

MASTER'S THESIS

An experimental study on identification of sulfur-fumigated Chinese medicinal materials (Codonopsis Radix and Ginseng Radix) by fluorescence microscopy

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**An experimental study on identification of sulfur-fumigated
Chinese medicinal materials (Codonopsis Radix and Ginseng
Radix) by fluorescence microscopy**

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Abstract

Background: SF processing has been firstly applied on the processing and storage of the rhizome of *Dioscorea persimilis Prain et Burkill*. in Wenxian country since 1900. Due to the simple, quick and low-cost characteristics of SF, it soon became a common post-harvesting method for CMMs. However, recent studies showed that SF can either cause chemical changes to CMMs or affect human health. The awareness of identification of sulfur-fumigated CMMs is arisen. Comparing with chemical methods, FM is more simple and user-friendly to be established in authentication. Also, recent studies showed that different chemical profiles of CMMs can emit fluorescence differently. This research aimed to validate if FM was suitable for identification of sulfur-fumigated CMMs through using *Codonopsis Radix* and *Ginseng Radix* as examples.

Method: 16 herbal samples were collected in different commercial market in different time, in which 6 of them was *Codonopsis Radix* and 8 of them was *Ginseng Radix*. Firstly, their chemical profiles of the samples were analyzed by UHPLC-QTOF-MS to make a chemical authentication. Then, their fluorescence characteristic were localized and captured on their transverse sections.

Result: All the samples of *Codonopsis Radix* and 2 samples of *Ginseng Radix* were confirmed to be sulfur-fumigated as compounds sulfates or sulfites were detected. Investigated by fluorescence, herbal samples emitted blue and yellow fluorescence in different intensity under blue and green light filter. The fluorescence of groups of laticiferous tubes and resin canals were remarkable in *Codonopsis Radix* and *Ginseng Radix* respectively. Sulfur-fumigated samples showed similar characteristic to those raw samples. It was significant that samples of *Codonopsis Radix* emitted fluorescence differently even all of them were sulfur-fumigated.

Conclusion: In the present study, samples with different growing condition, storage time and SF processing had some variation in their fluorescence characteristics. The result showed that fluorescence microscopy was not probable for identification of the sulfur-fumigated CMMs. The application of FM on the identification of sulfur-fumigated CMMs should be further investigated comprehensively.

Key works: sulfur-fumigation; *Codonopsis Radix*; *Ginseng Radix*; authentication; fluorescence microscopy; UHPLC-QTOF-MS

摘要

背景：硫磺熏蒸中藥技術是在 1900 年由溫縣人民發明並最早記載於河南溫縣縣誌的。由於硫磺熏蒸技術擁有最高效，低成本，便於操控的優點，因此一直被藥農及中藥開發藥廠用於中藥防蟲及乾燥加工。但近年不少論文開始報道有關硫磺對中藥材的危害性，其中以硫磺熏蒸會影響中藥材內部的化學成分和藥理活性的報告最令人擔憂。礙於高效液相色譜法(HPLC)等化學檢測手段的複雜性，使用化學手段鑒別硫磺熏蒸藥材存在困難及難以普及。而近年實驗證明，中藥材裏不同的化學成分在熒光顯微鏡下會發放不同熒光顏色。本研究以人參和黨參為例子，為應用熒光顯微鏡鑒別硫磺熏蒸中藥材，提供科學證據支持。

實驗方法：本研究採集了 6 個黨參及 8 個人參樣品進行分析。實驗首先以高效液相色譜-四極杆飛行時間串聯質譜 (UHPLC-QTOF/MS) 技術分析各樣品的化學成分用於鑒別樣品有否被硫磺熏蒸。然後各樣品先進行冷凍切割，並在熒光顯微鏡下進行橫切面觀察，從外到內觀察各特徵結構的熒光顏色，比較不同樣品的熒光差別。

結果：實驗結果顯示所有黨參樣品及 2 個白皮參樣品存在硫磺熏蒸后產生的硫酸鹽或亞硫酸鹽化合物，提示該樣品被硫磺熏蒸。所有樣品在熒光顯微鏡下都顯示不同程度的藍色及綠色熒光。儘管所有黨參樣品均被硫熏，但其顯示的熒光仍存在明顯差異，其中以樣品 5 和 6 最為明顯。而被硫熏的人參樣品，其熒光則非常類似於非硫熏樣品。非硫熏的人參其熒光仍存在個體差異，其中 2 個樣品的熒光強度較其他為強及明顯。黨參內的乳管群及人參內的樹脂道，其熒光強度及顏色最為突出。

結論：研究結果表明不同來源的樣品，其熒光特徵存在區別。熒光顯微鑑定技術不能有效鑒別市場上的黨參和人參是否經過硫磺熏蒸。熒光顯微鑑定硫磺熏蒸中藥方面的應用有待深入及系統探討。

關鍵詞：硫磺熏蒸；黨參；人參；熒光顯微鏡；中藥鑒別；高效液相色譜-四極杆飛行時間串聯質譜 (UHPLC-QTOF/MS)

Contents

Acknowledgements.....	I
Declaration.....	II
Abstract.....	III
摘要.....	IV
Contents.....	V
List of Figures and Tables.....	VII
1. Introduction.....	1
1.2 Standards for limitation of sulphur dioxide.....	3
1.3 Procedure of sulfur fumigation processing.....	4
1.4 Advantages and disadvantages of SF.....	5
1.5 Current methods for identification of sulfur-fumigated Chinese medicinal materials.....	7
1.6 Fluorescence microscopy.....	9
1.7 Brief introduction of Ginseng Radix and Codonopsis Radix.....	10
2. Materials and Methods.....	11
2.1 Herbal material information about Dangshen and Renshen.....	11
2.2 Apparatus.....	13
2.3 Methods.....	14
2.3.1 Chemical investigation to identify the sulfur-fumigated Dangshen.....	14
2.3.2 Chemical investigation to identify the sulfur-fumigated Renshen.....	15
2.3.3 Preparation of the transverse section.....	16
2.3.4 Recording the Fluorescence Characteristics.....	16
3. Results.....	18
3.1 Chemical profile of the Dangshen and Renshen samples.....	18
3.2 Fluorescence microscopic characteristics of Dangshen samples.....	20
3.2.1 Gross morphology of the transverse section of Dangshen (as seen by naked eyes).....	20
3.2.2 Common cellular morphology of the transverse section of Dangshen sample.....	20
3.2.3 Fluorescence characteristics of the transverse section of Dangshen samples.....	23
3.3 Fluorescence microscopic characteristics of Renshen samples.....	37
3.3.1 Gross morphology of the transverse section of Renshen (as seen by naked	

eyes)	37
3.3.2 Common cellular morphology of the transverse section of Renshen samples	37
3.3.3 Fluorescence characteristics of the transverse section of Renshen samples	41
4. Discussion	63
4.1 The quality evaluation of the CMMs	63
4.2 Preparation of the transverse section	64
4.3 Optimized SF and QOSFD	64
4.4 Relationship of fluorescence microscopic characteristics and the chemical profiles of CMMs	66
4.5 Fluorescence microscopic characteristics of the transverse section of Dangshen	67
4.6 Fluorescence microscopic characteristics of the transverse section of Renshen	68
4.7 Factors that impact the fluorescence microscopic characteristics	69
4.8 Limitation of the experiment	70
5. Conclusion	71
5.1 The chemical profiles of the samples by using UHPLC-QTOF-MS	71
5.2 The fluorescence characteristics of Codonopsis Radix (Dangshen) and Ginseng Radix (Renshen)	71
6. Future work	73
7. References	74