Thesis Title	Study of Phytochemicals and Biological Properties of Galangal and Bitter Ginger Extracts for Cosmetic and Beauty Applications
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ABSTRACT

Acne vulgaris, a common inflammatory skin disorder, is often exacerbated by bacterial colonization, particularly *Cutibacterium acnes*. Conventional treatments, including antibiotics and topical agents, are increasingly challenged by antibiotic resistance and side effects, prompting the exploration of plant-based alternatives. This study investigates the therapeutic potential of galangal (*Alpinia galanga*) and bitter ginger (*Zingiber zerumbet*) extracts for cosmetic applications, focusing on their phytochemical composition, antioxidant properties, and antimicrobial efficacy against acne-associated bacteria.

Extracts were obtained from rhizomes, stems, and leaves using methanol and ethanol as solvents and analyzed via and LC-MS/MS to identify bioactive compounds. Antioxidant capacity was evaluated using DPPH assay, while broth microdilution assays assessed antimicrobial activity against *C. acnes*, *Staphylococcus epidermidis*, and *Staphylococcus aureus*. To enhance applicability, hydrogel formulations incorporating the extracts were developed and evaluated for pH, viscosity, color stability, and long-term durability under cyclic temperature stress conditions.

The findings revealed that rhizome extracts exhibited superior antioxidant activity, with IC50 values comparable to standard antioxidants. Antimicrobial assays identified significant inhibitory effects, particularly from rhizome extracts, with low MIC and MBC values against acne-associated bacteria. Hydrogel formulations exhibited

excellent stability, maintaining homogeneity, viscosity, and pH throughout testing, confirming their suitability as carriers for bioactive compounds.

This research highlights the potential of galangal and bitter ginger as plant-based alternatives for acne treatment, offering natural, effective, and stable skincare solutions.

Keywords: *Acne vulgaris, Alpinia galanga*, Antimicrobial, Hydrogels, Phytochemicals, *Zingiber zerumbet*