



Research article

Processed Vietnamese ginseng: Preliminary results in chemistry and biological activity

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ARTICLE INFO

Article history:

Received 12 October 2013

Received in Revised form

11 November 2013

Accepted 12 November 2013

Available online 17 December 2013

Keywords:

antiproliferation

ginsenoside

Panax vietnamensis

steaming

Vietnamese ginseng

ABSTRACT

Background: This study was carried out to investigate the effect of the steaming process on chemical constituents, free radical scavenging activity, and antiproliferative effect of Vietnamese ginseng.

Methods: Samples of powdered Vietnamese ginseng were steamed at 120°C for various times and their extracts were subjected to chemical and biological studies.

Results: Upon steaming, contents of polar ginsenosides, such as Rb1, Rc, Rd, Re, and Rg1, were rapidly decreased, whereas less polar ginsenosides such as Rg3, Rg5, Rk1, Rk3, and Rh4 were increased as reported previously. However, ocotillol type saponins, which have no glycosyl moiety at the C-20 position, were relatively stable on steaming. The radical scavenging activity was increased continuously up to 20 h of steaming. Similarly, the antiproliferative activity against A549 lung cancer cells was also increased.

Conclusion: It seems that the antiproliferative activity is closely related to the contents of ginsenoside Rg3, Rg5, and Rk1.

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1. Introduction

Panax spp. occur in the northern hemisphere and mostly in temperate regions. In 1973, a wild *Panax* species was found at Mount Ngoc Linh in Central Vietnam. The plant was then identified as *Panax vietnamensis* Ha et Grushv., a new *Panax* species and now commonly known as Vietnamese ginseng (VG), which is the most southern *Panax* plant discovered so far. It has been used by the Sedang ethnic group as a miraculous herbal medicine for enhancement of physical strength and treatment of many diseases with similar therapeutic indications as those of *Panax ginseng* [1]. VG contains not only protopanaxadiol (PPD) and protopanaxatriol (PPT) saponins such as ginsenoside Rb1, Rd, Re, Rg1, but also ocotillol saponins, such as majonoside R1, R2 (in high yield), and vina-ginsenoside R1 and R2 (Fig. 1) [1–5]. Majonoside R2 constitutes >5% of the dried weight of VG [2]. In addition, ocotillol saponins, especially majonoside R2 exert remarkable pharmacological effects on the central nervous system

such as antistress, antidepressive, and anxiolytic activities, which distinguishes VG from other *Panax* species [6–11].

P. ginseng, or Korean ginseng (KG), has been regarded as an important and valuable oriental herbal medicine for thousands of years. Recently, a new type of processed ginseng, named as Sun Ginseng (SG), was reported as a steamed ginseng at higher temperature than that used for the preparation of red ginseng [12]. SG contains a high yield of less polar ginsenosides, especially Rg3, Rg5, and Rk1, which showed a stronger anticancer activity. Increased pharmacological activities including antioxidant, vasodilating, and antitumor promoting activities have been reported for SG [12,13]. These active ginsenosides could be generated from ginsenoside Rb1, Rb2, Rc, and Rd via hydrolysis, dehydration, and deglycosylation during the steaming process [14].

This study aimed to investigate the influence of different durations of steaming on the saponin composition as well as the antiproliferative and antioxidant activities of processed VG.

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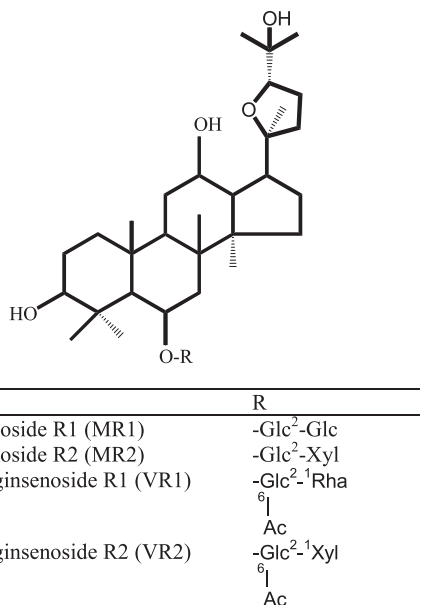


Fig. 1. Structures of ocotillol saponins in Vietnamese ginseng.

