

**Interesterifikasi Enzimatis *Palm Stearin* dan Lemak Larva  
Kumbang Badak (*Oryctes rhinoceros* L.) untuk  
Sintesis *Cocoa Butter Alternative***

**INTISARI**

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*Oryctes rhinoceros* L. merupakan hama utama pada tanaman kelapa dan sawit dengan memakan umbutnya. Salah satu pendekatan pengendalian hama *O. rhinoceros* adalah dengan mengurangi populasi larva melalui pemanfaatan lemak larva sebagai bahan pangan. Pencampuran lemak *O. rhinoceros* dan *palm stearin* (PS) pada perbandingan tertentu menggunakan proses interesterifikasi enzimatis dengan lipase *Rhizomucor miehei* akan berpotensi menghasilkan *cocoa butter alternative* (CBA) dengan *cocoa butter* (CB) di pasaran sebagai pembanding. Larva instar III diperoleh dari perkebunan kelapa dan sawit, serta PS diperoleh dari industri.

Tujuan pertama dari penelitian ini adalah mengevaluasi karakteristik lemak larva *O. rhinoceros* asal media limbah kelapa (OKL) dan sawit (OKS) sebagai bahan baku pembuatan CBA, meliputi: 1. Ekstraksi OKL dan OKS, 2. Analisis (a) bilangan peroksida, bilangan p-anisidin, dan bilangan total oksidasi, (b) komposisi asam lemak, (c) bilangan iodin, (d) *slip melting point*, (e) *hardness*, dan (f) warna. Tujuan kedua adalah menginvestigasi pengaruh rasio PS dan OKS terhadap sifat fisikokimia CBA yang dihasilkan, meliputi: 1. Preparasi matriks, 2. Modifikasi matriks secara hidrofobik, 3. Immobilisasi lipase *Rhizomucor miehei*, 4. Interesterifikasi enzimatis PS dan OKS, 5. Analisis (a) komposisi asam lemak, (b) polimorfisme kristal lemak, (c) morfologi permukaan kristal lemak, (d) karakteristik suhu kristalisasi dan pelelehan, (e) *solid fat content* (SFC), (f) *slip melting point* (SMP), (g) *hardness*, dan (h) warna. Tujuan ketiga adalah mengetahui rasio terbaik PS dan OKS untuk menghasilkan CBA dengan karakteristik termogram yang mendekati CB dan tingkat kekerasan yang rendah.

Hasil penelitian ini menunjukkan bahwa sampel OKL dan OKS memiliki asam lemak utama yang sama yaitu asam palmitat, oleat, dan stearat. Sampel OKS memiliki bilangan iodin lebih rendah, nilai SMP lebih tinggi, dan *hardness* lebih tinggi dibandingkan OKL. Berdasarkan SMP dan *hardness*, maka OKS dipilih sebagai bahan baku pembuatan CBA. Sampel SLs (lemak hasil interesterifikasi enzimatis) memiliki asam lemak utama yang sama yaitu asam palmitat, oleat, dan stearat dengan konsentrasi berdekatan antar sampel, memiliki bentuk kristal lemak utama yang sama yaitu  $\beta'$  (ortorombik), terlihat sangat kecil, sangat halus, dan berjumlah sedikit dengan jarak antar kristal berjauhan. Sampel SLs memiliki suhu kristalisasi, suhu pelelehan, dan SFC saling berdekatan. Semakin tinggi rasio OKS pada SLs, maka SLs memiliki SMP dan *hardness*

lebih rendah, serta memiliki warna kurang cerah dan lebih kuning. Sampel PS:OKS 20:80 dipilih sebagai CBA pada penggunaan *confectionery filling*, karena memiliki suhu kristalisasi dan suhu pelelehan paling mendekati CB, memiliki SMP paling mendekati CB, memiliki tekstur *slurry* pada suhu 40°C, dan memiliki *hardness* paling rendah dibandingkan SLs lainnya.

**Kata kunci:** *Cocoa butter alternative*, Interesterifikasi enzimatis, Lemak larva *Oryctes rhinoceros* L, Lipase *Rhizomucor miehei*, *Palm stearin*.

## Enzymatic Interesterification of Palm Stearin and Rhino Beetle Larvae Fat (*Oryctes rhinoceros* L.) for Synthesis Cocoa Butter Alternative

### ABSTRACT

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*Oryctes rhinoceros* L. was a major pest in coconut and oil palm plants by eating their tubers. One kind of controlling *O. rhinoceros* pest was reducing the larvae population through the utilization of larvae fat as a food ingredient. The blending of *O. rhinoceros* larvae fat and Palm stearin (PS) at various ratio using an enzymatic interesterification with *Rhizomucor miehei* lipase process would potentially produced a cocoa butter alternative (CBA) with cocoa butter (CB) in the market as a comparison. Third instar larvae were obtained from coconut and oil palm plantations, and PS was obtained from industry.

The first objective of this study was to evaluate the characteristics of *O. rhinoceros* larvae fat from coconut waste media (OKL) and oil palm waste media (OKS) as raw materials for making CBA, including: 1. OKL and OKS extraction, 2. Analysis (a) peroxide number, p-anisidine number, and total oxidation number, (b) fatty acid composition, (c) iodine number, (d) slip melting point, (e) hardness, and (f) color. The second objective was to investigate the effect of PS and OKS at various ratio on the physicochemical properties of CBA, including: 1. Matrix preparation, 2. Hydrophobic matrix modification, 3. *Rhizomucor miehei* lipase immobilization, 4. PS and OKS enzymatic interesterification, 5. Analysis (a) fatty acid composition, (b) fat crystal polymorphism, (c) surface morphology of fat crystals, (d) crystallization and melting temperature characteristics, (e) solid fat content (SFC), (f) slip melting point (SMP), (g) hardness, and (h) color. The third objective was to determine the best ratio of PS and OKS to produce CBA with thermogram characteristics that was closed to CB and had low hardness.

The results showed that OKL and OKS had same main fatty acids, they were palmitic, oleic, and stearic acid. OKS had lower iodine number than OKL. OKS had higher SMP and hardness value than OKL. Based on SMP and hardness, OKS was chosen as the raw material for making CBA. The SLs had same main fatty acids, they were palmitic, oleic, and stearic acid with closed concentrations between samples, they had same main fat crystal form, it was  $\beta'$  (orthorhombic), looked very small, very fine, and amounts to slightly with the distance between the crystals were far apart. SLs had crystallization temperature, melting temperature, and SFC was closed each other. The higher of OKS ratio in the blending was making the SLs had lower SMP and hardness, less lightness and more yellowish. Sample PS:OKS 20:80 was chosen as CBA for confectionery filling, because it had the crystallization temperature, melting

temperature, and SMP was closed to CB, had a slurry texture at 40°C, and had the lowest hardness than the other SLs.

**Keywords:** Cocoa butter alternative, Enzymatic interesterification, *Oryctes rhinoceros* L. larvae fat, Palm stearin, *Rhizomucor miehei* lipase.