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PREPARATION OF HYDROGEL FROM BEE POLLEN EXTRACTS

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ABSTRACT

Hydrogels are water-expanding insoluble polymers that are available as sheet, amorphous gel, and sheet hydrogel-impregnated dressings. Chitosan/PVA hydrogel layers are used to make a hydrogel that contains stingless bee pollen extract and could be used as wound dressing materials. The main purpose of this study is to prepare the hydrogel wound dressing with containing bee pollen extracts at different concentrations which at 5ml, 10ml and 15ml. Their tensile strength, gel fraction and porosity were investigated. In this study, hydrogel incorporated with different concentration of 5, 10,15 ml stingless bee pollen extract was obtained successfully. Sample 1 which is hydrogel with 5ml of bee pollen extract has a higher tensile strength with value of 0.348 $N.mm^2$ and higher gel fraction which the value is 25%.

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CHAPTER ONE
BACKGROUND

1.1 Introduction

Honey is a naturally sweet substance made by bees from flower nectar, plant secretions, or plant-sucking bug excretions. Bees take raw ingredients and convert them into honey by mixing them with salivary gland secretion, which is then left in the combs to develop and mature. (Ngalimat *et al.*, 2019) Because of its high sugar concentration, acidity, hydrogen peroxide (H_2O_2), and phytochemical components, stingless bee nest products, such as honey, are strong in antibacterial activity (Sinacori *et al.*, 2014). Bee pollen is made from pollen grains that bees capture and combine with salivary gland secretion or nectar before being kept and fermented in a storage pot. (Vásquez & Olofsson, 2009).

Pollen harvested by honeybees can be regarded a viable source of energy for human consumption. Pollen comprises carbohydrates, proteins, amino acids, lipids, vitamins, minerals, and trace amounts of micronutrients. (Serra Bonvehí *et al.*, 2001) Bee pollen extracts can be used as apitherapy or as a nutritional supplement because of the number of phenolic compounds and the ability to sequester the relevant free radicals for its carcinogenesis and stress oxidative. (TANG *et al.*, 2005) The bioactive qualities of apicultural pollen extracts can be enhanced by utilising a solvent suited for extraction, which improves free radical sequestration activity. (Di Paola-Naranjo *et al.*, 2004).

Bee pollen extract can be used as an ingredient in the production of hydrogel, particularly for wound treatment. Hydrophilic polymer networks in three dimensions make up hydrogel dressings. They create a moist environment at the wound site, which stimulates tissue regeneration through granulation and re-epithelialization.

The literature indicates that its antioxidative, immunomodulating, epithelialization accelerating, bacteriostatic, and anaesthetic capabilities, as well as the suitability of its application in burn wound treatment, are established. (Rzepecka-Stojko *et al.*, 2012) Furthermore, pollen has a strong anti-inflammatory impact, shortens healing time, reduces the discomfort of both the duration and intensity of diseases, and is significantly less expensive. (Lawag et al., 2021).

1.2 Literature Review

1.2.1 Stingless Bee Pollen

To do this study, bee pollen used is from stingless bee (*Heterotrigona Itama*) which was taken from Uitm Dungun, Terengganu Malaysia. In compared to other stingless bee species, research on the health benefits of its honey is limited. In their hive, stingless bees produce bee products such as honey, propolis, and bee pollen. Beebread (bee pollen) was made up of floral pollen combined with nectar and bee secretion and gathered by bees. (Mohd & Zin, 2020) It is used by bees as a protein source. Beebread's chemical makeup is determined by plant sources, geographic origin, climate conditions, soil kinds, and beekeeping operations. (Mohd & Zin, 2020) Protein, amino acids, lipids, and carbohydrates are the main components of beebread.

1.2.2 Extraction

Extraction is the initial stage in separating desired natural products from raw materials. Extraction methods include solvent extraction, distillation, pressing, and sublimation, depending on the extraction principle. The most commonly utilised approach is solvent extraction. (Zhang *et al.*, 2018) The solvent chosen is essential for solvent extraction. According to the law of resemblance and intermiscibility (like dissolves like), solvents with polarities close to the polarity of the solute will likely function better, and vice versa. Alcohols (Ethanol and Methanol) are universal solvents in phytochemical solvent extraction. (Zhang *et al.*, 2018).