysaccharide from red seaweed (Rhodophyceae) and it is well known as emulsifier, however the application of carrageenan has not widely used in traditional beverage in Java Island, Indonesia. Therefore, the purpose of this research was to determine the effect of carrageenan in turmeric emulsion on its total dissolved solids. Distribution of total dissolved solids was tested using total dissolved solid-meter. Iota and kappa carrageenan were used. As a result, carrageenan might increase total dissolved solid at 58±3.4% and iota had reached higher total dissolved solid than kappa. As conclusion, total dissolved solid might be elevated by the addition of carrageenan.

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Introduction

Emulsion quality can be seen from the amount of dissolved solids and the stability of the emulsion (Sikora *et al.*, 2017). The main factor affecting the quality of an emulsion is the type of emulsifier. Carrageenan, both iota and kappa forms is emulsifier from nature commonly used in the food industry to generate gels, increase total dissolved solids, increase adhesive and viscosity (Gu *et al.*, 2004). In addition, carrageenan is also a stabilizer in milk, ice cream, and yogurt (Langendorff *et al.*, 2000). Carrageenan is made from seaweed class Rhodophyceae (red algae), which is a hydrocolloid compound with three main components in the form of sulphate, galactose, and 3,6-anhydrogalactose (Santoso *et al.*, 2013). The use of carrageenan is used to bind fat or protein emulsions, for example in milk, but there has not been much research yet on carrageenan function as an emulsifier in non-fat emulsions, such as traditional beverage products in Java island, Indonesia.

The low stability of the emulsion can be seen from the less amount of dissolved solids which makes sedimentation easily (Fajar *et al.*, 2017) and traditional beverage products are considered to be easy to generate sedimentation (Kailaku *et al.*, 2012) which can affect the quality of product and storage (Sukasih *et al.*, 2009). Turmeric is one of the traditional herbs, much in demand by consumers in Java island, Indonesia (Mulyani *et al.*, 2014) and contains strong yellow pigments (Sahne *et al.*, 2016) and if sedimentation occurs it will greatly reduce the aesthetic value of turmeric beverage products. Therefore, the stability of the emulsion from turmeric beverage products is very necessary to maintain the good quality of the product. This study aims to apply carrageenan iota and kappa as emulsifiers in turmeric emulsions and detect changes that might be occurred in total dissolved solids. The benefit of this study is to obtain information on changes in turmeric emulsion with the addition of iota and carrageenan kappa.

Materials and Methods

Turmeric was obtained freshly from traditional market nearby Diponegoro University, Semarang. It was very easy to find turmeric and only one day from

postharvest of turmeric was chosen in this research. Iota and carrageenan kappa were received from CV Karagenan Indonesia, Semarang. The research was conducted from November 2017 to January 2018 at the Central Laboratory for Research and Services Diponegoro University (CORES DU), Semarang, Indonesia

Procedure for Making Turmeric Emulsions

A total of 1500 ml of turmeric juice was obtained from 3 kg of hot small size of turmeric (2x2 cm) without any additional water using a juicer and aseptic filter cloth. Turmeric juice was then dried using a drier (Lincat SCH1085, China) at a temperature of 40±1˚C for 24 hours. This process produced 500 g of fine turmeric pollen (Sahne *et al*., 2016). Production of turmeric emulsions was carried out according to the method of Marin *et al.* (2016) by mixing 5 g of turmeric pollen, 20 g of brown sugar, 15 ml of distilled water, and 0.8 g carrageenan or 2% (b/b). Turmeric emulsion was heated at a temperature of 70±2˚C for 5 minutes by stirring continuously and 15 ml of the emulsion was put in the tube. Distilled water was used as control to replace the carrageenan portion in those formula.

Total Dissolved Solid Testing Procedure

Testing of total dissolved solids was carried out using 10 ml of turmeric emulsion and detected using a total dissolved solid meter. Tool calibration was carried out using original standard solutions with a concentration of 706.5 ppm and the results of testing of total dissolved solids were expressed in units of ppm (Mashhadi *et al*., 2016).

Data Analysis

The test results of the total dissolved solid were calculated using Microsoft Excel 2007 and the data was shown as percentage.

Results and Discussion

Based on the results, carrageenan might increase total dissolved solids of turmeric emulsion at 55±3.4% as compare to the emulsion without carrageenan (control). iota carrageenan utilization provided higher total dissolved solid result than those of kappa carrageenan. This may be explained since iota carrageenan has a much more sulfate group that able to neutralize 3,6-anhydro-galactose as hydrophobic compound while kappa carrageenan is considered to have much more hydrophilic compound of 3,6-anhydro-galactose groups (Hambleton *et al*., 2009).

Addition of emulsifiers such as carrageenan has ability to bind a number of solid particles in the turmeric emulsion. Iota and kappa carrageenan are able to decomposed into reducing sugars that may increase the total solid (Gu *et al*., 2004). The function of carrageenan as gelling agent with a combination of heating treatment may cause molecular bonds in carrageenan to open and generate crosslinking which results in many particles being bound by carrageenan (Kumalasari *et al*., 2015).

Total high dissolved solids might increase emulsion stability since carrageenan might serve as a stabilizer that could stabilize large particles in the emulsion. This may be appeared due to adsorption process on the surface of the liquid by carrageenan thus reducing the surface tension of the emulsion (Edwin *et al*., 2004; Rifani *et al*., 2016). The total dissolved solids in an emulsion affect the physical properties of the emulsion such as viscosity and adhesiveness (Bourne, 2002; Razmovski and Vesna, 2011).

Conclusion

The addition of iota and kappa carrageenan increased total dissolved solids in turmeric emulsion.

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