

Peningkatan Stabilitas, Bioaksesibilitas *In Vitro* dan Kapasitas Antioksidan β -Karoten Menggunakan Sistem Pembawa Mikroemulsi

INTISARI

Setyaningrum Ariviani
(11/324239/STP/00150)

β -Karoten memperlihatkan manfaat kesehatan terkait dengan kapasitasnya sebagai antioksidan. Aplikasi β -karoten dalam formulasi pangan fungsional sangat terbatas karena rendahnya stabilitas dan bioaksesibilitas. Penelitian ini bertujuan untuk mengevaluasi kemampuan mikroemulsi sebagai sistem pembawa β -karoten untuk meningkatkan stabilitas, bioaksesibilitas dan kapasitas antioksidan. Tujuan penelitian dicapai melalui beberapa tahapan penelitian, yaitu (1) formulasi mikroemulsi, (2) karakterisasi dan evaluasi stabilitas mikroemulsi β -karoten selama penyimpanan, (3) evaluasi stabilitas fisik dan kimiawi mikroemulsi β -karoten selama digesti *in vitro*, (4) penentuan bioaksesibilitas β -karoten dalam mikroemulsi, (5) uji lipolisis fase minyak mikroemulsi dan korelasinya dengan bioaksesibilitas, (6) evaluasi kapasitas antioksidan β -karoten, dan (7) uji efektivitas mikroemulsi dalam meningkatkan bioaksesibilitas dan kapasitas antioksidan β -karoten yang dibawanya dengan pembanding emulsi. Hasil penelitian menunjukkan bahwa jenis minyak berpengaruh terhadap karakteristik mikroemulsi dan stabilitas β -karoten yang dibawanya selama penyimpanan. Stabilitas fisik dan kimiawi selama digesti, dan bioaksesibilitas tidak dipengaruhi oleh jenis minyak, namun ditentukan oleh konsentrasi minyak mikroemulsinya. Mikroemulsi β -karoten dengan konsentrasi minyak 4% b/b menunjukkan bioaksesibilitas dan stabilitas fisik maupun kimiawi terhadap kondisi saluran pencernaan yang lebih tinggi dibanding mikroemulsi dengan konsentrasi minyak 2% b/b. β -Karoten dalam mikroemulsi VCO memperlihatkan kapasitas penangkapan ABTS⁺ (TEAC) yang signifikan lebih rendah dibanding mikroemulsi minyak sawit. Mikroemulsi dengan kadar minyak 4% b/b terbukti lebih efektif dalam meningkatkan bioaksesibilitas β -karoten dibanding emulsi. Mikroemulsi lebih efektif dalam meningkatkan kapasitas antioksidan β -karoten bioaksesibel (tergabung misel) dibanding emulsi, jika konsentrasi fase minyaknya 2% b/b. Hasil penelitian ini memiliki dampak penting untuk desain dan pemanfaatan mikroemulsi sebagai sistem pembawa untuk meningkatkan stabilitas penyimpanan, stabilitas terhadap kondisi saluran pencernaan, bioaksesibilitas dan kapasitas antioksidan β -karoten.

Kata kunci: mikroemulsi, β -karoten, stabilitas, bioaksesibilitas, kapasitas antioksidan

Promotor : Prof. Dr. Ir. Sri Raharjo, M.Sc
Ko-Promotor 1 : Prof. Dr. Ir. Sri Anggrahini, MS
Ko-Promotor 2 : Dr. Ir. Sri Naruki, MS

Improvement of the Stability, *In Vitro* Bioaccessibility and Antioxidant Capacity of β -Carotene Using Microemulsions as a Delivery System

ABSTRACT

Setyaningrum Ariviani
(11/324239/STP/00150)

β -Carotene shows a variety of health benefits related to its antioxidant capacity. However, its application in food formulations is currently limited due to the chemical instability and the low bioaccessibility. This study aimed to evaluate the ability of microemulsions as the delivery system of β -carotene to enhance the stability, bioaccessibility and antioxidant capacity. The objective was achieved through several research stages, i.e. (1) the microemulsions formulation, (2) characterization and stability evaluation of the β -carotene microemulsion during storage, (3) physicochemical stability evaluation of the β -carotene microemulsion during *in vitro* digestion, (4) bioaccessibility measurement of β -carotene loaded microemulsions, (5) determination of microemulsions oil phase lipolysis and its correlation with the β -carotene bioaccessibility, (6) antioxidant capacity evaluation of the β -carotene as well as (7) determination of the microemulsion effectiveness both in improvement of β -carotene bioaccessibility and antioxidant capacity through the comparison with the emulsions. The results showed that the type of carrier oil has a significant effect either on the β -carotene microemulsion characteristics or the stability of β -carotene loaded during storage. The physical and chemical stability during digestion, and bioaccessibility of β -carotene loaded microemulsions were not influenced by the type of carrier oil, but it's determined by the concentration of carrier oil. The β -carotene microemulsions with higher oil concentration (4% (w/w)) showed higher either in the bioaccessibility or physical and chemical stability toward gastrointestinal tract simulation rather than the lower oil concentration (2% (w/w)). Microemulsions with VCO as an oil phase showed ABTS⁺ radical scavenging capacity (TEAC) were significantly lower than that of the palm oil ones. Microemulsions with the oil concentration of 4% (w/w) proved to be more effective in improving the β -carotene bioaccessibility compared to the emulsions. The effectiveness of the microemulsions in improving the antioxidant capacity (TEAC) of the bioaccessible β -carotene (β -carotene incorporated in the micelles) was observed if the carrier oil concentration was 2% (w/w). Results of this study have important consequences for the design and utilization of the microemulsions as a delivery system to improve the storage stability, the stability toward the digestive tract condition, bioaccessibility and antioxidant capacity of β -carotene.

Keywords: microemulsions, β -carotene, stability, bioaccessibility, antioxidant capacity

Promotor : Prof. Dr. Ir. Sri Raharjo, M.Sc
Co-Promotor 1 : Prof. Dr. Ir. Sri Anggrahini, MS
Co-Promotor 2 : Dr. Ir. Sri Naruki, MS