

OPTIMIZATION OF EXTRACTION PROCESS AT HERBA, SIDERITIS, AND SCARDICA THROUGH MACERATION

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Abstract

Sideritis tea (Herba, sideritis, scardica) has a long-time tradition in European culture, being classified as a caffeine-free tea used for physical stresses. If we see the effects and the benefits of this tea for human health, there are required more in-depth analyses to explain correctly main components of this plant and use them for specific purposes. At present, Sideritis tea, known as forest tea, is trying to be substituted with an extract taken from this medicinal plant. Which method will be used for extraction, depends on the field of use of extraction. Based on the structure of the leaves and the flowers of this plant, the easiest method would be percolation extraction, but to reach maximum values of the main components of this raw material, it is preferable to use extraction by maceration, where we can better control the technologic process during extraction, by changing any of the factors that affect the extraction process, or by advancing another factor for a complete technologic process, and on the other side to grow the extraction coefficient. The content of basic substances of more than 20 types of etheric oils, makes this type of extract to be one of the most advanced extracts used in the pharmaceutic industry.

Keywords: extract, maceration, percolation.

1. Introduction

Mountain tea (Sideritis scardica) belongs to the Lamiaceae family and grows in the rocky mountainous areas of the Balkans, in North-east Greece, North Macedonia, South Bulgaria, South-west Albania, and European Turkey. This type of tea grows at 1300 to 2000 meters above sea level. Mountain tea (Sideritis scardica herba) is a dried herb containing the stems, leaves, and flowers of Sideritis scardica. Harvesting is done during its blooming. After harvesting, the plant should be dried in the shade, slowly. Mountain tea, also called shepherd's herb, plays an important role in the traditional medicine of different Balkan countries. It is worth mentioning especially its use for gastrointestinal diseases, and respiratory diseases and as a drink which gives strength, relieves, and also relaxes. (Bruno, M, Piozzi, F, Ardold) According to the latest research results, there are indications for positive effects on the central nervous system, especially its antidepressant properties, calming effect, for coughs caused by colds and bronchitis, helps in gastrointestinal problems, inflammation of the stomach mucous and stomach ulcers, pain, bloating, and spasm. Recently, there were studies, in which Sideritis tea reduces the formation of plaques in the brain and improves memory, these studies are still in the initial stage, but clinical studies are expected to be done so that this tea can be used for Alzheimer's disease. In the lower part, the plant is woody and grows 15-50 cm. The leaves have a grey color and are covered with scales where the essential oils are concentrated, for this reason, it has a light aromatic smell. Some of the properties of Sideritis Scardus are highly valued from a medicinal point of view such as increasing immunity, antioxidant,

anti-inflammatory properties, pain reliever, relaxant, etc. (Evstatieva, L, and Koleva) This is possible due to the content of substances such as Adaptogens, Flavonoids, Minerals, as well as accompanying components, Antioxidants.

All these benefits that *Sideritis scardica* has, are found by consuming it in the form of tea, which does not require any specific preparation, we only mix this plant with hot water and use it like that without determining the amount of flower relation to water, directly affects the number of main components of this pharmaceutical substance, which for different ratio water: raw material, and their amount in the solution changes. (Menkovic, N, Risitc, M, Samardzic, Z, Savin, K and Kovacevic)

Today, new methods are required to make it possible to get the extract of *Sideritis scardica*, there will be a proportional participation of the constituent substances in the extract, so the dosage in certain portions and the purposes can be controlled. Very little work has been done in this case, although different forms of extraction are quite suitable for the extraction of *Sideritis scardica*. The simplest form to get semi-extracts is a mixture type of tinctures, but with a certain ratio of plants to solvents by adding other aromatic substances, where the extract remains liquid, and the extract is standardized to the extent that each drop of the extract has an identical composition to the obtained extract, and this extract is used by making diluted solutions mixed with water, however, even in this case the amount of constituent substances is reduced in the solution that is made. (Walbroel B, Feistel B) Therefore, there are required new methods of extracting and getting a dry extract, and then even the distribution of the components of the extract is proportional and the dosage in medicine is made correctly. However, the presence of conductors in the *Sideritis scardica* tea is much smaller than in the dry extract, therefore the amount that the patient must take is much larger. (IV. Aufl Österreichisches Lebensmittelbuch)

Many solvents have been tried for extraction and each of them has its advantages and disadvantages, either in the economic aspect or the complications during the extraction process. The first extracts are obtained by using hot water 40-50 °C with a mechanical mixture, with extraction within an hour, where an extract was obtained with insufficient amounts of main constituent substances in the plant raw material *Sideritis scardica*

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The extraction is made with 45% ethanol solvent. Before the extraction process, which is realized by using both the extraction methods, percolation and maceration to make it clear which of the methods is more advanced for the extraction of main components. Plant raw material is prepared, which must have a certain fineness to have sufficient contact between the grains of the raw material and the solvent, which also increases the extraction coefficient - the grinding was made with the grinder Resch 5000, considering the grinding to be average, because excessive grinding interrupts the process of percolation extraction, while for maceration extraction the same makes the filtration process unsuitable, a thin layer is created in the form of clay, which can completely interrupt the process of filtering. There were two analyses.

