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Abstract

**CHEMICAL COMPONENTS AND QUALITY CONTROL
OF *RHIZOMA CURCUMAE* ORIGINATED FROM THREE
SPECIES OF PLANTS**

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Ezhu, one of traditional Chinese medicines, is derived from three species of *Curcuma* including *Curcuma phaeocaulis* Val., *C. kwangsiensis* S. G. Lee et C. F. Liang and *C. wenyujin* Y. H. Chen et C. Ling according to Chinese Pharmacopoeia. The essential oil of *Ezhu* was reported to possess anti-tumour and antivirus activities. Previous studies showed that the three species of *Ezhu* had variation in their chemical composition. However, only curcumol was usually quantitated for quality control of *Ezhu* because of the absence of other chemical standards. Actually, germacrone was used as marker for quality control of *Ezhu* in China Pharmacopoeia (2005). However, it is thought that interaction of multiple chemical compounds contributes to the therapeutic effects of Chinese medicines.

In this paper, 11 chemical compounds were separated from *Rhizoma Curcuma* and two transformative compounds of curzerene were obtained, which were confirmed by UV, MS and NMR data. GC-MS and HPLC-DAD were developed to control the quality of *Ezhu*, and the chemical components in *Ezhu* originated from three different plant species were also compared. This thesis consists of five chapters. **Chapter 1** is the literature review on *Ezhu*, which includes the recent development on chemical compositions and pharmacological studies of *Ezhu*. The advance of quality control for *Ezhu* has also been reviewed in this chapter. **Chapter 2** focuses on the separation of chemical compounds in *Ezhu*. Thirteen pure compounds, including curcumenone, curzerene, furanodienone, curcumol, isocurcumenol, furanodiene, germacrone, neocurdione, curcumenol curdione, beta-elemene, callitrin and callitrisin were obtained and their chemical structures were confirmed by UV, MS and NMR data. Purity test showed that the compounds could be

used as chemical standards and they were suitable for quality control of *Ezhu*. The qualitative and quantitative analysis of *Ezhu* by using GC-MS was showed in **Chapter 3**. For optimization of GC conditions, some heat unstable compounds in *Ezhu* were studied. The pathway of transformation of those compounds, including furanodiene, germacrone, curdione, curcumol and curzerene were found. And GC-MS condition was optimized. The results showed that some heat labile components degraded with the increasing temperature. **Chapter 4** showed the qualitative and quantitative determination of *Ezhu* by using HPLC-DAD, The content of eleven compounds in *Ezhu* samples was determined and HPLC fingerprint of *Ezhu* was developed. Furthermore, GC-MS and HPLC-DAD for analysis of *Ezhu* was compared and evaluated in **Chapter 5**.

Based on the work, thirteen compounds derived from *Ezhu* were obtained. Our results showed that curcumol, which was identified as active component in *Ezhu*, was undetectable in *Ezhu* of three species of plants. However, curcumol could be formed from degradation of curcudione at high temperature. The phenomena could be found for several compounds such as furanodiene, furanodienone, germacrone, neocurdione. Therefore, GC-MS condition for analysis of *Ezhu* should be optimized to avoid the degradation of heat sensitive compounds. But furanodiene and furanodienone still degraded at the optimized condition, which suggested that GC-MS should not be used for analysis of these compounds. In addition, HPLC-DAD was developed to analyze the multiple components in *Ezhu*. The methods of GC-MS and HPLC-DAD for quality control of *Ezhu* were compared and evaluated. 21 *Ezhu* samples originated from three species of plants were qualitative and quantitative determined by GC-MS and HPLC-DAD, and fingerprint of *Ezhu* was also established by using GC-MS and HPLC-DAD.

In sum, the origin of curcumol in *Ezhu* was discovered for the first time in this thesis, and the transformative pathway of 5 heat liable compounds in *Ezhu* was elucidated. Simultaneous determination of eight and eleven components in *Ezhu* by GC-MS and HPLC-DAD were developed, respectively. Fingerprint of *Ezhu* was also established by GC-MS and HPLC-DAD. In addition, the difference of chemical components of *Ezhu* from three species was also compared, which should be helpful to the further development of quality control standards for *Ezhu*.

Key words: Ezhu, *Curcuma phaeocaulis*, *C. kwangsiensis*, *C. wenyujin*, GC-MS, HPLC-DAD, heat-labile compound, transformation, cluster analysis, fingerprint, quality control, chemical standards
