



MAPPING OF ESSENTIAL OIL ENRICHED EDIBLE COATING UTILIZATION IN FOOD MATRICES: A SYSTEMATIC REVIEW

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Bogor, July 2026

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ABSTRAK

HAZIM RIZQY RAMADHAN. Pemetaan Pemanfaatan Pelapis Edibel yang Diperkaya Minyak Atsiri dalam Matriks Pangan: Sebuah Tinjauan Sistematis. Dibimbing oleh HARSI DEWANTARI KUSUMANINGRUM.

Pelapis pangan aktif sedang beralih ke biopolimer fungsional yang diperkaya minyak atsiri untuk memperpanjang masa simpan dan menjamin keamanan pangan. Tinjauan sistematis ini mengevaluasi efikasi antimikroba komparatif pelapis tersebut, menganalisis formulasi pembawa, dan memetakan jalur inaktivasi subseluler berdasarkan 85 studi empiris utama. Analisis menunjukkan bahwa matriks kitosan kationik monolitik beroperasi pada zona sinergi muatan aktif rendah yang sangat efisien (0,2%–0,9% v/v) untuk menekan patogen dan pembusuk. Sebaliknya, matriks pati atau pektin yang inert secara kimiawi memerlukan muatan aktif yang tinggi (20,0%–25,05% berbasis berat kering polimer [w/w]) untuk mengompensasi kehilangan senyawa aktif volatil selama pengeringan film. Secara subseluler, tinjauan ini berhasil memetakan tiga jalur inaktivasi utama: gangguan membran hidrofobik, penurunan regulasi gen quorum sensing, dan inhibisi pompa efluks. Temuan ini memberikan panduan desain fungsional pelapis biopolimer aktif untuk meminimalkan risiko mikrobiologis spesifik pada komoditas pangan perishable seperti stroberi, daging unggas, dan produk perikanan.

Kata kunci: keamanan pangan, pelapis aktif, pelapis biopolimer, pembusukan pangan, tinjauan sistematis



ABSTRACT

HAZIM RIZQY RAMADHAN. Mapping of Essential Oil Enriched Edible Coating Utilization in Food Matrices: A Systematic Review. Supervised by HARSI DEWANTARI KUSUMANINGRUM.

Active food packaging is transitioning to functional biopolymer coatings enriched with essential oils to extend shelf life and ensure food safety. This systematic review evaluates the comparative antimicrobial efficacy of these coatings, analyzes carrier formulations, and maps subcellular inactivation pathways across 85 primary empirical studies. Analysis reveals that monolithic cationic chitosan matrices operate in a highly efficient, low-payload synergy zone (0.2%–0.9% v/v) to suppress pathogens and spoilage organisms. Conversely, chemically inert starch or pectin matrices require a high active payload (20.0%–25.05% based on polymer dry weight [w/w]) to compensate for the loss of volatile active compounds during film drying. Subcellularly, this review successfully maps three primary inactivation pathways: hydrophobic membrane disruption, down-regulation of quorum sensing genes, and efflux pump inhibition. These findings provide a functional design framework for active biopolymer coatings to minimize commodity-specific microbiological risks in perishable foods such as strawberries, poultry, and seafood.

Keywords: active packaging, biopolymer coatings, food spoilage, foodborne pathogens, systematic review

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MAPPING OF ESSENTIAL OIL ENRICHED EDIBLE COATING UTILIZATION IN FOOD MATRICES: A SYSTEMATIC REVIEW

HAZIM RIZQY RAMADHAN

Bachelor Thesis
As one of the requirements for obtaining a
Bachelor's degree in the
Food Technology Program

**FOOD TECHNOLOGY
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PREFACE

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Hopefully, this scientific work will be useful to those in need and contribute to the advancement of science.

Bogor, July 2026

Hazim Rizqy Ramadhan

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