

## Investigation of Methods for Quality Control of *Panax notoginseng*

### Abstract

Chinese traditional medicine (CTM), with mild nature and few side effects, is widely considered to be effective in disease prevention and health maintenance, as well as in curing chronic diseases. In recent years, with the rise of the back-to-nature trend and growing concern for treating ageing problem and chronic diseases, demand for Chinese medicine has been on the increase. The growth potential of the global market is promising. However, quality control is the bottle-neck for Chinese medicine enters into the world market. Therefore, how to control the quality such as safety, efficacy and stability of Chinese medicine or herbal medicine is very important.

*Panax notoginseng* (family Araliaceae), also called Sanqi, Sanqi ginseng, Tianqi ginseng and Jingbuhuan in Chinese, is one of the valuable and unique Chinese traditional medicines. For control the quality of Sanqi, saponins, major biological active components in Sanqi, were extracted by using pressurized solvent extraction (PSE) and the conditions were optimized. Analysis of saponins in Sanqi was also performed by using high performance thin layer chromatography (HPTLC), high performance liquid chromatography combined with diode array detector (HPLC-DAD) and liquid chromatography coupled with mass sapectrometry (LC-MS).

#### 1. Analysis of saponins from *Panax notoginseng* using HPTLC

HPTLC method for analysis of saponins from *Panax notoginseng* was developed. Using this method, the contents of ginsenoside Rg1, Rd, Re, Rb1 and notoginsenoside R1 were determined. And *Panax notoginseng*, *Panax quinquefolium* (Ameriacn ginseng) and *Panax ginseng* (Ginseng) were also compared. The results showed that HPTLC may be used as one of the methods for dicrimination of Sanqi, Ameriacn ginseng and Ginseng. However, it is not a good method for quantitative determination of individual saponin in Sanqi because of its poor precision, reproducibility and resolution.

#### 2. Analysis of saponins from *Panax notoginseng* using PSE coupled with HPLC

Sample preparation is the key step for quality control of TCM. It has often proved to be the bottleneck of most analytical procedures, as it is one of the least evolved parts of the whole method. During the past few years, one of the most promising and recent sample preparation techniques is the PSE (Dionex trade name ASE for accelerated solvent extraction), which offers the advantages of reducing solvent consumption and allowing for

automated sample handling. Here, saponins in Sanqi were extracted by using PSE. The operating parameters for PSE including extraction solvent, particle size, pressure, temperature and extraction times were optimized by using univariate approach in order to obtain the highest extraction efficiency. The optimized conditions are as follows: solvent, methanol; particle size, 0.3-0.45 mm; temperature, 150 °C; pressure,  $6.895 \times 10^3$  MPa and extraction times, 1. The reproducibility and extraction efficiency of our extraction methods including PSE, ultrasonication, Soxhlet and immersion were compared. The results showed that PSE is a simple, efficient and rapid method with lower solvent consumption.

HPLC-DAD was also developed for quantitation of saponins in Sanqi. Simultaneous determination of 9 saponins such as ginsenoside Rb1, Rb2, Rb3, Rc, Rd, Rf, Rg1 and notoginsenoside R1 was performed using HPLC-DAD coupled with PSE. The results showed that HPLC-DAD is still a good method for analysis of saponins in Sanqi, while evaporative light scattering detector (ELSD) wasn't popular in next few years.

### 3. Analysis of saponins from *Panax notoginseng* using LC-ESI-MS

LC-ESI-MS for analysis of saponins in Sanqi was developed to confirm the results of HPLC-DAD. The total ion chromatography (TIC) was obtained using full scan and multi-reaction monitoring (MRM) in the negative ion mode. The results showed that LC-ESI-MS was powerful for the identification of saponins from Sanqi based on the MS and MS<sup>2</sup>. It also confirmed the results obtained using HPLC-DAD.

**KEYWORDS:** *Panax notoginseng*; Ginsenosides; Notoginsenosides; Pressurized solvent extraction; quality control.