THE CONTENT DETERMINATION OF CALCIUM, MAGNESIUM AND ASCORBIC ACID IN SEA BUCKTHORN FRUITS AT VULCAN COAL DUMP

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Abstract. The study presents data on content determination of calcium, magnesium and ascorbic acid in sea buckthorn fruits collected from Vulcan coal dump. The dump was never covered with soil or fertilizers containing azoth, potassium and phosphorus. The sea buckthorn was planted directly on the sterile and it has an important function in stabilizing the acclivity and fixing the atmospheric azoth with the nodosities on the roots. So, the sea buckthorn becomes widespread plant in coal dumps because it helps to the soil formation. The results obtained after the determination of calcium, magnesium and ascorbic acid from the fruits of this plant were compared with the values already reported in various references, concluding that these differences are insignificant (3.7% for magnesium and 9.4% for calcium). Therefore, the sea buckthorn from the dump can be used in food industry, as well as in pharmaceutics and medicine.

Keywords: Romania, Petroşani Basin, coal dumps, Sea buckthorn, content of calcium, magnesium, ascorbic acid.

INTRODUCTION

Sea buckthorn (*Hippöphae rhamnoides*) is native to Central Asia. It grows in clumps or in spread-out shrubs vegetating on sand and gravel, or on pebbles exposed along riverbanks, ponds and rocky hillsides. It prefers salt-bearing geological formations, from seaside regions to the alpine level [14].

It is s pioneering, oligotrophic, xerophilic-mezohigrophile plant, suited for holding down badlands, ravines and land sliding hill sides. It spreads naturally [9].

Hippöphae rhamnoides grows as 1.5 – 4 m tall thorny shrub. Its maximum stem diameter is 15 cm. Depending on the climatic environments and soil types, this plant may develop in two different ways: either as low, creeping shrub in poor soil arid areas, or as 8-10m tall arborescent plants, on fertile soils [3, 13].

The root system is very well developed. The plant has a large capacity of producing root suckers at 20 cm deep in the ground. Nitrogen-fixing nodules similar to those of leguminous plants are formed on this plant roots [5]. The free bacteria of the *Rhizobium, Azotobacter* and *Clostridium* kinds, living into the soil, are producing them. These bacteria penetrate the plant through the absorbing trichomes, being attracted by root-secreted flavones and settle inside the root, where they form nodular-like globular formations [2]. *Azotobacter* is considered an indicator of ecologic features into a soil.[15].

The intensely ramified tree crown seems thick; however, it does not spread enough shadow on the ground. It bears a lot of very sharp, strong lignified thorns. The buds are foliaceous, small, spherical, presenting two trichome-covered scales [8].

The leaves are caduceus, alternate, small, short petiolated, linear to spear-shaped. They have narrow, 4-6 cm long limb and a single rib. The leaves lack stipule, but they are rich in vitamin C [2].

The flowers are dioecious, axillary, small, greenish-white, disposed in racemes and hidden among leaves, the emergence of which they precede [10].

The fruit is pseudoberry or false stone fruit, small, oval-shaped, fleshy, 0.7-0.8 cm in length. Its dominant color is orange, passing towards yellow. Numerous and disposed one next to the other, the fruits dress the branches the way a muff would do. The fruits' pulp may be yellow or orange; it is very juicy and the stains it leaves are oily. Sea buckthorn's fruits have a pleasant, aromatic smell. They are not fit for consumption while fresh, as they are sour and astringent. Sea buckthorn fruits contain 0.8-1% ascorbic acid, which may be lost at first frost [6].

Ageing of fruits begins in the first weeks of August and at the end of September and the beginning of October the fruits reach complete ripeness. If harvest takes place later, the quality of fruits depreciates, as they crack and lose some of their juice [3].

From pedo-climatical point of view, sea buckthorn grows in mountain, foothill and plain areas. It is able to withstand temperatures down to -35^0C, as well as excessive high temperatures of up to $+45^0$C. Nevertheless, it needs light, thus the best harvests are obtained in areas that offer the plant direct exposure to the sun [1].

