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Professional paper

OPTIMIZATION OF PARAMETERS OF OLIVE LEAVES EXTRACTION DURING MACERATION PROCESS

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Abstract

Olive leaves have a significant importance in phytopharmacology, first of all due to their efficiency in medicine. Extraction of leaves is of special importance, this involves preparing the leaves for extraction, choosing the extraction method as well as properly combination of factors that affect the extraction process. Olive leaves may be extracted in two different methods, through percolation or maceration. Percolation extraction does not require specific conditions for extraction but the extraction coefficient is lower,
therefore, maceration extraction has more advantages, the extraction coefficient is higher, less amount of obtained extraction but with more dried mass which makes further technologic process more fluid. The extraction process through maceration also requires optimization of essential factors that affect the extraction process, such as: degree of grinding of raw material, the degree of spinning the mixture, maceration temperature, the degree of concentration of the solvent, solvent ratio to raw material which is extracted, as well as the maceration time. Optimization of these factors makes the process profitable in the economy, and high extraction of the main components in the raw material.

Keywords: extraction, maceration, percolation, dry mass.

1. Introduction

Olive leaves tea (Oleae folium, PhEur) is a product that has been used since ancient times by Mediterranean countries, which is also used as a natural healing medicament. Olive leaf tea, is characterized by very positive properties that also give very good healing effects, such as strengthening immunity, high blood pressure, insomnia, and nervousness, etc. (Belitz H.-D., Grosch W., Schieberle P). Olive-leaf tea, unlike other teas, is pure and without caffeine, which has a taste similar to green tea. Although it is considered that olive leaves can lower blood pressure, there are no specific clinical studies that provide data on its healing properties as extracts (Bergling-Aumann N., Erdnüß F., Erdnüß Y.). The main components of olive leaves are Oleuropein, phenolic compounds, and organic acids as well as secondary components such as flavonoids Rutin, Hyperosid and Quercetin (Briante R, La Cara F, Febbraio F, Patumi M, Nucci R.). The olive tree can reach a height of up to 20 meters, which is characterized by not very large leaves. The main product of the olive fruit is olive oil, but the healing properties of olive leaves are completely different from olive oil due to the presence of the main ingredient Oleuropein, concentrated 10 times more in the leaves of the olive tree than in its fruits. (Muhammad Ali Hashmi,1 Afsar Khan,1 Muhammad Hanif,1 Umar Farooq,1 and Shagufta). In ancient times, olive leaves were used in the form of tea, which has antioxidant properties, without doing proper analysis of

the main components in the tea as well as their amount in the tea. Today, more advanced methods are required to get extracts where the number of main components is much more controlled and defined, but there are also more advanced extraction methods.

All extraction methods can be used, starting from the percolation extraction, CO2 to the most advanced maceration method. Each of these methods has its advantages and disadvantages, but the most important thing is to use a method that has a higher extraction coefficient and also prevents the extraction of undesirable substances. It is exactly the method of extraction with CO2 that brings much higher productivity of extraction, but with this method, because the process happens at very high pressures of 60-70 bar, there are extracted a large amount of substances that are undesirable for the extract of olive leaves, such as sugars, chlorophyllin, etc., which also reduce its healing ability (Raffaella Briante, Maurizio Patumi, Stefano Terenziani, Ettore Bismuto, Ferdinando Febbraio, Roberto Nucci.). The method of percolation extraction has the advantage of the simplicity of the process, but the extraction coefficient is not quite high, and the extraction process reaches a balance before the complete extraction finishes. The most advanced method is the maceration extraction, a process that can be controlled by optimizing all the factors that affect the extraction, on the other hand, the technological process of obtaining the extract should be as fluid as possible.

2. Body of Manuscript

2.1. The purpose of this work is to choose the most appropriate extraction method that has the highest extraction coefficient and the lowest ratio of the amount of raw material to the obtained extract.

2.2 By measuring the dry weight of both samples analyzed simultaneously and under the same extraction conditions, we can determine the most advanced extraction method, through percolation or maceration.

