

## COMMUNICATION

Chemistry

## QUANTITATIVE DETERMINATION OF SELENIUM IN ASTRAGALUS AND THYME OFFICINAL PLANTS

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The content of selenium organic forms in Astragalus and Thyme officinal plants was determined by means of spectrophotometry method using phenylthiourea as a reagent. The selenium content estimated spectrophotometrically is equal to: 11750  $\mu\text{g}/\text{kg}$  in Astragalus and 450  $\mu\text{g}/\text{kg}$  in Thyme. The amount of selenium in these plants determined earlier by means of mass-spectrometry method is equal to 12000  $\mu\text{g}/\text{kg}$  and 600  $\mu\text{g}/\text{kg}$ , respectively.

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**Keywords:** Astragalus, Thyme, selenium, phenylthiourea, optical density.

**Introduction.** Recently, owing to the deterioration of ecological conditions and continuous stress the role of functional products in the food ration of developed countries raises. The human food is mainly based on technologically treated raw materials, the intense treatment of which, including conservation, refinement, etc., leads to the loss of main vitamins, minerals and other nutrients essential for human organism.

The appearance of the so-called “civilization illnesses”: chronic fatigue syndrome, chronic stress, high blood pressure, diabetes, cardiovascular pathologies, different type of cancers is caused by above-mentioned factors.

Non-uniform distribution of selenium on the Earth’s surface (soil, water, plants) leads to the formation of regions, where its natural content is surplus or imperfect. The selenium content in different soils varies in a very wide range – from  $10^{-4}$  to 10% [1, 2]. The content of selenium in human blood is 0.001–0.004  $\text{mmol}/\text{L}$  [3].

One of the ways to raising human selenium status is the inclusion of selenium-rich products (Bio-active Additives) in food ration as well as the use of officinal plants as herbal teas. It is remarkable that recently the opinion of clinicians about officinal plants has changed dramatically, and now the importance of the latter for the prevention and protection of population health is emphasized.

Selenocysteine (SeCys) and selenomethionine (SeMet) are the most important organic forms, which are assimilated by human organism at a level of 95–98%, whereas inorganic forms may be assimilated only by 10%.

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It is well-known from literary sources that *Astragalus officinalis* plant can accumulate selenium from soil more selectively compared to many other plants. The present work is about the quantitative determination of selenium content in *Astragalus* and *Thyme*, growing in the territory of the Republic of Armenia.

**Experimental Part.** 100.0 mL of  $1 \cdot 10^{-2}$  mol/L of stock standard solution of Se(IV) (selenious acid  $\text{H}_2\text{SeO}_3$ ) was prepared by dissolving 0.07896 g of an accurately weighed sample of metallic selenium (chemically pure) in saturated nitric acid under heating conditions. The de-nitration process was carried out with distilled water on a water bath up to negative reaction of vapors towards diphenylamine. Other standard solutions of Se(IV) were prepared by appropriate dilution of the initial stock solution.

To prepare 1.5% phenylthiourea (PTU,  $\text{H}_2\text{N-CS-NH-C}_6\text{H}_5$ ) solution, accurately weighed (1.5 g) re-crystallized substance was dissolved in 100.0 mL of ethanol. Solutions of hydrochloric and sulfuric acids were prepared by appropriate dilution of the saturated initial solution.

According to the technique described in [4], phenylthiourea complex of Se(IV) was obtained and its spectrum was recorded using UV-T60 spectrophotometer. Light absorption maximum is observed at 365 nm.

Aiming to build calibration curve 1.0, 2.0, 4.0, 8.0 mL of Se(IV) standard solution with a concentration of 0.001 mg/mL were taken in four volumetric flask, 5 mL of 1.5% PTU solution was added and the volume was brought to the mark using sulfuric acid 6 mol/L background solution. The optical density at a wavelength of 365 nm of each solution was measured and a calibration curve in the optical density – concentration (A–C) coordinates was built using the data obtained.