This plant can adapt to any kind of soil, be it dried, chernozem or brownish-red. It can grow on saline soils, which have been treated with gypsum, phosphogypsum, aluminium sulphate, calcium chloride, calcium carbonate [4, [****]].

MATERIALS AND METHODS

The sea buckthorn fruits were collected in the first half of September from the Vulcan coal dump, the purpose being to determine the content of calcium, magnesium and ascorbic acid. The coal dumps contain clay, marl, slate and argillaceous sandstone which were never covered with a soil layer, therefore the sea buckthorn was planted directly on the sterile.

For the calcium determination, it was used as indicator Murexid and for magnesium Black Eriocrorm T. [7]. The ascorbic acid was pointed out by thin layer

chromatography using a silica chromatographic plate with a 254 nm fluorescence indicator.

RESULTS

The results obtained in laboratory are presented in Tables 1 & 2, and Fig. 1.

The distribution histogram of Mg content in depend of sample is presented in Fig. 1. It can be observed that in two cases, sample 1 and 3, the Mg quantity exceeds a little over the standard value of 186.1 mg magnesium / 100 g dry substance while sample 2 indicates an inferior value, the average value being a little below standard limit for the plant to be accepted for industrial processing. This fact is explained by the poor content of magnesium in the formatting soil particles. Anyway the magnesium level in fruits is sufficient for being important in alimentation.

Table 1. Magnesium results after laboratory investigation.

Sample no.	Complexon volume (ml)	Complexon volume (C_M=0,05M) (ml)	Magnesium grams from the sample ($x \cdot g\ Mg^{2+} = V \cdot 5 \cdot 10^{-5} \cdot 24{,}31$)	Magnesium grams from whole sample (25·x)	Magnesium grams/100 g solid substance
1	10	0.4	$48.62 \cdot 10^{-5}$	$1215.5 \cdot 10^{-5}$	0.187
2	10	0.35	$42.5425 \cdot 10^{-5}$	$1063.5625 \cdot 10^{-5}$	0.163625
3	10	0.4	$48.62 \cdot 10^{-5}$	$1215.5 \cdot 10^{-5}$	0.187
Average	10	0.3833	$46.590115 \cdot 10^{-5}$	$1164.7528 \cdot 10^{-5}$	0.17929

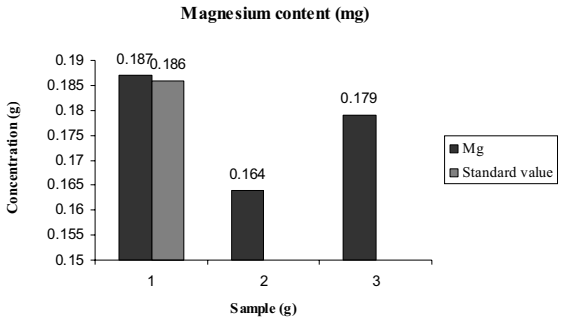

Figure. 1. Mg contain variation in depend to the sample.

In Fig. 2 it can be observed the Ca content distribution in depend to sample being noticed the same value for each sample, 231 mg/ 100g dry substance, a little over the standard level of 211.8 mg /100 g dry substance. The fact is explained by the share of calcium ions from decay of clay minerals and marl verifiable with the absence of other oligo-elements possible found in fertile soil's humus.

The high content of calcium and lower one of magnesium in sea buckthorn fruits points out o strong relationship with the soil but also an active tendency to form a new-fertile soil. The sea buckthorn being a scrub with caduceus leafs, the leaf-litter represents a natural source of organic elements.

Table 2. Calcium results after laboratory investigation.

