Comparison of the Anti-Cancer Drugs Camptothecin and 10-Hydroxy-Camptothecin from Different Plant Species by Using ...

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ABSTRACT

Camptothecin(CPT) is a compound isolated by Wall ’ s and others in 1966 from Camptotheca acuminate. Camptothecin(CPT) and its analogues can inhibit DNA topoisomerase I, which will arrest the DNA of oncogenes from synthesizing and inhibit the growth of tumors. The goals of this research is to find the best analyzing and extraction method for obtaining Camptothecin(CPT) and 10-hydroxy-camptothecin(10-OH-CPT), and compare the CPT and 10-OH-CPT content differences in various Camptothecin(CPT) containing plants. We experimented with leaves of Taiwan ’ s Camptotheca acuminate Decaisne, leaves of Taiwan ’ s Nothapodytes foetida (Wight.) Sleumer, tree branches of Taiwan ’ s Nothapodytes foetida (Wight.) Sleumer, leaves of Hunan Changsha ’ s Camptotheca acuminate Decaisne, and fruits of Hunan Changsha ’ s Camptotheca acuminate Decaisne. This experiment uses the following three extracting systems to conduct research, which are heat recirculation, ultrasound assistant extraction, and microwave assistant extraction. In the area of heating reflux extraction, we used different solvents to find out the best extraction method. Results revealed that the leaves of Taiwan ’ s Nothapodytes foetida (Wight.) Sleumer had the richest CPT content. We repeated three sessions of 3hr heating reflux extraction by using a mixed solvent composed of Methylene dichloride and water (ratio 9:1) under temperatures of 48℃. The extraction rate was 0.61 times of DMSO analysis [The ultrasonic-assisted extraction took 30 minutes using Dimethyl sulfoxide as a solvent (DMSO), which had a water content of 20%]. Leaves of Taiwan ’ s Camptotheca acuminate Decaisne had the richest 10-OH-CPT content; we repeated three sessions of 3hr heating reflux extraction by using 95% ethanol as a solvent under temperatures of 78.5℃. The extraction rate was 0.35 times of DMSO analysis [The ultrasonic-assisted extraction took 30 minutes using Dimethyl sulfoxide as a solvent (DMSO), which had a water content of 20%]. Ultrasonic-assisted extraction was used to extract effective elements within the plants, it is faster, easier, does not need heating, achieves higher extraction rates, does not destroy the structure of the extracts, displays good effects, thus proving it to be the better method. The Merck Index indicates that DMSO is a very good solvent, therefore we used various DMSO with different water contents (which are 100%, 80%, 60%, and 40%) to understand the one that would be most effective in extraction, thus establishing a standard for analysis. The results indicated that extraction was at its best when the water content was 80% for duration of 30 minutes. The content for 10-OH-CPT was 5.25g/kg, while the content for CPT was 2.67g/kg. When we compared different plants, we discovered that the leaves of Taiwan ’ s Nothapodytes foetida (Wight.) Sleumer were richest in CPT content. We applied ultrasonic- assisted extraction for 30 minutes, using a mixed solvent composed of Methylene dichloride and water (ratio 9:1) under temperatures of 48℃. The extraction rate was 2.89 times of DMSO analysis [The ultrasonic-assisted extraction took 30 minutes using Dimethyl sulfoxide as a solvent (DMSO), which had a water content of 20%]. Leaves of Taiwan ’ s Camptotheca acuminate Decaisne had the richest 10-OH-CPT content; we applied ultrasonic-assisted extraction for 30 minutes, using a mixed solvent composed of Methylene dichloride and water (ratio 9:1) under temperatures of 35℃. The extraction rate was 0.35 times of DMSO analysis [The ultrasonic-assisted extraction took 30 minutes using Dimethyl sulfoxide as a solvent (DMSO), which had a water content of 20%]. The time the ultrasonic took to finish was 18 times shorter than heating reflux extraction. Effects of microwave-assisted extraction. Microwave extraction techniques can shorten experiment and production time, save energy, reduce amounts of solvent used, decrease amounts of waste produced, it can also increase recycle rates and purity of the extraction. When we compared the plants, we discovered that the leaves of Taiwan ’ s Camptotheca acuminate Decaisne had the richest CPT content. We applied microwave-assisted extraction for 1 minute, using a mixed solvent composed of Methylene dichloride and water (ratio 9:1) under temperatures of 48℃. The extraction rate was 2.79 times of DMSO analysis [The ultrasonic-assisted extraction took 30 minutes using Dimethyl sulfoxide as a solvent (DMSO), which had a water content of 20%]. Leaves of Taiwan ’ s Nothapodytes foetida (Wight.) Sleumer were richest in 10-OH-CPT content. We applied microwave-assisted extraction for 1 minute, using a mixed solvent composed of Methylene dichloride and water (ratio 9:1) under temperatures of 35.1℃. The extraction rate was 0.31 times of DMSO analysis [The ultrasonic-assisted extraction took 30 minutes using Dimethyl sulfoxide as a solvent (DMSO), which had a water content of 20%]. Results indicate that although the total extraction amount for ultrasonic-assisted extraction is higher that microwave-assisted extraction, yet the time spent on microwave-assisted extraction is 30 times shorter. Microwave-assisted extraction only needs 1 minute to achieve higher extraction rates and uses fewer solvents. Apparently, microwave-assisted extraction will be the future trend and method adopted by extraction industries.

Keywords : Camptothecin ; 10-hydroxylcamptothecin ; Ultrasonic-assisted extraction ; Microwave-assisted extraction

Table of Contents

目錄 封面內頁 簽名頁 授權書..... iii 中文摘要..... iv 英文摘要..... vii 誌謝..... x 目錄..... xi 圖目錄..... xiii 表目錄..... xvi 第一章 緒言..... 1 第二章 文獻回顧..... 2 第一節 喜樹之簡介..... 2 第二節 青脆枝之簡介..... 4 第三節 生物鹼..... 6 第四節 喜樹鹼的研究現況..... 7 一、喜樹鹼的物化性質..... 7 二、喜樹鹼在喜樹中的分佈..... 7 三、喜樹鹼萃取、純化方法之概述..... 7 四、目前的分析法..... 8 五、喜樹中的其他化學成分..... 10 六、喜樹鹼的衍生物及其抗癌機制..... 12 第三章 材料與方法..... 16 第一節 材料..... 16 一、本研究使用含有CPT之植物..... 16 二、化學試藥..... 16 三、儀器設備..... 17 第二節 方法..... 17 一、喜樹鹼及10-羥基-喜樹鹼標準品備製..... 17 二、熱迴流法..... 18 三、超音波輔助萃取..... 18 四、微波輔助萃取..... 19 五、高效液相層析法操作條件..... 19 六、分析用樣品葉片或枝幹含水率測定..... 19 七、濃度計算..... 20 八、統計分析..... 20 第四章 結果與討論..... 21 第一節 標準品曲線的繪製..... 21 第二節 不同萃取方法萃取CPT及10-OH-CPT結果之比 較..... 24 一、熱迴流法..... 24 二、超音波輔助萃取..... 34 三、微波輔助萃取..... 52 第五章 結論..... 69 參考文獻..... 71 附錄..... 75

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