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Research article

Effects of steaming on saponin compositions and antiproliferative activity of Vietnamese ginseng

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ABSTRACT

Background: Steaming of ginseng is known to change its chemical composition and biological activity. This study was carried out to investigate the effect of different steaming time-scales on chemical constituents and antiproliferative activity of Vietnamese ginseng (VG).
Methods: VG was steamed at 105°C for 2–20 h. Its saponin constituents and antiproliferative activity were studied. The similarity of chemical compositions between steamed samples at 105°C and 120°C were compared.
Results: Most protopanaxadiol and protopanaxatriol ginsenosides lost the sugar moiety at the C-20 position with 10–14 h steaming at 105°C and changed to their less polar analogues. However, ocotillol (OCT) ginsenosides were reasonably stable to steaming process. Antiproliferative activity against A549 lung cancer cells was increased on steaming and reached its plateau after 12 h steaming.
Conclusion: Steaming VG at 105°C showed a similar tendency of chemical degradation to the steaming VG at 120°C except the slower rate of reaction. Its rate was about one-third of the steaming at 120°C.

1. Introduction

Panax vietnamensis Ha et Grushv. or Vietnamese ginseng (VG) was reported in 1973, and is the most recently reported *Panax* plant [1,2]. VG contains ginsenosides as other *Panax* plants, but contains not only protopanaxadiol (PPD) and protopanaxatriol (PPT) ginsenosides, but also contains ocotillol (OCT) saponins, such as majonoside R1 (M-R1), majonoside R2 (M-R2), vinaginsenoside R1 (V-R1), and vinaginsenoside R2 (V-R2) in high yields [3,4]. In particular, M-R2 is a major saponin in VG and plays an important role in pharmacological effects on the central nervous system [5–7].

Panax ginseng or Korean ginseng (KG) has been regarded as an important and valuable herbal medicine for thousands years. Red ginseng is a traditional steamed preparation of *P. ginseng*. Red ginseng shows enhanced pharmacological activities over white ginseng in most cases. The difference in biological activities of white and red ginsengs results from the change of their chemical constituents that occur during the steaming process [8]. It has been reported that the steaming of KG at higher temperature induces the change in its chemical composition and increase of its biological activity [9–11].

Recently, we reported that steaming VG at 120°C induces the modification of saponin constituents and enhancement of its biological activity [12]. However, the temperature of 120°C is slightly high for the processing. Therefore, as a part of our continuing study on processed VG, the processing temperature at 105°C for VG was studied on the saponins composition and antiproliferative activity.

2. Materials and methods

2.1. Materials and reagents

VG was collected in 2010 from Quangnam Province, Vietnam. The voucher specimen was deposited at the herbarium of College of Pharmacy, Seoul National University (SNUP-2012-A-01).

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A Perkin Elmer series 200 HPLC (high performance liquid chromatography; Perkin Elmer, Inc., Waltham, MA, USA) system equipped with Alltech ELSD 2000 (Evaporative Light Scattering Detector; Alltech, Deerfield, IL, USA) and Sunfire C18 column (250 mm × 4.6 mm. i.d., 5 μm); (Waters Corporation, Milford, MA, USA) was used for HPLC analysis. MicroToF-QII LC/MS (Bruker Daltonics, Bremen, Germany) was used for the LC/MS analysis. SpectraMax 340PC384 microplate reader (Molecular Devices, Sunnyvale, CA, USA) was used to measure the absorbance of the samples.

A549 lung cancer cell line was purchased from the American Type Culture Collection (ATCC, Manassas, VA, USA). DMEM/F12 media, fetal bovine serum (FBS), penicillin/streptomycin antibiotics, and phosphate buffer saline (PBS) were purchased from Gibco (Grand Island, NY, USA). 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) was purchased from Amresco (Solon, OH, USA) and DMSO was purchased from Sigma–Aldrich (St. Louis, MO, USA). Solvents for HPLC were purchased from Duksan (Ansan, Korea). Ginsenoside standards were isolated and identified from KG and VG in our laboratories [3,9].

