HALAMAN PENGESAHAN

**LAPORAN AKHIR**

**PENELITIAN STRATEGIS NASIONAL**

Judul : Peningkatan Spektrum Antibakteri Lisozim dan Pengaturan Difusi Lisozim dalam Edible Film Protein Whey untuk Meningkatkan Keamanan Pangan Keju Gouda.

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**Peningkatan Spektrum Antibakteri Lisozim dan Pengat uran Difusi Lisozim dalam Edible Film Protein Whey untuk Meningkatkan K eamanan Pangan Keju Gouda**


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**UNIVERSITAS BRAWIJAYA**
**Desember, 2013**

## ABSTRAK

**Peningkatan Spektrum Antibakteri Lisozim dan Pengaturan Difusi Lisozim dalam Edible Film Protein Whey untuk Meningkatkan Keamanan Pangan Keju Gouda**



Abdul Manab, S.Pt. MP, Prof.Dr. Ir. Hari Purnomo, M.App.Sc., Ir. Manik E.. Sawitri, MS, Khotibul Umam A. S.Pt. M.Si

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Penelitian ini bertujuan untuk: (1) Peningkatan penempelan lisozim ke matrik edible film protein whey secara kovalen menggunakan buffer potassium fosfat 1/15 M pH 6,8 yang mengandung sodium cyanoborohidrat; (2) Pengaplikasian lisozim termodifikasi pada Keju gouda dengan ditambahkan pada *edible film* protein whey yang bisa mengikat dan mengendalikan difusi lisozim sehingga aktifitas penghambatan lisozim termodifikasi terhadap bakteri gram positif dan negatif dapat ditingkatkan untuk meningkatkan mutu keju dan keamanan pangan.

Metode Penelitian Tahun II : Tahap IV: Peningkatan penempelan lisozim pada edible film protein whey menggunakan buffer potassium fosfat mengandung 1/15 M pH 6,8 mengandung sodium cyanoborohidrat. Konsentrasi sodium cyanoborohidrat (0,005; 0,007 dan 0,009%) dalam buffer potassium fosfat mengandung 1/15 M pH 6,8. Metode :

Rancangan Acak Kelompok. Variabel: Pelepasan lisozim dari edible film protein whey, Aktifitas antimikroba lisozim, water vapor permeability, kelarutan protein, mikrostruktur edible film protein whey. Tahap V : Aplikasi lisozim termodifikasi dalam *edible film* protein whey ke keju gouda. Perlakuan : konsentrasi lisozim termodifikasi (0, 0,05 dan 0,1%) dan Pemeraman dengan 1 hari, 2 minggu, 4 minggu. Metode: Penelitian Tersarang dengan Rancangan Acak Kelompok. Variabel : Kualitas mikroorganisme (TPC, BAL, Enterococcus, *Coliform, E. coli*, *Salmonella, S. aureus,* kapang dan khamir), perubahan fisiko kimia (warna, tekstur, mikrostruktur, pH, produksi asam laktat, profil asam amino dan asam lemak) aktifitas enzim (lipase dan protease).

Hasil Penelitian Tahun II: Tahap IV menunjukkan bahwa (1) Penambahan sodium cyanoborohidrat ke edible film protein whey mengandung lisozim termodifikasi tidak menghasilkan perbedaan pengaruh ($P>0,05$) terhadap WVP, kelarutan protein, aktifitas antimikroba terhadap E. coli dan bakteri asam laktat. Tahap V menunjukkan bahwa penambahan lisozim termodifikasi ke larutan edible film tidak memberikan perbedaan pengaruh yang nyata ($P>0.05$) terhadap karakateristik fisik (Tekstur, warna L, a, b), kimia (pH, Aw, kadar air, lemak, protein dan garam) dan mikroorganisme (total mikroorganisme, kapang/khamir, bakteri asam laktat, enterococcus, coliform, E. coli, Salmonella dan S. aureus), namun pemeraman keju gouda yang tersarang pada penambahan lisozim ke larutan edible film menghasilkan pengaruh yang sangat nyata ($P<0,01$) terhadap karakateristik fisik (warna a, b), kimia (pH, Aw, kadar air, lemak, protein) dan mikroorganisme (total mikroorganisme, bakteri asam laktat, enterococcus, coliform, E. coli).



Kata kunci: lisozim, spectrum antibakteri, difusi, edible film, keju gouda.

## ABSTRACT

**Antibacterial Spectrum Enhance and Lysozyme Release In Whey Protein Edible Film For Goude Cheese Food Safety Improvement**



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The research objected: (1) Improvement of lysozyme attachment to whey protein edible film matrix covalently using potassium phosphate buffer 1/15 M pH 6,8 containing sodium cyanoborohidrate; (2) Modified Lysozyme application on gouda cheese with addition on whey protein *edible film* to control of lysozyme diffusion in gouda cheese and improvement of cheese quality.

Research method in **Second Year** : **Step IV Research**,: Sodium cyanoborohidrat content (0,005; 0,007 dan 0,009%) in potassium phosphate containing 1/15 M pH 6,8 using Completely Randomized Design. The variables were: Lysozyme Release from whey protein edible film, antimicrobial activity of lysozyme, water vapor permeability, protein solubility, microstructure of whey protein edible film. **Step V** : Modified lysozyme content (control, 0,05 and 0,1%) and cheese ripening (1 day, 2 weeks, 4 week) using Nested Design with Group Randomized Design. The variables were: microorganism quality (TPC, LAB, Enterococcus, *Coliform, E. coli*, *Salmonella, S. aureus,* yeast and mold), physico chemical changes (color, texsture, microstructure, pH, Aw, protein, water, lipid and salt content, amino acid and fatty acid content), enzyme activity (lipase and protease).

