CHAPTER I

INTRODUCTION

1.1 Rationale

Morinda citrifolia (Noni), a plant which has been used in folk remedies for over 2000 years, has recently gained increased interest from the scientists and medical professionals. The true health benefits of these remedies are being investigated widely. All parts of the plants, which include the fruits, the leaves, the bark, and the roots have been shown to contain active compounds that have high medicinal values. *Wang et al., 2002* have recently published a review of Noni research, which summarizes the therapeutic effects of various compounds in this plant (*Wang et al., 2002*). Noni fruits and leaves are edible and have been used as a food and in herbal remedies to maintain overall health and to treat various diseases. The roots of Noni plants were used by Polynesians to produce yellow or red dye. but more importantly, they contain medicinally active components, namely anthraquinones, which show several therapeutic effects. These include anti-bacterial, anti-viral, and anti-cancer activities as well as analgesic effects, which make the roots potentially useful in several medical applications (*Hiramatsu et al., 1993; Asahina et al., 1994*). However, making use of the roots is unlike making use of the fruits and the leaves. When the roots are harvested, the entire plants are generally destroyed, thus no longer offering medicinal value thereafter. Re-growing the plants generally takes 3 to 4 years before they are ready to be extracted. Thus, it is important that the roots be extracted efficiently.

Recent studies have shown that ultrasound-assisted extraction techniques enhances the efficiency of secondary metabolites extraction by increasing the yield and by shortening the time of extraction. This technique was investigated for various plant tissues, such as excised leaves of tea, mint, sage, chamomile, ginseng, arnica, and gentian (*Mason et al., 1994; Li et al., 1994; Salisova et al., 1997; Vinatoru et al., 1997; Hromádková et al., 1999*). These studies demonstrated that ultrasound is capable of accelerating the extraction of organic compounds contained within the plant tissues by disrupting the cell walls and enhancing mass transfer of cell contents. The review of ultrasonic isolation of bioactive compounds from plant materials can be found in a recent paper by *Vinatoru et al., 1999.*

Microwave is another alternative for efficient recovery of natural product. The enhancement of product recovery by microwave is attributed to its heating effect, which occurs due to the dipole rotation of the solvent in the microwave field. This heating effect causes the temperature of the solvent to rise, which then increases the solubility of the compound of interest.

The review of microwave isolations of bioactive compounds has appeared in literature. Microwave has been applied to the extraction of plant materials such as glycyrrhizic from the licorice root and ginsenoside from ginseng root *(Shu et al., 2000; Shu et al., 2003)*. Even though the effects of ultrasound and microwave have been studied in over 50 herbal species, to the author's knowledge, their effects on the extraction of *Morinda citrifolia* has not been investigated

The aim of this study is therefore to determine the yield and the rate of extraction of anthraquinones from the roots of *Morinda citrifolia* by means of conventional ethanol extraction *per se* as compared with ultrasound-assisted extraction and microwave-assisted extraction. We specifically investigate the effects of times of ultrasonic and microwave treatment, temperature, ultrasonic and microwave power, type and compositions of solvents on the release of anthraquinones.

1.2 Objectives

1.2.1 To determine the percent recovery of anthraquinones using ultrasound-assisted solvent extraction and microwave-assisted solvent extraction from the roots of *Morinda citrifolia.*

1.2.2 To investigate the appropriate operating conditions for ultrasound-assisted solvent extraction and microwave-assisted solvent extraction of anthraquinones

1.2.3 To compare the recovery of ultrasound-assisted solvent extraction and microwave-assisted solvent extraction with classical solvent extractions.

1.2.4 To measure antioxidant activities of anthraquinone extracts resulted from ultrasound assisted extraction and microwave assisted extraction and compare them with that of the extract from classical solvent extraction.

1.3 Expected benefits

1.3.1 Provide a new and efficient alternative for extraction of plant derived medicinal compounds

1.3.2 Provide fundamental information useful for industrial scale-up of an extraction process.

1.4 Working scopes

1.4.1 Investigation of anthraquinones extraction by ultrasound assisted extraction at the temperatures of 25, 45 and 60 °C, the power settings of 3, 6 and 9 (15.7 -56.14 W) and the radiation durations of 15, 30, 45, 60, and 90 min.

1.4.2 Investigation of anthraquinones extraction by microwave assisted extraction at the temperatures of 60, 80,100 and 120 °C and at radiation durations of 5, 10, 15, and 20 min.

1.4.3 Investigation of antioxidant activities of anthraquinones extracts obtained using ultrasound and microwave assisted extraction in comparison with ethanol solvent extraction.

1.4.4 Investigation of anthraquinones extraction by ultrasound and microwave assisted extraction in various solvents and mixtures of solvents of various compositions.