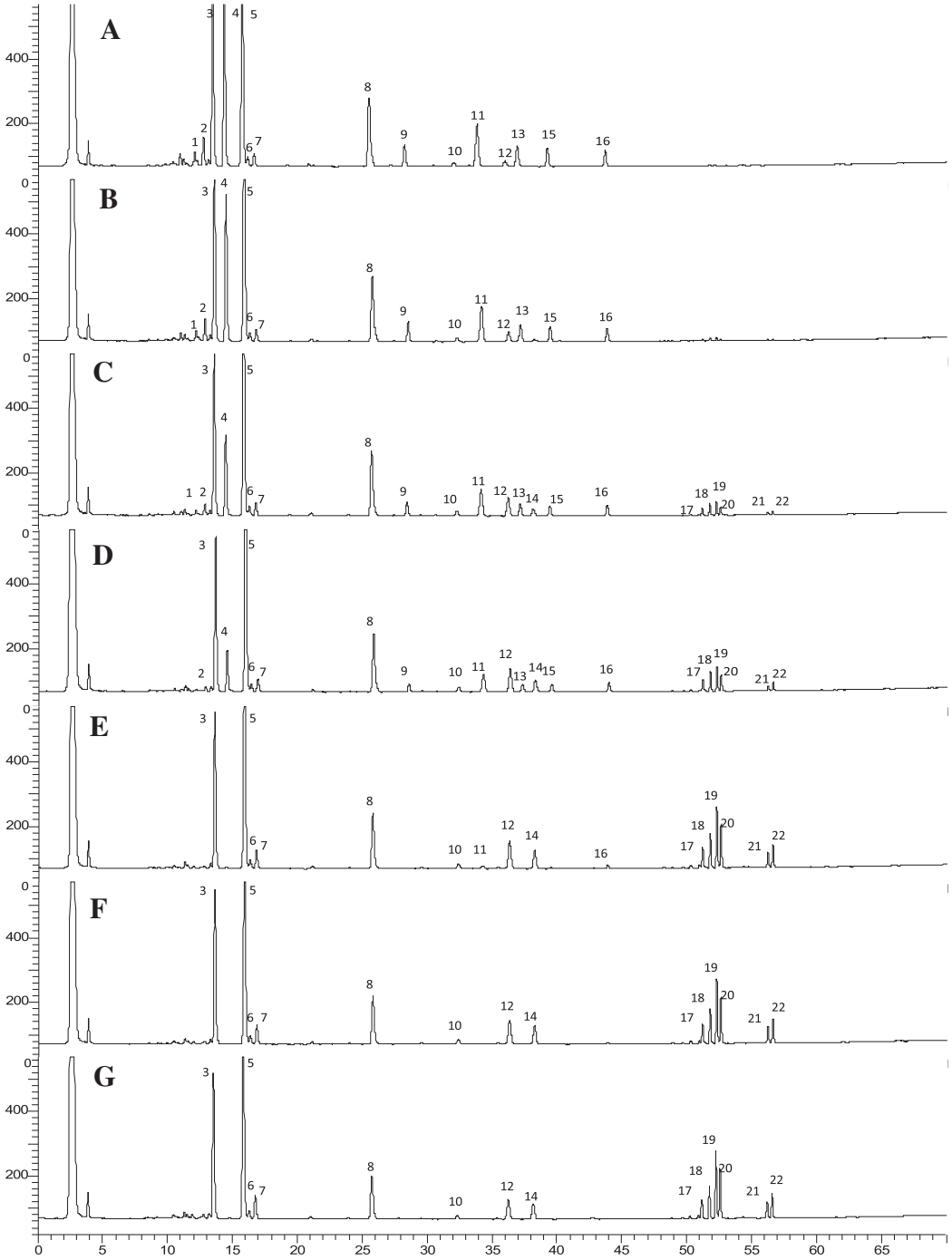

Fig. 1. Typical HPLC-evaporative light scattering detector chromatograms. Raw (A) and steamed Vietnamese ginseng at 105°C for 2 h (B), 4 h (C), 8 h (D), 12 h (E), 16 h (F), and 20 h (G). Peaks: 1, unknown 1; 2, unknown 2; 3, M-R1; 4, G-Rg_1 + G-Re; 5, M-R2; 6, V-R11; 7, P-RT4; 8, V-R2 + V-R1; 9, unknown 3; 10, unknown 4; 11, G-Rb_1; 12, 20(*S*) G-Rh_1; 13, unknown 5; 14, 20(*R*) G-Rh_1; 15, G-Rb_2; 16, G-Rd; 17, G-Rk_3; 18, G-Rh_4; 19, 20(*S*) G-Rg_3; 20, 20(*R*) G-Rg_3; 21, G-Rk_1; 22, G-Rg_5. HPLC, high performance liquid chromatography.