



Harnessing the potential of *Heterotrigona itama* propolis: An overview of antimicrobial and antioxidant properties for nanotechnology–Based delivery systems

Afzan Mahmad^{a, b}, Lee Suan Chua^{a, c}  , Teh Ubaidah Noh^c, Chee Kiong Siew^d,
Lay Jing Seow^e

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Highlights

- *Heterotrigona itama* propolis possesses antimicrobial and antioxidant properties.
- Propolis is rich in bioactive compounds, especially polyphenolics and terpenoids.
- Antioxidant propolis is mainly contributed by flavonoids and phenolics.
- Antimicrobial propolis could be attributed to flavonoids and terpenoids.
- Propolis is potentially developed into nano-based system for better therapeutic function.

Abstract

Propolis which is derived from the stingless bee species of *Heterotrigona itama* is primarily found in Southeast Asia. It is rich in phenolics including flavonoids and tannins for many applications. This review delves into studies reporting the characterization of *H. itama* propolis, including its physicochemical analyses, antimicrobial and antioxidant activities, focusing on its future use in nanotechnology–based delivery systems. Studies revealed a complex profile of bioactive compounds, encompassing fatty acids, phenols, steroids, terpenoids, and other groups. Various extraction techniques, such as ultrasound–assisted extraction, maceration, Soxhlet, and liquid–liquid partition using different solvents, have been employed to extract propolis. Each method offers advantages in enhancing the quality of propolis extract for the phenolics, flavonoids, tannins, and antimicrobial and antioxidant capacity. The potential of *H. itama* propolis in nanotechnology–based delivery systems has focused on the nutraceutical delivery. Various nanoscale platforms such as nanoemulsion and nanoemulgel could demonstrate remarkable potential for the delivery of active compounds in propolis, to combat systemic microbial diseases. The exploration of *H. itama* propolis–based delivery systems within the framework of nanotechnology can comprehensively elucidate the applicability, versatility, and potential performance of the systems in the realm of health sciences while embracing the unique taste of propolis.

Graphical abstract