2. Materials and methods

2.1. Materials and reagents

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

Perkin Elmer series 200 HPLC (Waltham, MA, USA) (high performance liquid chromatography) system equipped with evaporative light scattering detector (Alltech ELSD 2000, Alltech, Deerfield, IL, USA) and Phenomenex C18 column (250 mm × 4.6 mm. i.d., 5 μm, Torrance, CA, USA) were used for HPLC analysis. MicroTOF-Q II LC/MS (Bruker Daltonics, Bremen, Germany) was used for the LC/MS analysis.

A549 lung cancer cells line was purchased from the American Type Culture Collection (ATCC, Manassas, VA, USA). DMEM/F12 media, fetal bovine serum, 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 purchase from Amresco (Solon, OH, USA), and 2,2-diphenyl-1-picrylhydrazyl radicals (DPPH), DMSO were purchased from Sigma Aldrich (St. Louis, MO, USA). SpectraMax 340PC384 microplate reader (Molecular Devices,

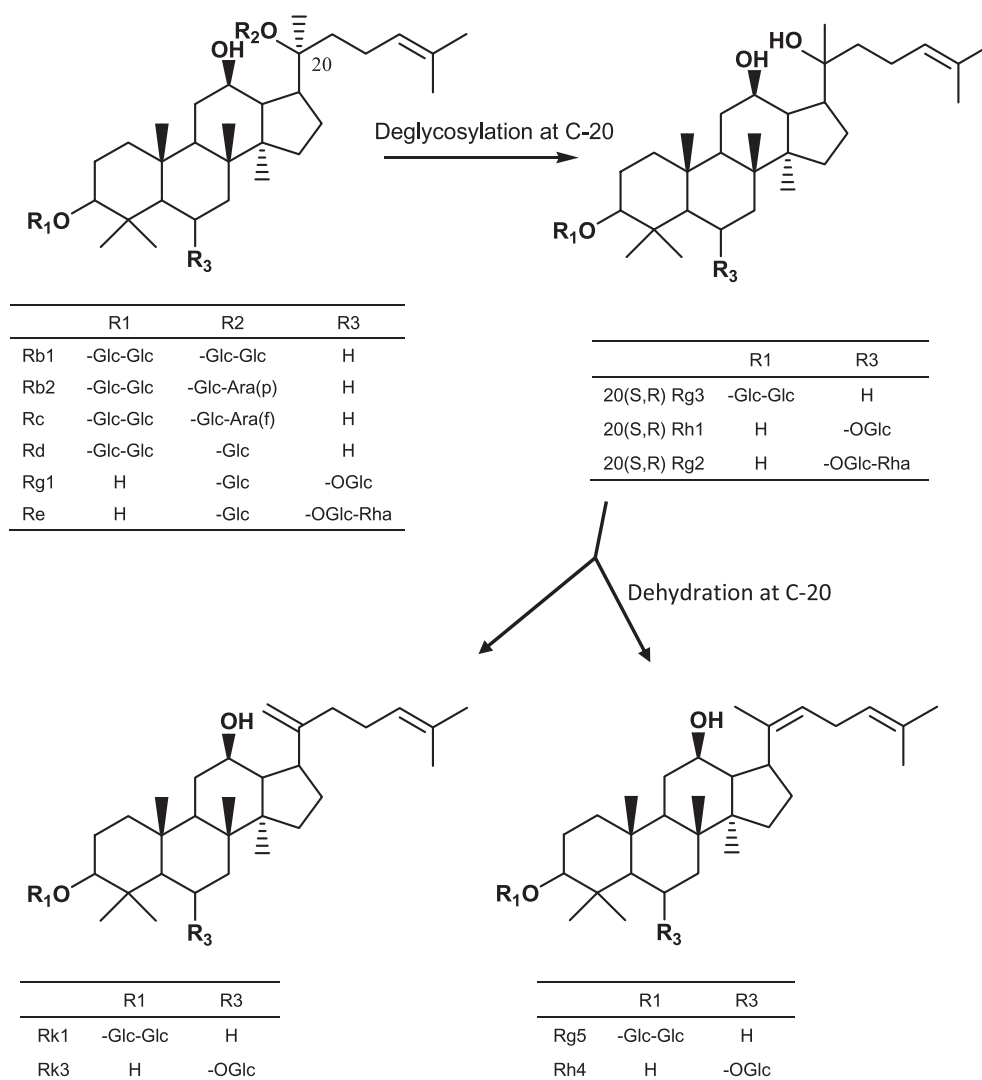


Fig. 2. Typical modification of ginsenosides by heat processing.

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