

Exactly took 4 ml of the *S. sarmentosum* Bunge. sample solution, operated according to the colorimetric method mentioned above and determined successively for five times. The average absorption was 0.489, and the RSD attained was 0.09%, demonstrating that the instrument used had a high precision.

A series of *S. sarmentosum* Bunge. samples were taken and treated according to sample preparation and colorimetric methods mentioned above. The flavonoid contents calculated from regression equation were 1.06%, 1.05%, 1.01%, 1.04%, 1.01%, and 1.00%, so the average content was 1.03% with RSD < 2.7% ($n = 6$), investigating a good repeatability.

Recovery experiment was performed to evaluate the accuracy of the methods. 1.0g of *S. sarmentosum* Bunge. sample powder were spiked with 0.5ml rutin solution (containing 10 mg of rutin) prior to the extraction. The spiked samples were analyzed in six copies. Recoveries of total flavonoids obtained are shown in Table 2, which informed us that the method possessed a nice accuracy.

After the extraction of *S. sarmentosum* Bunge., the sample mentioned above was dealt with according to the

procedures for the determination of total flavonoids; absorptions were measured every 20 min ranging from 0 min to 120 min [Figure 2]. It's clear that the absorption of the solution was relatively stable (RSD = 0.78%) if the measurement was carried out within 120 min. Thus, all the analyses should be performed within 2 h after the color reaction.

Sample analysis

The present method was applied to the analyses of flavonoid contents in three crude drugs from Genus *Sedum* and the results are displayed in Table 3. It is obvious that all the related plant drugs contain flavonoids, which may be associated with their common pharmacological actions.

A relationship between total flavonoid content and harvest season is also revealed by Table 3. All the three plant medicines contained maximum flavonoids in April (flowering period), and then the flavonoid quantities kept decreasing from April to June or July (during this time, the leaves of *S. erythrostictum* Migo. mostly fell down). But for *S. sarmentosum* Bunge. and *S. lineare* Thunb., the contents began to rise a little after August [Figures 3 and 4] (except *S. sarmentosum* Bunge. sample collected in Wuhan), while the flavonoid quantities of *S. erythrostictum* Migo. continued to drop during autumn [Figure 5]. It seemed

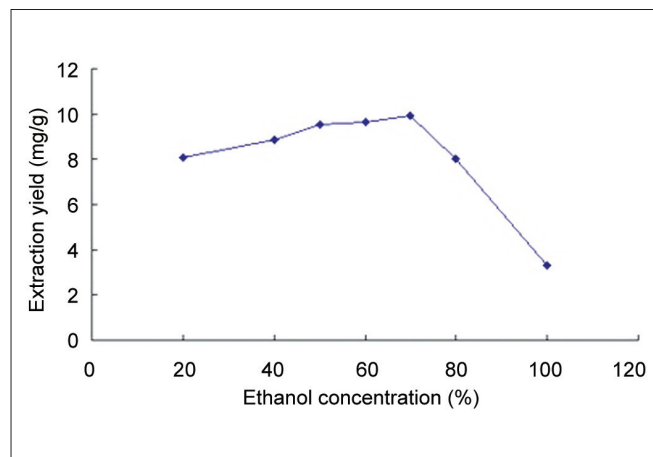


Figure 1: The relationship between the ethanol concentration and the flavonoid extraction yield of *S. sarmentosum* Bunge.

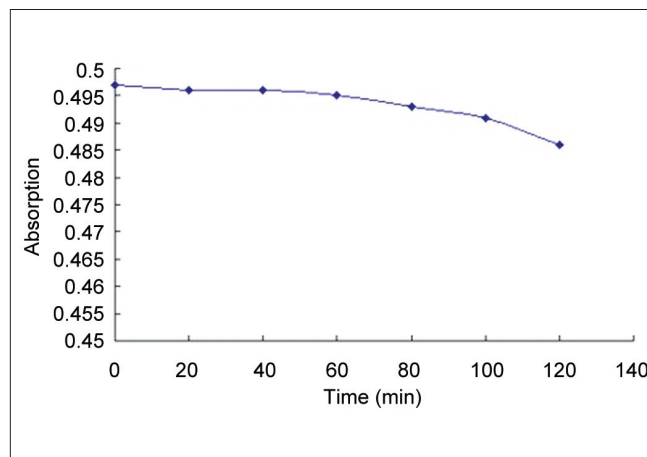


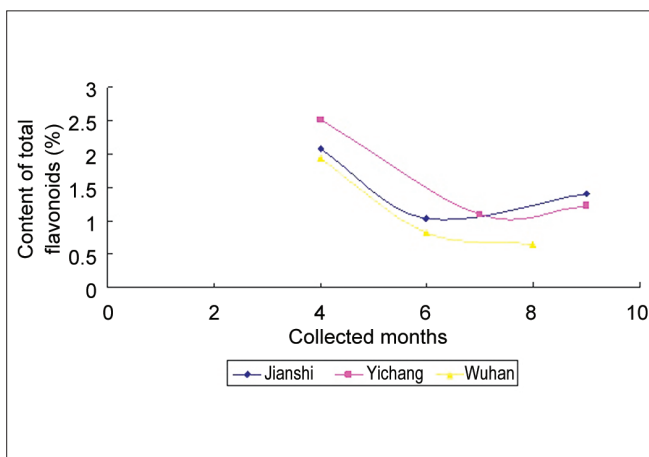
Figure 2: The relationship between the analysis time and absorption

