ABSTRACT

Natural *Cordyceps* is one of valued Chinese Medicines (CMs), and its function is described as invigorating lung and kidney, hemostasis and eliminating phlegm according to Chinese Pharmacopoeia (2005). It is known for its efficacy in circulatory, immune, hematogenic, cardiovascular, respiratory and glandular system in modern pharmacological studies. On the other hand, analytical researches about *Cordyceps* mainly focused on the seeking of biomarkers and the developments of new methods for quality control. However, the investigation of heavy metal, another important aspect of quality control for *Cordyceps*, was ignored for a long time. In recent years, more attentions have been drawn to heavy metals in CMs. The CMs containing high content of arsenic, lead and mercury are forbidden in many countries, which led enormous economical loss. Therefore, it is essential and crucial for quality contro of CMs such as *Cordyceps sinensis*.

This thesis consists of five chapters:

Chapter 1 is the literature review on the research progress of heavy metals in CMs and their speciation analysis. Brief review on natural *Cordyceps* and its habitat has also been described here.

Chapter 2 focuses on the Flame Atomic Absorption Spectrometry analysis of iron and copper, and Graphite Furnace Atomic Absorption Spectrometry analysis of arsenic, cadmium and lead in 13 natural *Cordyceps* samples from 6 regions. The results showed toxic metals, including arsenic, cadmium and lead, existed in natural *Cordyceps*, and the contents of arsenic were higher than the limit controlled by "Green Standards of Medicinal Plants and Preparations for Foreign Trade and Economy".

Chapter 3 describes the preliminary source analysis of heavy metals in natural *Cordyceps*. The works included the determination of heavy metals in whole *Cordyceps*, stroma and dead caterpillar after careful cleaning, as well as several soil samples. The levels of lead, cadmium, iron and copper in *Cordyceps* samples

were lower after cleaning but that of arsenic was not decreased obviously. The results also showed that the heavy metals in stroma were higher ($P<0.05$) than in the dead caterpillars except arsenic.

Chapter 4 is for arsenic speciation analysis in *Cordyceps*. The separation of inorganic and organic arsenic was performed according to the national standard extraction method using 6 mol/L hydrochloric acid. Moreover, anion exchange resins were used for the separation of pentavalent and trivalent arsenic. The results showed that the arsenic in *Cordyceps* was mainly inorganic, and pentavalent arsenic.

In summary, quantitative analysis of 5 heavy metals, preliminary source analysis and the further species of arsenic, in natural *Cordyceps* were investigated, which is helpful to control the quality of *Cordyceps*.

Keywords: Natural *Cordyceps*, Heavy metals, Quantitative analysis, Source analysis, Arsenic, Speciation analysis