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Abstract

# **Quality Evaluation of *Salvia Miltiorrhiza* Based on Multiple Components Determined by Twice Development Thin Layer Chromatography**

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Danshen, the dried root and rhizome of *Salvia miltiorrhiza*, has been frequently used to treat various ailments, especially cardiovascular diseases. Recent researches have revealed Danshen's possible benefits in ischemia or coronary artery diseases, renal diseases, alcohol temperance, liver diseases and so on, which were contributed by both water-soluble salvianolic acids and fat-soluble tanshinones in *S. miltiorrhiza*.

According to the Chinese Pharmacopoeia (2005), the identification of Danshen is performed by thin layer chromatography (TLC) on tanshinone IIA and salvianolic acid B, while the quantification of this herb is done by high performance liquid chromatography (HPLC) on the aforementioned compounds. Recent researches have revealed many improved HPLC methods of determining tanshinones and salvianolic acids for the quality assessment of Danshen. In fact, TLC is a quick and convenient

way for qualitative and quantitative analysis, but former studies have only analyzed the hydrophilic and lipophilic bioactive constituents in Danshen on separate TLC plates. None of them have analyzed these two groups of compounds simultaneously on one single plate.

In the present research, a twice development TLC method has been established for simultaneous qualitative and quantitative determination of twelve hydrophilic and lipophilic constituents, namely sodium danshensu, salvianolic acid B, rosmarinic acid, salvianolic acid A, caffeic acid, protocatechuic acid, protocatechuic aldehyde, dihydrotanshinone I, cryptotanshinone, tanshinone I, tanshinone IIA and miltirone, in *Salvia miltiorrhiza*. Optimized developing solvents dichloromethane-ethyl acetate-formic acid (22:24:10) and petroleum ether-ethyl acetate-cyclohexane (25:11:14) were used for the twice development on silica gel 60F<sub>254</sub> plates. Their characteristic TLC profiles were observed under UV 254 nm and 365 nm, while the quantification was achieved by scanning at 260 nm or 290 nm with reference wavelength of 400 nm. In addition, fingerprints and hierarchical cluster analysis were also performed based on the TLC profiles and quantitative results, which is helpful for Danshen's quality evaluation.

**Keywords:** Danshen, *Salvia miltiorrhiza*, phenolic acids, tanshinones, thin layer chromatography (TLC), twice development, hierarchical cluster analysis, fingerprint