Table 2: Recoveries of total flavonoids

Sample amount (g)	Flavonoids in the sample (mg)	Spiked rutin amount (mg)	Determined flavonoid amount (mg)	Recovery (%)	Mean recovery (%)	RSD (%)
1.0003	10.3031	10	20.07404	0.977094	93.8	2.80
1.0003	10.3031	10	19.7861	0.9483		
1.0002	10.3021	10	19.86837	0.956627		
1.0001	10.3010	10	19.58042	0.927942		
1.0001	10.3010	10	19.49815	0.919715		
0.9999	10.2990	10	19.29247	0.899347		

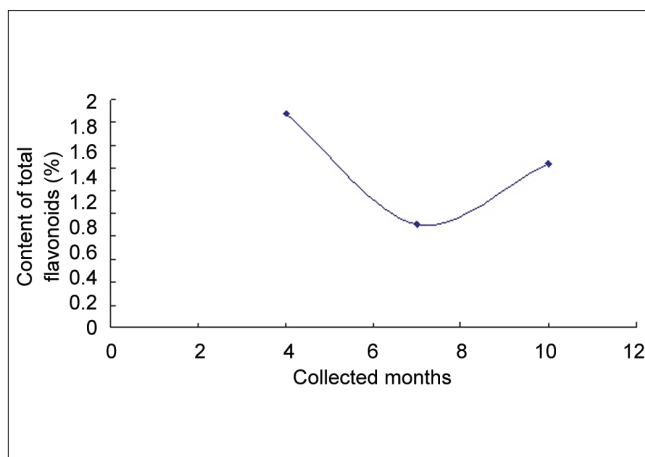
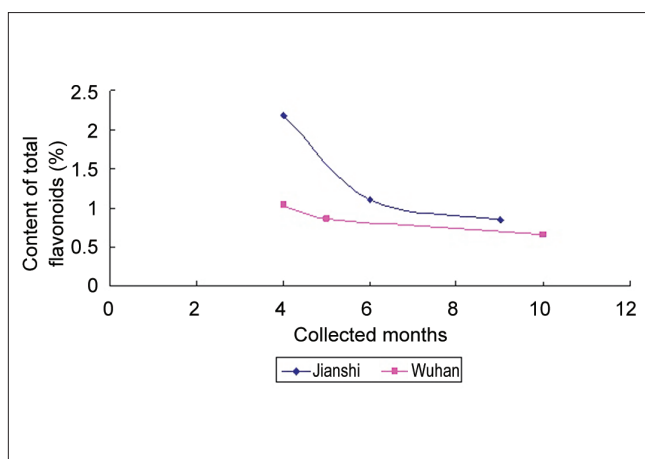
Table 3: Total flavonoids in three crude drugs from the genus *Sedum*

Species	Habitat	Date of collection	Flavonoid content (%)
<i>S. sarmentosum</i> Bunge.	Jianshi	April 27, 2006	2.09
		June 28, 2006	1.04
		September 16, 2006	1.41
	Yichang	April 16, 2006	2.52
		July 14, 2009	1.10
		September 29, 2009	1.22
	Wuhan	April 3, 2006	1.93
		June 6, 2009	0.82
		August 29, 2006	0.64
<i>S. lineare</i> Thunb.	Huangmei	April 2, 2009	1.88
	Luotian	July 14, 2006	0.91
	Huangmei	October 5, 2008	1.44
<i>S. erythrostictum</i> Migo.	Jianshi	April 26, 2006	2.18
		June 27, 2006	1.10
		September 17, 2006	0.85
	Wuhan	April 3, 2006	1.04
		May 2, 2006	0.86
		October 4, 2006	0.66

**Figure 3:** The relationship among month of collection, habitat and the content of total flavonoids in *S. sarmentosum* Bunge.

that all the three plant drugs should have the best quality if harvested in flowering time. Thus, the quality could be preliminarily controlled by flavonoid determination.

On the other hand, it was also manifested that a certain relation existed between the flavonoid content and the sample habitat. Both Figures 3 and 5 informed us that

**Figure 4:** The relationship between month of collection and the content of total flavonoids in *S. lineare* Thunb**Figure 5:** The relationship among month of collection, habitat and the content of total flavonoids in *S. erythrostictum* Migo

samples collected in the west of Hubei Province (Jianshi or Yichang) usually possessed higher flavonoid quantities than those collected in the east. Therefore, it was reasonable to deduce that Western Hubei should be a more suitable habitat to collect the three crude drugs from genus *Sedum* than the east.

CONCLUSION

As the components contained in a Chinese traditional medicine are various and complicated, the strong polar glycosides, i.e., *S. sarmentosum* Bunge. glycoside (Sarmentosin), are not the only active composition associated with hepatitis treatment. Flavonoid ingredients are also the key point. Therefore, the flavonoid quantities reflected the quality of the three medicines from one aspect.

Studies on total flavonoid determination of the *S. sarmentosum* Bunge., *S. lineare* Thunb., and *S. erythrostictum* Migo. samples collected from different habitats and months clearly manifested that the flavonoid contents are closely related to the collected seasons, which may help to judge the optimum harvest time of the three plant drugs, so that the quality could be preliminarily controlled. The results also suggested that the flavonoid content changed with the habitat. The samples harvested in the west of Hubei usually possessed higher flavonoid contents compared with those collected in the east.

The method established for the flavonoid determination in three crude drugs of genus *Sedum* was simple, direct, and accurate, providing a valuable reference for quality control.

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