

## ABSTRAK

Pengobatan diabetes melitus dengan inhibitor  $\alpha$ -glukosidase seperti acarbose dan miglitol efektif menurunkan glukosa postprandial, namun sering menimbulkan efek samping gastrointestinal. Ekstrak jahe merah (*Zingiber officinale var. rubrum*) memiliki senyawa bioaktif (gingerol dan shogaol) yang berpotensi sebagai antidiabetes, tetapi pemanfaatannya dibatasi oleh kelarutan dan ketersediaan hayati yang rendah. Penelitian ini bertujuan mengembangkan formulasi Self-Nanoemulsifying Drug Delivery System (SNEDDS) ekstrak jahe merah serta mengevaluasi pengaruh kombinasi Tween 20 dan propilen glikol terhadap kualitas nanoemulsi dan aktivitas penghambatan  $\alpha$ -glukosidase. Penelitian dilakukan secara eksperimental dengan rancangan faktorial  $3 \times 2$  (propilen glikol 10; 12,5; 15 g dan Tween 20 40; 80 g) sehingga diperoleh 6 formula menggunakan asam oleat sebagai fase minyak. Evaluasi meliputi organoleptik, pH, viskositas, waktu emulsifikasi, dan % transmitan, dilanjutkan karakterisasi PSA, zeta potensial, PDI, serta FTIR. Seluruh formula memiliki pH 4,504–7,117, viskositas 80,0–239,9 cP, dan waktu emulsifikasi <1 menit. Formula dengan Tween 20 80 g menunjukkan % transmitan mendekati 100% yang mengindikasikan nanoemulsi jernih dan homogen. Ukuran partikel berada pada skala nano dengan nilai zeta potensial -22,88 hingga -47,36 mV. Analisis FTIR tidak menunjukkan perubahan struktur kimia yang bermakna. Aktivitas penghambatan  $\alpha$ -glukosidase ekstrak jahe merah memberikan  $IC_{50}$  340,10 ppm. Formula terpilih adalah T20<sub>80</sub>P<sub>15</sub> dengan % transmitan 99,3%, waktu emulsifikasi 5,48 detik, PDI 0,363, dan ukuran partikel 194,0 nm. Formulasi SNEDDS berpotensi meningkatkan performa penghantaran ekstrak jahe merah sebagai kandidat antidiabetes berbahan alam.

**Kata kunci:** Diabetes Melitus, Jahe Merah, SNEDDS,  $\alpha$ -Glucosidase,  $IC_{50}$

KARAWANG

## ABSTRACT

*Treatment of diabetes mellitus with  $\alpha$ -glucosidase inhibitors such as acarbose and miglitol is effective in reducing postprandial glucose levels; however, it often causes gastrointestinal side effects. Red ginger (*Zingiber officinale* var. *rubrum*) extract contains bioactive compounds (gingerol and shogaol) with potential antidiabetic activity, but its utilization is limited by poor solubility and low bioavailability. This study aimed to develop a Self-Nanoemulsifying Drug Delivery System (SNEDDS) formulation of red ginger extract and to evaluate the effect of Tween 20–propylene glycol combinations on nanoemulsion quality and  $\alpha$ -glucosidase inhibitory activity. An experimental study with a  $3 \times 2$  factorial design (propylene glycol 10, 12.5, and 15 g; Tween 20 40 and 80 g) was conducted, yielding six SNEDDS formulations using oleic acid as the oil phase. Evaluations included organoleptic properties, pH, viscosity, emulsification time, and percent transmittance, followed by characterization using PSA, zeta potential, PDI, and FTIR. All formulations showed pH values of 4.504–7.117, viscosity of 80.0–239.9 cP, and emulsification time of <1 minute. Formulations containing Tween 20 at 80 g exhibited percent transmittance close to 100%, indicating clear and homogeneous nanoemulsions. Particle sizes were in the nanoscale, with zeta potential values ranging from –22.88 to –47.36 mV. FTIR analysis did not indicate any significant chemical structural changes. The  $\alpha$ -glucosidase inhibitory activity of red ginger extract yielded an  $IC_{50}$  of 340.10 ppm. The selected formulation was T20<sub>80</sub>P<sub>15</sub>, with 99.3% transmittance, an emulsification time of 5.48 seconds, a PDI of 0.363, and a particle size of 194.0 nm. The SNEDDS formulation has the potential to improve the delivery performance of red ginger extract as a natural antidiabetic candidate.*

**Keywords:** Diabetes Mellitus, Red Ginger, SNEDDS,  $\alpha$ -Glucosidase,  $IC_{50}$

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