The results of the research (Step IV) were sodium cyanoborohidrat addition in whey protein edible film protein containing modified lysozyme did not gave significant effect ($P>0,05$) on WVP, protein solubility, antimicrobial activity on E. coli and lactic acid bacteria. Step V research: showed that modified lysozyme addition in whey protein edible film did not gave significant effect ($P>0.05$) on physical properties (texture, color L, a, b) and composition (water, lipid, protein, salt content and pH, Aw) and microorganism (total of microorganism, lactic acid bacteria, enterococcus, coliform, E. coli, salmonellae and S. aureus), but cheese ripening nested in modified lysozyme addition gave highly significant effect ($P<0.01$) on physical properties (texture, color a, b) and composition (water, lipid, proteint content and pH, Aw) and microorganism (total of microorganism, lactic acid bacteria, enterococcus, coliform, and E. coli).



Keywords: lysozyme, antibacterial spectrum, diffusion, edible film, gouda cheese.

# RINGKASAN

## Peningkatan Spektrum Antibakteri Lisozim dan Pengaturan Difusi Lisozim dalam Edible Film Protein Whey untuk Meningkatkan Keamanan Pangan Keju Gouda

Abdul Manab, S.Pt. MP, Prof.Dr. Ir. Hari Purnomo, M.App.Sc., Ir. Manik E.. Sawitri, MS, Khotibul Umam A. S.Pt. M.Si
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Penelitian ini dilakukan di Laboratorium Teknologi Hasil Ternak, Laboratorium Epedemiologi Fakultas Peternakan, Laboratorium Biokimia Fakultas MIPA, Laboratorium Sentral Ilmu Hayati dan Laboratorium Biosain Universitas Brawijaya Malang, Laboratorium Bersama Fakultas MIPA Universitas Negeri Malang.

Penelitian ini bertujuan untuk: (1) Peningkatan penempelan lisozim ke matrik edible film protein whey secara kovalen menggunakan buffer potassium fosfat 1/15 M pH 6,8 yang mengandung sodium cyanoborohidrat; (2) Pengaplikasian lisozim termodifikasi pada Keju gouda dengan ditambahkan pada *edible film* protein whey yang bisa mengikat dan mengendalikan difusi lisozim sehingga aktifitas penghambatan lisozim termodifikasi terhadap bakteri gram positif dan negatif dapat ditingkatkan untuk meningkatkan mutu keju dan keamanan pangan.

Materi yang digunakan yaitu putih telur, protein whey, gliserol, asam asetat, ethanol, NaCl, KCl, NH4Cl, EDTA, beeswax, tepung porang, Micrococcus lysodeicticus, Salmonella, S. aureus dan E. Coli, standard lisozim, buffer potassium fosfat, PCA, PDA, MRS agar, VRBA, BPA, SS agar, Kanamycin Aesculin Azide agar dan EMBA. Peralatan yang digunakan meliputi sentrifuse, SDS-PAGE, Spektrofotometer UV-VIS, SEM, pH meter, waterbath shaker, timbangan analitik, autoclave, inkubator. Metode Penelitian Tahun II : **Tahap IV** : Peningkatan penempelan lisozim pada edible film protein whey menggunakan buffer potassium fosfat mengandung 1/15 M pH 6,8 mengandung sodium cyanoborohidrat. Konsentrasi sodium cyanoborohidrat (0,005; 0,007 dan 0,009%) dalam buffer potassium fosfat mengandung 1/15 M pH 6,8. Metode : Rancangan Acak Kelompok. Variabel : Pelepasan lisozim dari edible film protein whey, Aktifitas antimikroba lisozim, water vapor permeability, kelarutan protein, mikrostruktur edible film protein whey. **Tahap V** : Aplikasi lisozim termodifikasi dalam *edible film* protein whey ke keju gouda. Perlakuan : Konsentrasi lisozim termodifikasi (0, 0,05 dan 0,1%) dan Pemeraman dengan 1 hari, 2 minggu, 4 minggu. Metode : Penelitisn Tersarang dengan Rancangan Acak Kelompok. Variabel : Kualitas mikroorganisme (TPC, BAL, Enterococcus, *Coliform, E. coli*, *Salmonella, S. aureus,* kapang dan khamir), perubahan fisiko kimia (warna, tekstur, mikrostruktur, pH, produksi asam laktat, profil asam amino dan asam lemak) aktifitas enzim (lipase dan protease).

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Kata kunci: lisozim, spectrum antibakteri, difusi, edible film, keju gouda.

## SUMMARY

**Antibacterial Spectrum Enhance and Lysozyme Release In Whey Protein Edible Film For Goude Cheese Food Safety Improvement**



Abdul Manab, S.Pt. MP, Prof.Dr. Ir. Hari Purnomo, M.App.Sc., Ir. Manik E.. Sawitri, MS, Khotibul Umam A. S.Pt. M.Si

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This research was conducted on Mei 2013 until December 2013 in The Animal Product Technology Laboratory, Epidemiology Laboratory Animal Husbandry Facullty, Biochemistry laboratory MIPA Faculty, Laboratorium Sentral Ilmu Hayati dan Laboratorium Biosain Universitas Brawijaya Malang.

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