

## Anticancer Activity of Lignan from the Aerial Parts of *Saussurea salicifolia* (L.) DC.

G. CHUNSRIIMYATAV<sup>1, 2\*</sup>, I. HOZA<sup>1</sup>, P. VALÁŠEK<sup>1</sup>, S. SKROVANKOVÁ<sup>1</sup>,  
D. BANZRAGCH<sup>2</sup> and N. TSEVEGSUREN<sup>3</sup>

<sup>1</sup>Department of Food Engineering, Tomas Bata University in Zlín, 760 01 Zlín, Czech Republic;

<sup>2</sup>Institute of Chemistry and Chemical Technology, Mongolian Academy Sciences, Ulaanbaatar,

MON 51 Mongolia; <sup>3</sup>Department of Organic Chemistry, Faculty of Chemistry, National

University of Mongolia, Ulaanbaatar, Mongolia, \*E-mail: chunsrii82@yahoo.com

**Abstract:** Aerial parts of *Saussurea salicifolia* (L.) DC were studied for their lignan and flavonoids in solvent chloroform and *n*-butanol of ethanolic extract. Isolation and identification of phenolic compounds of the chloroform and *n*-butanol fractions were performed with Dionex HPLC-DAD system with water-methanol gradients in 4 different wave lengths (235 nm, 254 nm, 280 nm and 340 nm), using online UV and LC-MS as described previously. 9-OH-pinoresinol which is a lignan with anticancer activity was dominated in the chloroform fraction, whereas mainly flavonoid glycosides like quercetin-3-*O*-galactoside, apigenin-7-*O*-rhamnoside with anti-inflammatory effect were detected in the *n*-butanol fraction. Additionally, 9-OH-pinoresinol was also found in the *n*-butanol fraction. Anticancer tests were conducted in leukemia mouse lymphoma cells L5178Y at a concentration of 10 µg/ml of test compound. Crude ethanol extract of *S. salicifolia* reduced the growth of leukemia mouse lymphoma cells L5178Y to 23.8%.

**Keywords:** flavonoids; *Saussurea salicifolia*; anticancer activity; Dionex HPLC-DAD system

### INTRODUCTION

*Saussurea salicifolia* is a medicinal plant belonging to genus of *Saussurea* of Asteraceae family. *Saussurea* is represented by about 300 species in regions of Asia, Europe, and North America. Forty two species of them are grown in the flora of the Mongolia; and *Saussurea salicifolia* is widespread in the Mongolia (GRUBOV 1982). Species of the genus *Saussurea* are widely used in Mongolian traditional medicine for treatment of influenza, cough with cold, and typhoid fever as antiviral, anti-fever and antitoxic agent. *Saussurea salicifolia* is used in the traditional medicine to make Tsarvon-4, Banzdoo-6, Tanchin-10 and Tuglogunsel for the treatment of lung disease, respiratory tract inflammation, infectious cold, and for the activation of digestive organs (LIGAA 1997). Previous phytochemical and bioactivity investigations of

several species of *Saussurea* by other scientists in the world have revealed the presence of interesting bioactive compounds like flavonoids (JIANG *et al.* 1979; FAN *et al.* 2003), lignans (TAKASAKI *et al.* 2000; KO *et al.* 2004), sesquiterpene lactones (TODOROVA *et al.* 1991; JIANG *et al.* 2004) and  $\gamma$ -linolenic acid (TSEVEGSUREN *et al.* 1997) with antioxidant, anticancer and anti-atherosclerotic activities. Therefore the objective of this study was to analyse the composition of lignan and flavonoids in *Saussurea salicifolia* using HPLC-DAD method.

### MATERIAL AND METHODS

**Plant material.** The aerial parts of *Saussurea salicifolia* were collected from the Central part of Mongolia (in Tov Province) in August, 2007.

Table 1. Identified lignan and flavonoids in chloroform and *n*-butanol fractions of *S. salicifolia* ethanol extract

Fractions	Compounds identified	HPLC (Peak-RT/min)	UV spectra ( $\lambda$ max, nm)
Chloroform	9-OH-Pinoresinol	20.36	228.0; 278.3
	Quercetin-3- <i>O</i> -galactoside	21.20	256.4; 356.9
<i>n</i> -Butanol	Apigenin-7- <i>O</i> -rhamnoside	22.09	267.1; 336.2
	9-OH-Pinoresinol	20.35	227.9; 278.5

They were dried at room temperature while being protected from direct sunlight.

**Sample preparation.** The air dried plant material (100 g) was exhaustively extracted with 95% ethanol at room temperature. The extract was then filtered and evaporated by a rotary vacuum evaporator. Concentrated ethanolic extract of *Saussurea salicifolia* (L.) DC was dissolved in distilled water and then fractioned by re-extracting with *n*-hexane, chloroform, ethyl acetate and *n*-butanol.

**Chromatographic equipment and conditions.** Isolation and identification of phenolic compounds of the chloroform and *n*-butanol fractions were performed with Dionex HPLC-DAD system with water-methanol gradients in 4 different wave lengths (235 nm, 254 nm, 280 nm and 340 nm), using online UV and LC-MS as described previously.

## RESULTS AND DISCUSSION

Table 1 shows lignan and flavonoids identified by online UV and LC-MS in chloroform and *n*-butanol fractions of *Saussurea salicifolia* ethanol extract.

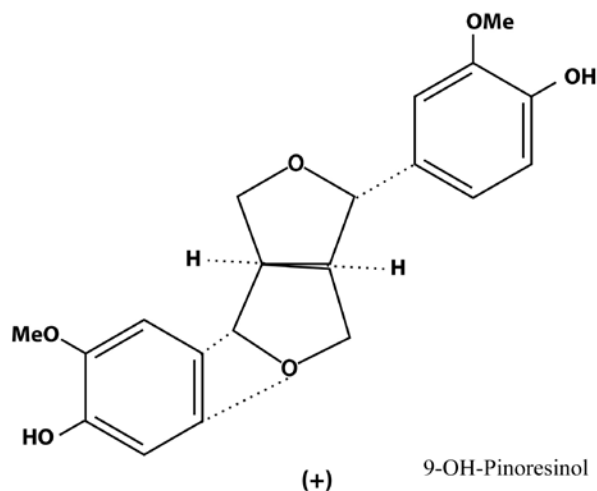


Figure 1. Structure of the lignan identified in *Saussurea salicifolia* (L.) DC

9-OH-pinoresinol which is a lignan with anti-cancer activity was dominated in the chloroform fraction, whereas mainly flavonoid glycosides like quercetin-3-*O*-galactoside, apigenin-7-*O*-rhamnoside with anti-inflammatory effect were detected in the *n*-butanol fraction. Additionally, 9-OH-pinoresinol was also found in the *n*-butanol fraction. Main structure of the lignan identified in this study is presented in Figure 1.

**Anticancer activity.** Crude ethanol extract of *S. salicifolia* reduced the growth of leukemia mouse lymphoma cells L5178Y to 23.8%. For the activity looks to be responsible the lignan like 9-OH-pinoresinol, which is well known from other plant sources.

## CONCLUSIONS

According to the results of HPLC analysis, 9-OH-pinoresinol which is a lignan with anticancer activity was dominated in the chloroform fraction, whereas mainly flavonoid glycosides like quercetin-3-*O*-galactoside, apigenin-7-*O*-rhamnoside with anti-inflammatory effect were detected in the *n*-butanol fraction. Crude ethanol extract of *S. salicifolia* reduced the growth of leukemia mouse lymphoma cells L5178Y to 23.8%.

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