

MIKROENKAPSULASI MINYAK ESENSIAL PALA (*Myristica fragrans* Houtt.) DENGAN METODE PENGERINGAN SEMPROT: STUDI CAMPURAN MALTODEKSTRIN DAN TEPUNG PROTEIN KEDELAI SEBAGAI BAHAN PENYALUT

INTISARI

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Tanaman pala (*Myristica fragrans*) merupakan salah satu tanaman rempah endemik Kepulauan Banda, Indonesia. Produksi dan pangsa pasar ekspor pala mendominasi hampir 75% secara global dalam bentuk mentah maupun produk turunan salah satunya yaitu minyak esensial pala yang tinggi dengan antioksidan. Akan tetapi, minyak esensial bersifat volatil yang rentan terhadap kerusakan selama pengolahan dan penyimpanan serta memiliki keterbatasan pengaplikasian pada bahan dengan pelarut berbasis air. Oleh karena itu, studi ini bertujuan mengetahui karakteristik emulsi dan bubuk mikroenkapsulasi dalam variasi konsentrasi maltodekstrin dan rasio maltodekstrin-tepung protein kedelai (TPK) dalam mengenkapsulasi minyak esensial pala. Kombinasi konsentrasi maltodekstrin (9%, 8%, dan 7%) dan rasio (2:1 dan 1:1) agen enkapsulan berupa maltodekstrin dan TPK diujikan dalam bentuk emulsi dengan minyak esensial pala 25% melalui proses homogenisasi dan ultrasonikasi kemudian proses pengeringan semprot hingga menjadi bubuk, lalu dianalisis. Sifat-sifat emulsi seperti viskositas (kekentalan), stabilitas, dan ukuran diameter partikel serta sifat-sifat enkapsulan seperti *yield* enkapsulasi, efisiensi enkapsulasi, *moisture content*, aktivitas air (A_w), warna, dan aktivitas antioksidan. Emulsi dan mikroenkapsulasi paling optimal diperoleh pada konsentrasi maltodekstrin 8% dan rasio maltodekstrin-TPK 2:1 dengan viskositas $11,95 \pm 0,07$ mPa.s, ukuran partikel $1,72 \pm 0,80$ μ m, stabilitas emulsi yang baik, waktu pengeringan $58,5 \pm 0,71$ menit, suhu outlet $98,5 \pm 0,71^\circ\text{C}$, *yield* total (wb) $5,28 \pm 0,04\%$, *yield* total (db) $58,06 \pm 0,39\%$, *solid yield* $72,57 \pm 0,50\%$, efisiensi enkapsulasi $94,23 \pm 0,74\%$, *surface oil* $5,77 \pm 0,74\%$, *moisture content* $4,70 \pm 0,11\%$, aktivitas air (A_w) $0,34 \pm 0,01$, higroskopisitas $22,86 \pm 0,05\%$, total solid $76,24 \pm 0,09\%$, aktivitas antioksidatif $56,30 \pm 0,57\%$, *luminosity* (kecerahan) $94,32 \pm 0,53$, *whiteness index* $93,26 \pm 0,38$, *browning index* $3,98 \pm 0,38$, *hue angle* $15,66 \pm 0,26^\circ$, dan *chroma* (saturasi) $3,93 \pm 0,09$.

Kata kunci: Mikroenkapsulasi, minyak esensial pala, pengeringan semprot, maltodekstrin, tepung protein kedelai.

**MICROENCAPSULATION OF NUTMEG (*Myristica fragrans* Houtt.)
ESSENTIAL OIL USING SPRAY DRYING TECHNOLOGY: A STUDY OF
MALTODEXTRIN AND SOYBEAN PROTEIN POWDER AS COATING
MATERIALS**

ABSTRACT

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*Nutmeg (*Myristica fragrans*) is a spice plant endemic to the Banda Islands, Indonesia. Indonesian nutmeg's production and export market share dominates nearly 75% globally in the form of raw and derived products, one of which is nutmeg essential oil, which is high in antioxidants. However, essential oils are volatile which susceptible to damage during processing and storage and have limited application in water-based solvents. Therefore, this study aims to determine the characteristics of microencapsulated emulsions and powders in varying concentrations of maltodextrin and maltodextrin-soybean protein flour (SPF) ratio in encapsulating nutmeg essential oil. Combinations of maltodextrin concentrations (9%, 8%, and 7%) and ratios (2:1 and 1:1) of encapsulating agents in the form of maltodextrin and SPF were tested in the form of an emulsion with nutmeg essential oil (25%) through a homogenization and ultrasonication process followed by spray-drying process into powder, then analyzed. Emulsion properties such as viscosity, stability, and particle diameter size and microencapsulation properties such as encapsulation yield and efficiency, moisture content, water activity (A_w), color, and antioxidant activity were analyzed. The most optimal emulsion and microencapsulation were obtained at 8% maltodextrin concentration and 2:1 maltodextrin-SPF ratio with viscosity 11.95 ± 0.07 mPa.s, particle size 1.72 ± 0.80 μ m, good emulsion stability (no emulsion separation occurred), drying time 58.5 ± 0.71 minutes, outlet temperature $98.5 \pm 0.71^\circ$, total yield (wb) $5.28 \pm 0.04\%$, total yield (db) $58.06 \pm 0.39\%$, solid yield $72.57 \pm 0.50\%$, encapsulation efficiency $94.23 \pm 0.74\%$, surface oil $5.77 \pm 0.74\%$, moisture content $4.70 \pm 0.11\%$, water activity (A_w) 0.34 ± 0.01 , hygroscopicity $22.86 \pm 0.05\%$, total solid $76.24 \pm 0.09\%$, antioxidative activity $56.30 \pm 0.57\%$, luminosity 94.32 ± 0.53 , whiteness index 93.26 ± 0.38 , browning index 3.98 ± 0.38 , hue angle $15.66 \pm 0.26^\circ$, and chroma (saturation) 3.93 ± 0.09 .*

Keyword: microencapsulation, nutmeg essential oil, spray drying, maltodextrin, soybean protein flour