Development of Immunostimulant Lozenges Based on a Combination of Ciplukan Fruit Extract and Propolis Extract

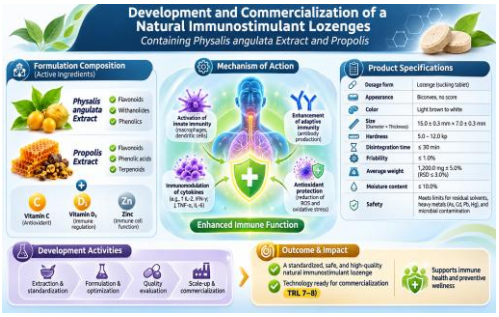
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ABSTRACT

This project aims to develop and commercialize natural immunostimulant lozenges combining Physalis angulata fruit extract and propolis through collaboration between Institut Teknologi Bandung and PT Meprofarm. Achievements include successful pilot-scale production, quality characterization, packaging design, and efficacy studies published in Medicinus. Accelerated stability testing confirmed compliance with physical quality and marker content specifications. Taste evaluation, production cost analysis, and raw material supplier audits were completed. Ongoing activities include preparation for subchronic toxicity testing and compilation of regulatory dossiers for BPOM marketing authorization. These achievements strengthen technological readiness toward TRL 7–8 and support future commercialization of locally sourced herbal products.



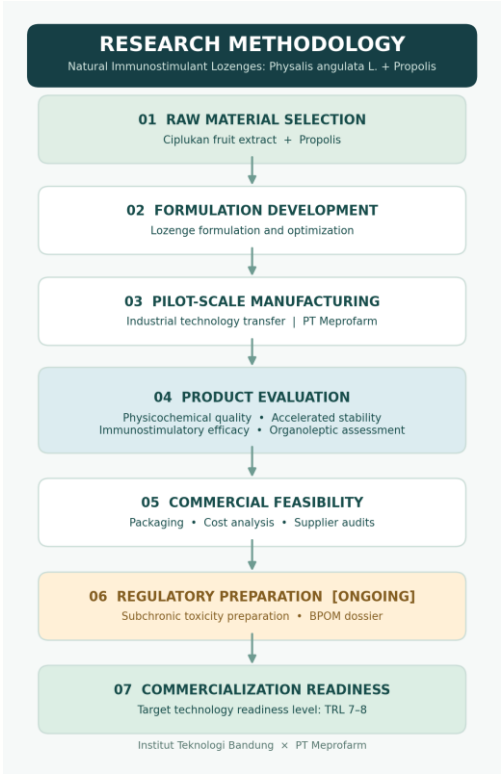
Keyword: Ciplukan (*Physalis angulata L.*), propolis, immunostimulant lozenges, pilot-scale production, pharmaceutical product commercialization.

INTRODUCTION

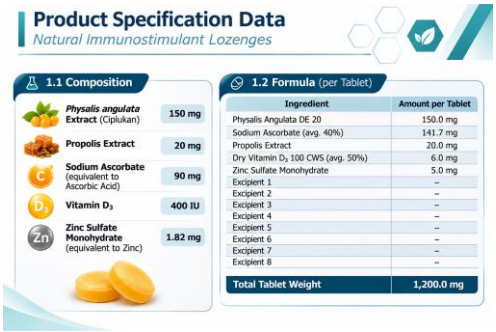
Natural immunostimulants derived from medicinal plants offer promising opportunities to strengthen Indonesia's pharmaceutical self-reliance and promote sustainable healthcare innovation. Physalis angulata L. (ciplukan) and propolis contain bioactive compounds with potential immunomodulatory, antioxidant, and anti-inflammatory activities. Combining these natural ingredients into an innovative lozenge formulation provides a practical approach to supporting immune health while enhancing the economic value of local biodiversity. This collaborative project between Institut Teknologi Bandung and PT Meprofarm focuses on formulation optimization, pilot-scale manufacturing, quality characterization, stability evaluation, and regulatory readiness. Scientific evidence supporting immunostimulatory efficacy provides a strong foundation for further product development. Through the integration of academic research, industrial expertise, quality assurance, and commercialization strategies, the project aims to advance Technology Readiness Levels (TRL 7–8), facilitate regulatory approval, ensure sustainable raw material supply, and accelerate the commercialization of high-quality, locally sourced herbal healthcare products in Indonesia, contributing to national pharmaceutical innovation and sustainable economic growth.

RESEARCH METHODS

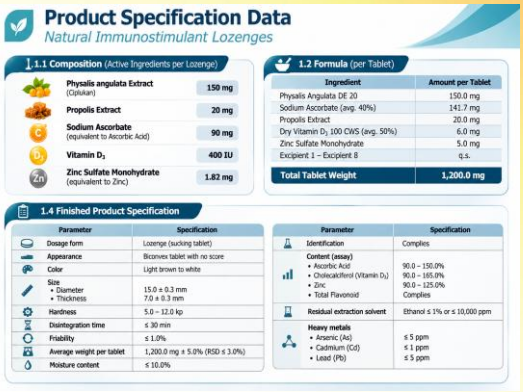
This study employed an integrated research and development approach through collaboration between Institut Teknologi Bandung and PT Meprofarm. Immunostimulant lozenges containing Physalis angulata fruit extract and propolis were developed and scaled up from laboratory to pilot-scale production. Product evaluation included physicochemical characterization, accelerated stability testing, and marker compound quantification. Immunostimulatory efficacy was investigated through biological studies, while organoleptic properties were assessed through taste evaluation. Packaging design, production cost analysis, and raw material supplier audits were conducted to assess commercialization feasibility. Further activities involved preparation for subchronic toxicity testing and compilation of regulatory dossiers for BPOM marketing authorization submission.



DISCUSSION & RESULTS



Formulation and key active ingredients of Natural Immunostimulant Lozenges.



The natural immunostimulant lozenges integrate Physalis angulata extract, propolis, vitamin C, vitamin D3, and zinc, providing a scientifically grounded combination of antioxidant and immune-supporting ingredients. The comprehensive product specifications establish clear quality standards for physicochemical properties, active ingredient content, and microbiological safety, supporting formulation consistency, product stability, and pharmaceutical quality assurance.



The figure illustrates the primary and secondary packaging of KEBALIN, a chocolate-flavored natural immunostimulant lozenge supplement. The primary packaging consists of a white plastic bottle containing 30 lozenges, while the secondary packaging features a printed cardboard carton. Both packages incorporate consistent branding, product information, and illustrations of honey, bees, and botanical ingredients. The packaging design combines aesthetic appeal, functionality, and consumer convenience, supporting product identification, quality presentation, market recognition, and commercialization potential within the nutraceutical industry.



The activities included an internal monitoring and evaluation (Monev) visit by the DHKT team to PT Mepro in Bandung, as well as research team visits to a ciplukan farmer in Ciwidey and a propolis vendor in Bogor to assess raw material quality and supplier readiness.

CONCLUSIONS

1. **Development:** Successful pilot-scale production.
2. **Quality**: Stable formulation meeting specifications.
3. **Commercialization**: Progress toward TRL 7–8 and BPOM approval.