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Bitterness Compounds from *Panax ginseng*

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Objectives

The purpose of this study was to investigate the use of the artificial taste sensor in the evaluation of *Panax ginseng* with bitterness.

Materials and Methods

- Materials: *Panax ginseng* from Korea Food Research Institute
- Methods

Isolation: The sliced and dried peels of *Panax ginseng* were extracted with 40% EtOH for 3 h (6 L × 7) under reflux. Filtrates of the extraction solution were evaporated *in vacuo* to produce 40% EtOH extract. The residue was suspended in H_2O and partitioned with *n*-hexane, $CHCl_3$, EtOAc, and *n*-BuOH, successively. A portion of the $CHCl_3$ fraction was chromatographed on a silicagel column using step wise gradient of *n*-hexane-EtOAc (100% *n*-hexane up to 100% EtOAc) and EtOAc-MeOH (EtOAc-MeOH mixture of increasing polarity) solvent system to yield 38 sub-fractions. Sub-fractions 6 (*n*-hexane : EtOAc = 85 : 15) led to the isolation of compound **1** using MeOH recrystallization. Sub-fractions 18 (EtOAc : MeOH = 9 : 1) led to the isolation of compound **2** using MeOH recrystallization.

Bitterness: Electronic tongue analyses were performed with the commercially available Taste-Sensing System SA 402B (Intelligent Sensor Technology Co., Ltd., Japan), namely electronic tongue (ET). The detecting part of the system consists of seven sensors whose surface is attached with artificial lipid membranes having different response properties to chemical substances on the basis of their taste.

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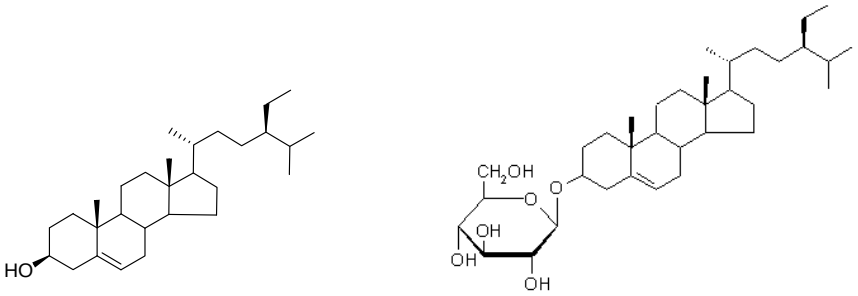
Results

Compound **1** was obtained as white powders from the $CHCl_3$ fraction and it showed a molecular ion peak at *m/z* 414 $[M]^+$ in the EI-MS. The ^{1}H-NMR spectrum of **1** showed existence of sterol skeleton. The two angular methyl singlets of 18- and 19-Me at δ 0.68 and 1.01 ,and the three doublets of 21-, 26-, and 27-Me at δ 0.96, 0.83 and 0.80 ,and the one triplet of 29-Me at δ 0.91 were observed, respectively. The olefinic proton broad doublet one signal at δ 5.35 was showed H-6. The ^{13}C-NMR spectrum of **1** showed 27 resonances, and C-5 and -6 signals were noticed at δ 141.1 and 122.2, respectively. Accordingly, the structure of **1** was elucidated as β-sitosterol (stigmast-5-en-3-ol).

Compound **2** was obtained as white powders from the $CHCl_3$ fraction and it showed a molecular ion peak at *m/z* 599 $[M+Na]^+$ in the FABMS. Two angular methyl singlet two signals of 18-Me and 19-Me at δ 0.65 and 0.98, and the doublet of 21-Me, 26-Me, and 27-Me at δ 1.00, 0.83, and 0.79 were observed, respectively. The broad doublet at δ 5.34 showed H-6 and the signals of δ 3.00 ~ 5.00 showed glycoside. The ^{13}C-NMR spectrum of **2** showed 29 resonances, and C-5 and -6 signals were noticed at δ 141.1 and 122.2, respectively. Accordingly, the structure of **2** was elucidated as daucosterol (β-sitosterol 3-*O*-glucoside).



1 **2**

Fig. 1. Chemical structures of two sterols (**1** and **2**) isolated from *P. ginseng*.

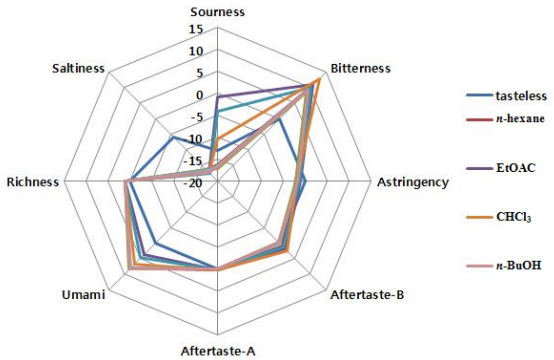


Fig. 2. Sensor output patterns of four fractions from *P. ginseng*.