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**Special lecture**

# Quantitative Assay of Korean Ginseng Components, Saponins

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## 韓國 人蔘成分 사포닌의 定量的 分析

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It is now recognized that the major specific constituents of Korean Ginseng are represented by dammarane-type saponins:

*Rbcd group* (sapogenin: 20(S)-protopanaxadiol): ginsenosides-$Rb_1$, -$Rb_2$, -Rc, and -Rd etc.

*Refg group* (sapogenin: 20(S)-protopanaxatriol): ginsenosides-Re, -Rf, -$Rg_1$, and -$Rg_2$ etc.

Though other biologically active principles have been evidently expected to be isolated from this famous medicinal plant.

Quantitative analysis of plant glycosides, especially saponins (glycosides of triterpenes or spirostanols) has been one of the highly difficult subjects in the field of pharmacognosy. The haemolytic index which has been generally used for estimation of saponins in crude drugs can not be applied to the analysis of Ginseng saponins, because these saponins have no haemolytic activity. On development of analytical procedures, several modern methods for determination of Ginseng saponins have been reported recently.

HIAI, OURA, HAMANAKA, ODAKA, and NAKAJIMA reported colorimetric analysis of the total saponins of Ginseng in use of vanillin-sulfuric acid reagent (*Planta Medica*, **28**, 131, 363 (1975)). A solution of *Rbcd* group with this coloring reagent absorbs at 544nm and a solution of *Refg group* with this reagent shows its absorption maxim. at 542nm. They used panaxadiol and panaxatriol (migrated sapogenins) as the standard compound on analysis. The similar color reaction with this reagent was also observed for other type of triterpenes, saponins, unsaturated fatty acids, phenolic natural products, and sterols.

NAMBA, YOSHIZAKI, TOMIMORI, KOBAYASHI, and HASE (*Yakugaku Zasshi*, **94**, 252 (1974)) reported the separatory determination of Ginseng saponins on Thinchrograph after separation by thin layer chromatography. On the application of this procedure, the Korean scientists, H.J. KIM, S.H. NAM, Y. FUKURA and S.K. LEE elaborated the determination of the saponins in Ginseng tea and extract (*Korean J. Ginseng Sci.* **1**, 79 (1976)). It is notable that there exist a lot of components other than saponins, "amino acids, saccharides, and phenolic glycosides etc." on the thin layer chromatogram of crude saponin-fraction of Ginseng.

In 1976, SAITO, SANADA, SHOJI and SHIBATA reported the separatory analysis of Ginseng saponins by densitometry on dual wavelength thin layer chromato-scanner (Annual Meeting

**Table I.**

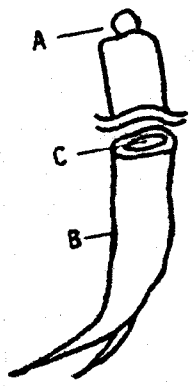
| Ginseng | 産　地 | Rbcd(換算)(%) | Refg(換算)(%) | Total(%) |
|---|---|---|---|---|
| 白　蔘(white ginseng) | Korea | 1.3 | 0.5 | 1.8 |
| | Korea | 1.8 | 0.9 | 2.7 |
| | Fukushima | 1.0 | 0.5 | 1.5 |
| | Nagano | 1.0 | 0.5 | 1.5 |
| 白　毛(root hair) | Korea | 11.0 | 4.0 | 15.0 |
| | Fukushima | 7.0 | 2.0 | 9.0 |
| | Nagano | 7.0 | 2.4 | 9.4 |
| 間引人蔘(1 year old ginseng root) | Korea | 2.9 | 1.0 | 3.9 |
| 間引人蔘(2 year old ginseng root) | Korea | 2.3 | 0.9 | 3.2 |

**Table II.**

| | | Rbcd(換算)(%) | Refg(換算)(%) | Total(%) |
|---|---|---|---|---|
| 人　蔘　茶 (ginseng tea) | A | 1.7 | 0.6 | 2.3 |
| | B | 1.0 | 0.3 | 1.3 |
| | C | 0.8 | 0.2 | 1.0 |
| | D | 0.8 | 0.1 | 0.9 |
| | E | 0.5 | 0.3 | 0.8 |
| | F | 0.3 | 0.1 | 0.4 |
| | G | 0.2 | 0.1 | 0.3 |
| | H | <0.01 | <0.01 | |
| | I | <0.01 | <0.01 | |
| 人蔘엑기스(ginseng ext.) | J-1 | 5.0 | 1.7 | 6.7 |
| | J-2 | 2.5 | 1.0 | 3.5 |

Table III.

| | Rbcd(%) | Refg(%) |
|---|---|---|
| A | 3.2 | 3.0 |
| B(反) | 3.2 | 2.1 |
| C | 0.07 | 0.05 |
| D(白蔘) | 1.6 | 0.6 |




Collected in Kumsan, Korea in 1977, 7, 22

of The Japanese Society of Pharmacognosy, Nov. 1976, Hiroshima).

Sakamoto and Morimoto of our research group reported the quantitative analysis of Ginseng saponins as their migrated sapogenins, panaxadiol and panaxatriol. (*Yakugaku Zasshi*, **95**, 1456 (1975)). On hydrolysis with dilute mineral acid, *Rbcd* and *Refg* afforded panaxadiol and panaxatriol, respectively. The optimal condition of the hydrolysis was determined and the crude hydrolysate was trimethylsilylated with N-trimethylsilyl-imidazole to give TMSi-panaxadiol and-panaxatriol in constant yields, which were

subjected to gas chromatographic analysis using diacetylhederagenin methyl ester as the internal standard. In the application of this procedure, they determined the saponin contents of crude drugs of Ginseng, Ginseng tea and extract as shown in Table I and II. Under the international joint research program, Prof. M.W. HONG, Prof. J.H. KIM, Prof. I.H. KIM and our research members visited Kumsan and collected Korean Ginseng specimen. The analytical results are shown in Table III. Very recently, SUGA of our research group determined panaxadiol and panaxatriol on dual wavelength thin layer chromatoscanner, calibrating the saponin content of Ginseng (to be published).

It should be noted that in the study of the quantitative analysis of Gineng saponins, the most tedious process is the preparation of the pure saponins as the standard sample.

Addendum of literatures:

Quantitative analysis of Ginseng saponins by colorimetry with vanillin-$H_2SO_4$ after preparative thin layer chromatography was reported by L. K. WOO, B.H. HAN, D.W. BAIK and D.S. PARK: *Yakhak Hoeji*, **17**, 129 (1973).

Quantitative analysis of Ginseng saponins by colorimetry after separation by droplet counter current chromatography (D.C.C.C.): H. OHTSUKA, I. MORITA, S. SHIBATA and Y. OGIHARA, Annual Meeting of Japanese Society of Pharmacognosy, Oct. 1974, Osaka.