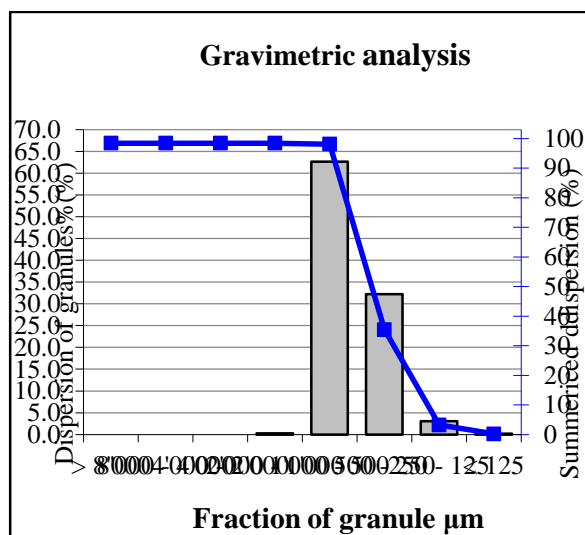
In the first analysis, it was performed percolation extraction, the ratio of the raw material *Sideritis Scardus* to ethanol solvent was 1:12, and by maceration, it was 1:8. From the processed results, it can be seen that during the percolation extraction, we have a lower degree of the dry mass, which in the first place affects the extraction of flavonoids, which are very essential for this product. From Tab.2 Diag.2 we can conclude that in the second half of the percolation time, the reaction is very slow and almost reaches equilibrium, and additional solvent must be added to move the reaction out of equilibrium, in order the extraction to continue, this makes the process more difficult in other stages of the technological process. This method of extraction can be used for

extraction if it is previously found that the raw material is *Sideritis Scardica*, but we must consider a lower coefficient where there are higher amounts of main substances materials. By percolation we must also consider higher amounts of solvent which complicates the further technological process

In the second analysis, the extraction was performed by maceration with solvent Ethanol 45% Tab 3 Diag.3 where there is a higher degree of extraction with higher values of the dry mass, therefore the extraction reaction has a higher fluidity and the reaction is not allowed to remain at equilibrium due to the constant mixing of the mixture. Both phases of extraction can be seen here too, in the first phase a fast and constant extraction of up to 40 minutes, and in the second phase a more sporadic extraction, which means that the amount of the component in *Sideritis* in the second phase is less, but that the process takes place continuously and the amount of solvent compared to the first substance is less, which is in favor of the extraction process with maceration, and the further technological process is fluid.

3. Table Figures and Equations

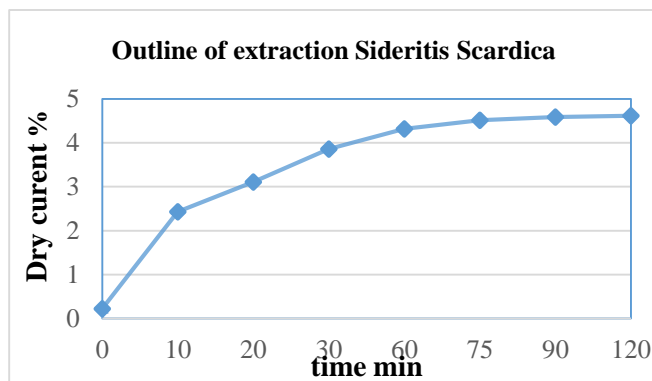
Table 1 Fractions of raw material according to th size of strainer



Size of strainer	Measuring vessel gr	Vessel + raw material gr	Netto
8.00 mm	448.1	448.1	0
4.00 mm	430.82	430.82	0
2.00 mm	399.7	399.7	0
1.00 mm	362.8	362.95	0.15
0.50 mm	322.5	353.84	31.34
0.25 mm	290.1	306.21	16.11
0.125 mm	279.48	280.99	1.51
0.063 mm	271.64	271.74	0.1
Sludge	400.88	401.21	0.33

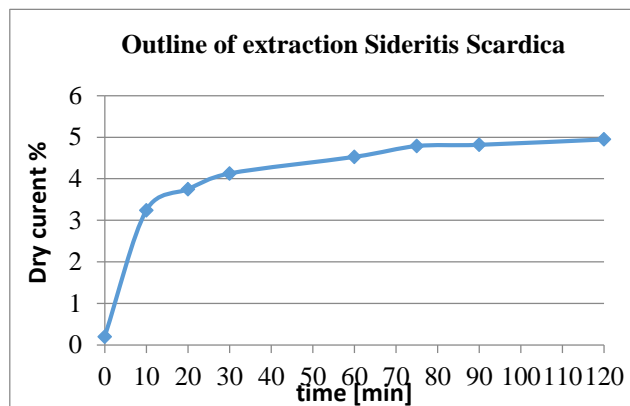
Diag.1 Granules size distribution

Extraction Time min	Dry current %
0	0.22
10	2.43
20	3.11
30	3.86
60	4.32
75	4.52
90	4.59
120	4.62



Tab.2 Diag.2 Ratio dry mass to the extraction time with percolation

Extraction Time min	Dry current%
0	0.2
10	3.24
20	3.75
30	4.13
60	4.53
75	4.79
90	4.82
120	4.95



Tab.3 Diag.3 Ratio dry mass to the extraction time with maceration

4. Conclusions

- Before the extraction process is performed, it is preferable to make an adequate selection of the level of grinding, first of all, the grinding should not be high, so it is preferred an average fraction between 125-500 μ m
- Extraction coefficient for smaller strainer fractions is not preferred for extraction due to the creation of an adhesive substance, which completely blocks the filtration process and the technological process becomes difficult to perform.
- Percolation extraction is more difficult to realize, it has lower values of dry mass the extraction coefficient is lower, and the further technological process is more complicated.
- Maceration extraction is more advanced for *Sideritis scardica*, it has a higher level of dry mass, the extraction coefficient is higher and the further technological process is also more fluid.
- It is not preferable for both extractions to prolong for more than 120 min after the extraction of undesirable substances such as sugars and chlorophyllin begins.

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