2.3 For extraction, there were prepared 2x100 g of olive leaves (Oleae folium, PhEur), which were preliminary prepared to a certain degree of grinding as shown in Tab. 1 Diag.1 and Tab.2 Diag.2 wherein the first case it is the lowest degree of grinding with fractions of 1mm - 0.125 mm, where is found the high fraction over 1 mm, and in the second case, there a high degree of grinding, namely 1mm - 0.125, but distributed in different fractions and the same is a homogeneous mixture of ground raw material. A raw material ratio of Oleae folium 1:8 was used, which means that 800 ml of 70% Ethanol solvent were weighed for the extraction by maceration, while the percolation extraction is made with a raw material ratio to ground olive leaves with Ethanol solvent 1:10, which means there were weighed 100 grams of olive leaves and 1000 ml of 70% ethanol. This is one of the reasons that make the process of percolation extraction harder and more complicated since during the technological process we have high amounts of solvent, which during the further process must be removed and the economic rationale is lost, while on the other hand, from the results Tab. 4 Diag 4, the values of the dry mass are not very high. In both cases, there is analyzed the extraction for other unchanged parameters to find which of these raw materials of olive leaves has the highest coefficient of extraction with percolation and maceration. A solvent with a concentration of 70% Ethanol at a temperature of 45°C was used for an extraction time of 120 min. During the extraction with maceration in Tab 4 Diag. 4, it can be seen that the amount of dry mass is higher, and the extraction coefficient is higher, which results in a lower value of the ratio of raw material-extract.

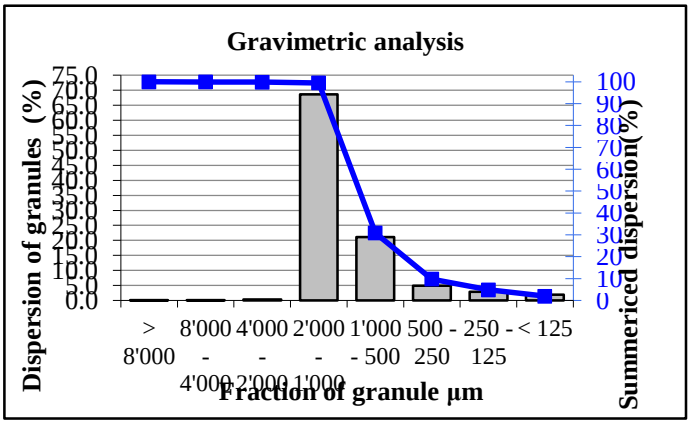
The extraction was performed for both samples for the same extraction conditions, the same extraction temperature, the same concentration of the solvent, the same time, and the same temperature during extraction,

Compared to the amount of solvent during percolation, it is higher and the percolation is made without mixing, in contrast to maceration, which is made under the same conditions but with constant mixing at a rotation speed of 400 rpm and with a lower amount of solvent. If we see the gravimetric analysis of two samples, we can conclude that the degree of grinding is not a key factor for the increase of the extraction coefficient, since Diag. 3 and 4 cannot. in tab. 3 and 4 be seen that the process of extraction with maceration has its advantages for extraction, but in Tab 4 Diag4, can be seen higher values of the dry mass.

3. Table Figures and Equations

Table1 . Gravimetric analyze for the first sample

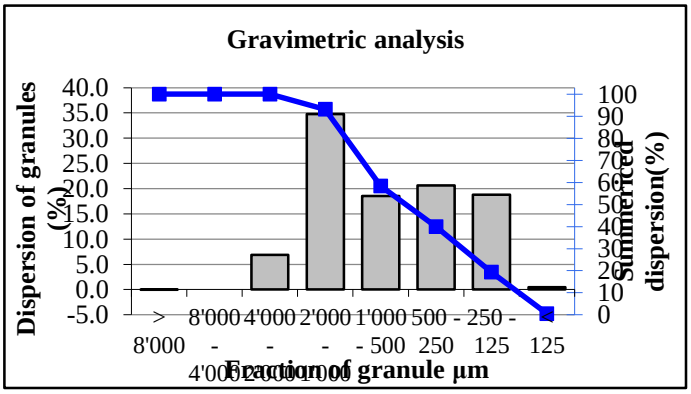
Size of strainer	Measuring vessel gr	Vessel + raw material gr	Netto
8.00 mm	451.58	451.62	0.04
4.00 mm	430.32	430.36	0.04
2.00 mm	400.32	400.50	0.18
1.00 mm	361.97	396.36	34.39
0.50 mm	322.47	333.03	10.56
0.25 mm	289.58	292.05	2.47
0.125 mm	280.18	281.63	1.45
Sludge	400.88	401.86	0.98