Sample no.	Complexon volume (ml)	Complexon volume (C_M=0.05M) (ml)	Calcium grams from the sample ($x \cdot g\ Ca^{2+} = V \cdot 5 \cdot 10^{-5} \cdot 40.08$)	Calcium grams from whole sample (25·x)	Calcium grams/100 g solid substance
1	10	0.3	$60.12 \cdot 10^{-5}$	$1503 \cdot 10^{-5}$	0.231
2	10	0.3	$60.12 \cdot 10^{-5}$	$1503 \cdot 10^{-5}$	0.231
3	10	0.3	$60.12 \cdot 10^{-5}$	$1503 \cdot 10^{-5}$	0.231
Average	10	0.3	$60.12 \cdot 10^{-5}$	$1503 \cdot 10^{-5}$	0.231

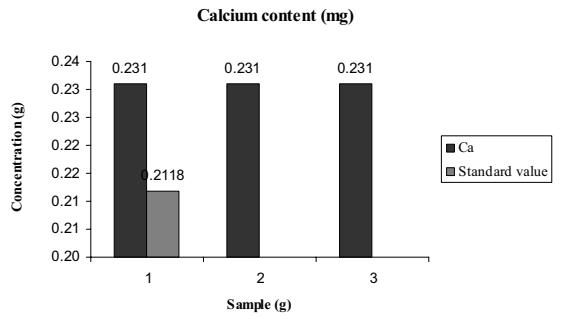

Figure. 2. Ca content variation in depend to the sample.

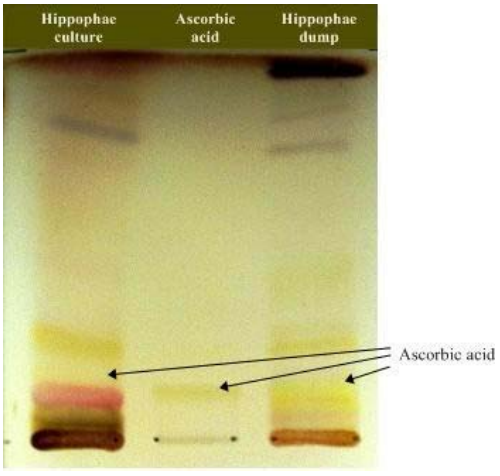

Figure 3. Ascorbic acid chromatogram obtained after investigation.

DISCUSSIONS

According to references, the sea buckthorn contains 211.8 g calcium, 186.1 g magnesium [12]. The results obtained in laboratory for calcium and magnesium were the following: 231 g calcium/ 100 g dry substance and 179 g magnesium / 100 g dry substance, as it reveals from Table 1 & 2.

In Fig. 3 can report that the ascorbic acid, presents a grey-yellow spot in the inferior third for ascorbic acid, in perfect resemblance with the standard sample.

The sample's chromatogram reveals 1-2 grey-yellow strips after start, under ascorbic acid 2 yellow-grey strips, at level with ascorbic acid a grey-yellow strip, in superior third o yellow strip, one or more violet strips.

Hence results that fruits contain sufficient ascorbic acid pointed out by the spots but less than in cultivated plants.

The low level of ascorbic acid indicates that the soil on which the sea buckthorn is forming, the plants having an important cause in this way because of the stepped forming, building-up and stabilization of organic humus to bound the sterile particles. The fact that the underbrush fruits have a bit low magnesium level and higher calcium one can be appropriate for specific diets and for every-day usage.

In 1998 Wu Du and Wang S. made an ascorbic acid determination on sea buckthorn fruits using the high-valence iron reduction method. The reduction method had simple, high sensitivity and accuracy in comparison with fluorospectrophotometry or indophenol titration method. Its limit of detection was 0.01 microg/mL, the relative standard deviation and the average recovery was 0.83% (n = 8) and 95.6% (n = 6) respectively. They also researched the influence of the environment factors (temperature, storage period and condition, pH value) on the stability of ascorbic acid in fructus hippophae fruit [16].

In 2006 W. Ohkawa and all made an ascorbic acid quantification on *Hippöphae rhamnoides ssp. mongolica* and *ssp. rhamnoides,* that are grown in Japan. During this process they observe that the ascorbic acid content in fructs of ssp. *mongolica* was lower than in fruits of ssp. *rhamnoides* [11].

After quantitative investigation of calcium and magnesium performed in laboratory on sea buckthorn fruits, we can say that this plant besides stabilizing the processes leading to unpleasant landscape, it can be also used in food industry, in pharmacies and medicine for diseases as obesity, depressions, hepatitis, allergies, etc.

The differences between determinations made in laboratory on the sea buckthorn fruits from the coal dump and the already issued references are very small.

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