# Correlation Analysis of Liposoluble Components, Kernel Weight and Germination Rate of Salvia Seeds

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#### Abstract

Aim: Study the relation of liposoluble components, kernel weight to germination rate and investigate the quality characteristics of Salvia (*Savia miltiorrhiza*) seeds with different geographic origins. Methods: The liposoluble components were analyzed by HPLC (High Performance Liquid Chromatography). Data was analyzed with SPSS. Results: Correlation coefficient of kernel weight and germination rate was 0.7990, and that of liposoluble components and germination rate was 0.0785. From data analysis, we concluded that kernel weight related to germination rate most and liposoluble components can be used as an indicator of geographic origins of Salvia seeds.

Keywords: Salvia seeds, Kernel weight, Liposoluble components, HPLC, Germination rate

#### 1. Introduction

Salvia (*Savia miltiorrhiza*) belongs to the family *Lamiaceae*. The dried root and rhizome of Salvia are valued for their application in herb medicine. Over the years, there has been a steady demand for Salvia herb medicine. Consequently, Salvia culture are increased and developed. Seed seedling transplanting is the most common method for Salvia production. However, at present time, the seeds of Chinese herbal medicines are still produced and managed with no standard. Considering climate differences and different storage conditions, seed quality is difficult to be ensured. In the present study, we analyzed the purity, kernel weight, moisture content and liposoluble components of Salvia seed to investigate their influence on the germination rate.

#### 2. Instruments and Reagents

EC2000 High Performance Liquid Chromatograph (Dalian Elite Analytical Instrumentts Co., Ltd.); UV230 detector (Dalian Elite Analytical Instrumentts Co., Ltd.); Salvia seed bought from Shanxi Qingba Chinese Herbal Medicines Buying and Selling Company; Ethyl acetate; Methanol.

## 3. Methods

### 3.1 Purity

Salvia seeds samples were from different geographic origins of China. 80 g were taken from each sample using the method of cutting half by hand. The samples were sieved by sifter with 50 holes per square inch to remove the dust and the smaller foreign matters. Then other foreign matters and seeds of other plant species were picked out. The weight of pure Salvia seeds and foreign matters were measured respectively, with 3 times repeats.

#### 3.2 Kernel Weight

The pure Salvia seeds from different places of China were divided by quartering. 1000 seeds were taken from one part of each sample and weighted with 3 times repeats.

#### 3.3 Moisture Content

The moisture content was tested by the method of constant weight at 105 °C, e.g. 20 g of full Salvia seeds were taken from the pure sample and dried to constant weight at 105 °C in oven, with 3 times repeats.

#### 3.4 Germination Rate

20 full Salvia seeds were taken from the pure samples of 6 origins, respectively. The seeds were soaked in 0.2% hypochlorous solution for 24 h and dried at room temperature.

Steriled filter paper was soaked by distilled water and put on the bottom of beakers. The seeds were scattered on the wet paper. The breakers were incubated at 20~25 °C with 80% relative humidity (RH) for 12 days. Then calculate the germination rate. The experiment was carried out with repeat.

#### 3.5 Quantity of Liposoluble Components

Salvia seeds of 6 origins were dried to constant weight in the oven. 20g dried seeds from each sample were grinded, soaked by ethyl acetate and ultrasonicated for 30 min. Then the samples were filtered. The filtrate was heated to eliminate ethyl acetate, weighted.

#### 3.6 Liposoluble Components

 $2 \times 10$ g Salvia seeds were taken respectively from the pure samples of 6 origins and put into conical flasks. 50 ml ethyl acetate was added and ultrasonicated for 30 min, cooled. Then the samples were filtered and the filtrate was made to 5 ml. 1 g Salvia was managed as above and used as control.

10  $\mu$ l samples were tested by HPLC with Sinochrom ODS-BP 5  $\mu$ m (4.6x250 mm) column, Methanol:Water (80:20) as lipid phase and 270 nm wave length.

#### 4. Results

4.1 Characteristics of Salvia Seeds

The results were showed in Table 1., which demonstrated that:

(1) The Salvia seeds purity of 6 origins were all more than 80%, and had minimum coefficient of variation.

(2) The coefficient of variation of Salvia seeds kernel weight of different origins was 29%. The correlation coefficient of kernel weight and germination rate was 0.7990. Salvia seeds from Sichuan and Shan Xi were similar in appearance. The kernel weight was about 1 g and the germination rate was 0, which may be explained by premature harvest in these areas.