Diag1 Distributed fractions for the first sample

Table 2 Gravimetric analyze for the second sample

Size of strainer	Measuring vessel gr	Vessel + raw material gr	Netto
8.00 mm	448.52	448.51	-0.01
4.00 mm	430.88	430.88	0.00
2.00 mm	399.76	403.20	3.44
1.00 mm	361.84	379.26	17.42
0.50 mm	318.33	327.61	9.28
0.25 mm	285.68	296.01	10.33
0.125 mm	242.41	251.83	9.42
Sludge	400.81	401.05	0.24

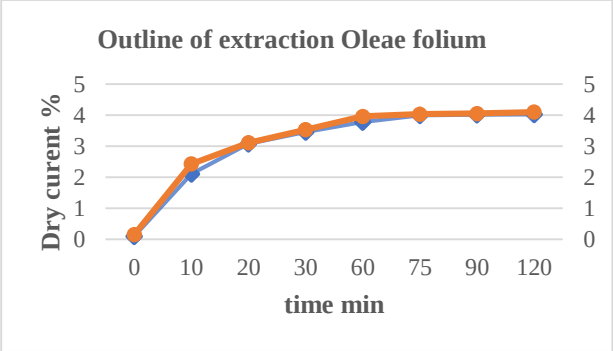


Diag2 Distributed fractions for the second sample

Table 3. Dry mass ratio in relation with the percolation time

Extraction Time min	Dry curent % Probe.1	Dry curent %Probe.2
0	0.1	0.15
10	2.11	2.43

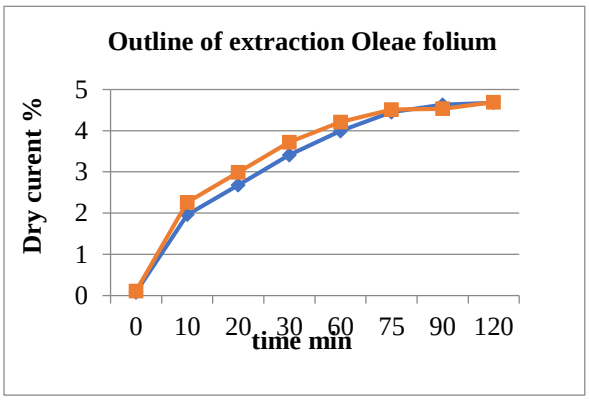
20	3.08	3.11
30	3.46	3.53
60	3.78	3.96
75	3.99	4.03
90	4.01	4.05
120	4.02	4.1



Diag.3 The curves of percolation extraction for both samples with different grinding fractions.

Table 4. Dry mass ratio in relation with the maceration time

Extraction Time min	Dry curent % Probe.1	Dry curent %Probe.2
0	0.08	0.11
10	1.96	2.26
20	2.68	2.99
30	3.41	3.72
60	3.99	4.21
75	4.45	4.51
90	4.63	4.53
120	4.68	4.69



Diag.4 The curves of maceration extraction for both samples with different grinding fractions

4. Conclusion

- The degree of grinding does not have a big influence on the extraction process, either by percolation or maceration. There are preferred fractions 1000-125 μm of a strainer.
- The time of 120 minutes is sufficient time for the complete realization of the extraction process
- The extraction temperature of 45°C is optimal, otherwise, the increase in temperature may affect the transformation of the main components, or their complete elimination.
- The concentration of the solvent 70% Ethanol is optimal since at lower concentrations the extraction process is not completed until the end and reduces the extraction coefficient.
-The maceration extraction has advantages over the percolation one, because it has a higher degree of extraction and the amount of dry mass is higher compared to the percolation extraction, and on the other hand, the amount of solvent is smaller, which makes the process more profitable.

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