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ACCEPTED MANUSCRIPT

High-Efficient Extraction of Principal Medicinal Components from Fresh *Phellodendron* Bark (Cortex Phellodendri)

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ABSTRACT

There are three key medicinal components (phellodendrine, berberine and palmatine) in the extracts of *Phellodendron* bark, as one of the fundamental herbs of traditional Chinese medicine. Different extraction methods and solvent combinations were investigated to obtain the optimal technologies for high-efficient extraction of these medicinal components. Results: The results showed that combined solvents have higher extracting effect of phellodendrine, berberine and palmatine than single solvent, and the effect of ultrasonic extraction is distinctly better than those of distillation and soxhlet extraction. Conclusion: The hydrochloric acid/ methanol- ultrasonic extraction has the best effect for three medicinal components of fresh *Phellodendron* bark, providing an extraction yield of 103.12 mg/g berberine, 24.41mg/g phellodendrine, 1.25mg/g palmatine.

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Keywords: Phellodendron; Cortex phellodendri; Extraction methods; Medicinal components

1. INTRODUCTION

Phellodendron bark has been widely known as one of the fundamental herbs of traditional Chinese medicine. *Phellodendron* bark is also called cortex phellodendri, which is the bark of two *Phellodendron* trees: *P. amurense* and *P. chinense*. *Phellodendron* bark is characterized by humorism, as bitter and cold, affecting the kidney, urinary bladder and large intestine meridians in a traditional Chinese medicine counterpart (Zhang et al., 2016). *Phellodendron* bark is also medically used to clear heat, reduce fire, dry dampness and release toxins (Li et al., 2014). Modern pharmacological researches indicated that *Phellodendron* bark has the functions of anti-pathogenic microorganism, anti-ulcer, antihypertensive and anti-arrhythmic, etc. *Phellodendron* bark can reduced blood uric acid levels in mice with hyperuricemia by inhibiting xanthine oxidase activity (Yang et al., 2005).

Many scientific findings had revealed the biomedical activities of extracts from *Phellodendron* bark. The further researches indicated that there are three key bioactive components (phellodendrine, berberine and palmatine) in the extracts of *Phellodendron* bark. Ethanol extracts of *Phellodendron* bark displayed antidiarrheal activity by attenuating ion transport by intestinal epithelium (Tsai et al., 2004; Guo et al., 2017). Medicinal extracts of *Phellodendron* bark reduced the rate of growth of Candida, which has been ascribed to berberine and palmatine content (Park et al., 1999). Different extracts of *Phellodendron* bark showed multiple functions, especially including: protect against airway inflammation in response to lipopolysaccharide treatment of mice (Mao et al., 2010; Gao et al., 2017), reduce blood glucose levels and slow the development of diabetic nephropathy in mice treated with streptozocin to induce diabetes (Kim et al., 2008 ; Muhammad et al., 2017a), reduce contractions of smooth muscle of isolated rat prostate glands (Xu and Ventura, 2010), and reduce cell replication of tumors in mice (Park et al., 2004).

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