Chapter 1

Introduction

Coccinia grandis is a dioecious perennial vine plant originating from the family Cucurbitaceae. Also known as the Ivy gourd, the plant is commonly distributed in Asian nations ranging from India, The Philippines, Indonesia and up to the northern regions of New Guinea. The herb has been used in ayurvedic and in traditional chinese medicine practices due to its numerous pharmacological effects such as wound healing, antipyretic and anti-inflammatory effects which is used for a variety of conditions and diseases such as diabetes, ulcers, urinary tract infections (Tamilselvan et al., 2011). Particularly in Indonesia, certain parts of the plant such as the leaves and the fruits have been consumed for its antidiabetic properties. A study by Al-Madhagy et al. (2019) has revealed that the herb contains numerous phytochemical compounds such as triterpenoids, flavonoids, saponins, sterols and other phenolic compounds such as ferulic acid and methyl caffeate.

However, the main limitation of utilizing phytochemical extracts such as that of *Coccinia grandis* is its poor bioavailability, therefore making its use especially in Indonesia less prevalent. According to a study by Peduruhewa et al. (2022), the antioxidant bioaccessibility of *C. grandis* is revealed to only be around 40%. Furthermore, most studies in Indonesia revolving around the use of *C. grandis* only analyzed the extract itself without incorporating it to a certain vehicle or system (Putra et al., 2021 ; Wasantwisut & Viriyapanich, 2003). Not only for *C. grandis*, many phytochemical compounds that are extracted from herbs tend to have low bioavailability, which in turn reduces how well they exert their therapeutic effects. Furthermore, the shelf life and storage of herbal extracts and preparations can pose another challenge as they tend to be less stable compared to synthetic compounds or drugs.

Therefore, the utilization of nanoemulsions onto the extracts of *C. grandis* may potentially improve its bioavailability by encapsulating the bioactive compounds within the nanoemulsion droplets. This approach enhances the solubility, bioavailability, and also protects the herbal extracts from physical

and chemical degradation (Gopi et al., 2016). The use of nanoemulsions can also improve tissue distribution and sustain drug delivery, which in turn improves the efficacy and the therapeutic potential. Furthermore, the drug delivery system can be made more specific to target desired organs or certain tissues by manipulating the method of preparation, excipients, oil-phase and surfactants used, where in this case the formula is to be made for oral administration. Therefore, the development of *C. grandis* nanoemulsion can prove to be a sustainable and environmentally friendly research which can potentially increase the local value of *C. grandis* as a natural resource in Indonesia while also contributing to the development of natural active ingredients in the country.

1.1 Objective

- Develop a nanoemulsion formulation incorporating the *Coccinia grandis* extract
- Characterize its droplet size, size distribution, zeta potential, droplet structure
- Evaluate its antioxidant activity

1.2 Hypotheses

- The nanoemulsion will have significantly better antioxidant activity compared to the crude extract.
- The nanoemulsions will successfully be formed.
- The nanoemulsions formed will be stable after being subjected to stability testing.