(3) The water moisture of Salvia seeds from both Shanxi and Shandong was more than 10% and the germination rate was less than 50%. Both the coefficient of variation and correlation coefficient of water moisture is more than that of purity.

(4) There were significant differences of the extract patterns of seeds with different origins. The colors of all extracts were green except the seeds extracts from Sichuan and Hubei, which were red. The correlation coefficient of quantity of liposoluble components and germination rate was 0.0785, and the coefficient of variation was 58%.

#### 4.2 Liposoluble Components

The liposoluble components of Salvia seeds from 6 origins were showed in Figure. 1-7.

All the seeds extracts had an absorption peak at the 18-20 min remaining time, which was consistent with the No. 13 peak (Tanshinone IIA) of *Savia miltiorrhiza* extract. The seed extracts from Hubei and Sichuan showed similar HPLC map. The HPLC maps of seed extracts from Shandong, Shanxi, Gansu and Shan Xi were similar. There was no linear relation between the size of absorption peak and germination rate.

#### 5. Conclusion

5.1 Kernel weight related to germination rate most, in comparison, the correlation between liposoluble components and germination rate was least. Kernel weight could be used as the most sensitive factor to measure seeds quality.

5.2 The color and HPLC map of seeds extracts demonstrated that Savia seeds from Hubei and Sichuan were different from Savia seeds from Shandong, Shanxi, Gansu and Shan Xi. Consequently, liposoluble components could be used as an indicator of Salvia seeds geographic origins.

#### References

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Origins	Purity/ %	Kernel weight/g	Moisture content/%	Extraction efficiency of liposoluble components	Germinatio n rate /%
Shanxi	85.0	1.9652	10.60	7.6	45
Sichuan	80.6	1.0282	7.07	20.69	0
Gansu	86.7	1.7422	4.35	6.2	50
Shandong	80.6	1.8994	10.09	15.0	30
Hubei	88.7	1.5765	7.07	24.11	60
Shan Xi	90.5	0.9378	4.47	6.5	0
Correlation coefficient	0.2077	0.7990	0.2200	0.0785	
Coefficient of variation	5	29	37	58	84

Table 1. Characteristics of Salvia seeds of different geographic origins (*n*=3)

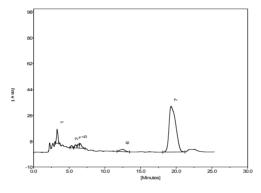


Figure 1. Liposoluble components of Savia seeds from Gansu

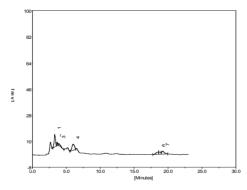


Figure 2. Liposoluble components of Savia seeds from Hubei

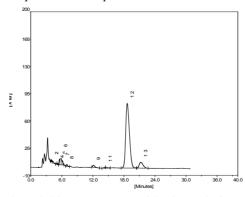


Figure 3. Liposoluble components of Savia seeds from Shandong

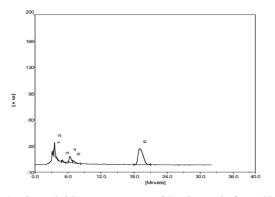


Figure 4. Liposoluble components of Savia seeds from Shan Xi

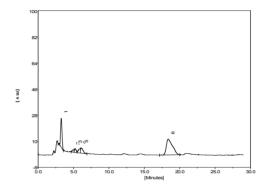


Figure 5. Liposoluble components of Savia seeds from Shanxi

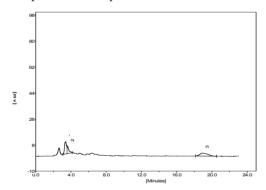


Figure 6. Liposoluble Components of Savia seeds from Sichuan

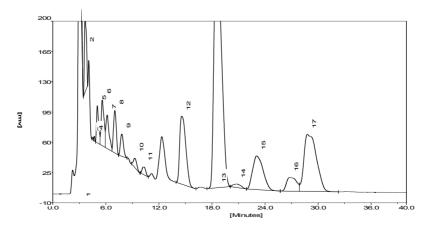


Figure 7. Liposoluble components of Savia miltiorrhiza