The treatment of herbal raw (“Ghazaros” Closed Joint-Stock Company) was carried out in the following way: 20 g of dry samples of *Astragalus* and *Thyme* were treated with 15 mL of saturated sulfuric acid and settled for 20 min into Ultrasonic Homogenizer Sound Arrend (MRC) for shredding. Then, under moderate heating conditions nitric acid was added drop-by-drop in a water bath, and the heating was continued until the complete removal of nitrogen oxides. After decomposition of sulfuric acid 10 mL of hydrochloric acid (1 : 1) was added to reduce Se(VI) to Se(IV) and moderate heating was continued. The remainder was transferred into a volumetric flask (50 mL) and the volume was brought to the mark by distilled water.

5 mL of saturated sulfuric acid was added to 10 mL of the obtained solution. After cooling, 4 mL of 1.5% PTU was added and the volume was brought to 50 mL by distilled water, waited for 5 min and the optical density was measured at 365 nm. The selenium content in the samples was determined by means of calibration curve. The analysis was carried out twice. The data obtained are given below:

$$\text{Astragalus (1)} \quad A_x = 0.180; \quad C_x = 48 \mu\text{g}; \quad X = 4.8 \cdot 5 \cdot 50 = 12000 \mu\text{g/kg};$$

$$\text{Astragalus (2)} \quad A_x = 0.173; \quad C_x = 46 \mu\text{g}; \quad X = 4.6 \cdot 5 \cdot 50 = 11500 \mu\text{g/kg};$$

$$X_{\text{average}} = (12000 + 11500) : 2 = 11750 \mu\text{g/kg};$$

$$\text{Thyme (1)} \quad A_x = 0.08; \quad C_x = 2.03 \mu\text{g}; \quad X = 2.03 \cdot 5 \cdot 50 = 507.5 \mu\text{g/kg};$$

$$\text{Thyme (2)} \quad A_x = 0.06; \quad C_x = 1.52 \mu\text{g}; \quad X = 1.52 \cdot 5 \cdot 50 = 380.6 \mu\text{g/kg};$$

$$X_{\text{average}} = (507.5 + 380.6) : 2 = 444 \mu\text{g/kg}.$$

The selenium content in the indicated samples was also determined by means of mass-spectroscopy method. The analyses were carried out on an ELAN 9000

(Perkin Elmer) instrument. The selenium content corresponding to this method is 12000  $\mu\text{g}/\text{kg}$  in Astragalus and 600  $\mu\text{g}/\text{kg}$  in Thyme.

**Conclusion.** Proceeding from the results obtained one can make a conclusion that indicated officinal plants may be used as herbal teas as an alternative to selenium-containing food additives.

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#### ՍԵԼԵՆԻ ԶԱՆԱԿԱԿԱՆ ՈՐՈՇՈՒՄԸ ՈՒՐՑ ԵՎ ԳԱՉ ԴԵՂԱԲՈՒՅՍԵՐՈՒՄ

Սպեկտրալուսաչափական եղանակով որոշվել է սելենի պարունակությունը գազ և ուրց դեղաբույսերում՝ ֆենիլթիոմիզանյութն օգտագործելով որպես ազդանյութ: Նշված եղանակով որոշված սելենի պարունակությունը գազում 11750  $\mu\text{g}/\text{kg}$  է, իսկ ուրցում՝ համապատասխանաբար 450  $\mu\text{g}/\text{kg}$ : Այդ դեղաբույսերում մասս-սպեկտրաչափական եղանակով որոշված սելենի պարունակությունը գազում և ուրցում հավասար է 12000  $\mu\text{g}/\text{kg}$  և 600  $\mu\text{g}/\text{kg}$ , համապատասխանաբար:

Г. Г. ДАРБИНЯН, А. Г. ХАЧАТРЯН

#### КОЛИЧЕСТВЕННОЕ ОПРЕДЕЛЕНИЕ СЕЛЕНА В ЛЕКАРСТВЕННЫХ РАСТЕНИЯХ АСТРАГАЛЕ И ТИМЬЯНЕ

Спектрофотометрическим методом с применением в качестве реагента фенилтиомиочевины определено содержание селена в лекарственных растениях астрагале (царская трава, золототысячник, кошачий горох) и тимьяне. Указанным методом установлено, что содержание селена в астрагале составляет 11750  $\text{мкг}$ , а в тимьяне – 450  $\text{мкг}$ . Содержание селена в названных образцах, выявленное масс-спектрометрическим методом, равно 12000  $\text{мкг}/\text{кг}$  и 600  $\text{мкг}/\text{кг}$  соответственно.