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Professional paper

ADJUSTMENT OF EXTRACTION PARAMETERS OF URTICA DIOCIA USING ADVANCED EXTRACTION METHODS

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Abstract

The pharmaceutical raw material Urtica diocia requires proper preparation so that the extraction process is conducted without obstacles and enables reaching the highest extraction coefficient. It also required special care in adjusting extraction parameters, as well as the appropriate selection of the extraction method, since not all methods give good results and good quality of the extract, and the conduction of a continuous process of extraction. The size of granules of the raw material is an essential factor in selecting the extraction method, with which, there will be achieve the highest values of the extraction coefficient and maximum withdrawal of conductive main components of the raw material. Due to the shape of the pharmaceutical plant Urtica diocia, which is characterized by 85/leaves, and the rest part consists of stems, it gives us clear signals that not all extraction methods may be applied for extraction, since after grinding, it creates a homogeneous mixture with a high level of grinding, which completely blocks the realization of the extraction process. There should be researched extraction methods that keep the extraction process in continuity that will be developed to the end, achieving higher levels of the extraction coefficient by adjusting the process in a way that the solution reaches a stage of supersaturation as late as possible, so the process of extraction reaches equilibrium in a higher interval of the extraction time, where this process would end. The high rate of rotation of the mixer determines the selection of the extraction method because it creates a solution that interrupts the filtration process.

Keywords: extract, granule size, Extraction coefficient,

1. Introduction

Urtica diocia, also known as nettle, belongs to the group of the Urticaceae family and is a perennial herbaceous plant that has a fine, hot fluff on its stem and serrated leaves, which are used as a medicinal plant and in food. This plant has curative abilities for the problems that can appear in the liver, which can produce juice in the gallbladder. (Erich Oberdorfer) For this purpose, doctors recommend drinking one glass a day of prepared nettle tea. This herbal pharmaceutical substance helps a lot, even for the better functioning of the kidneys and other rheumatic diseases and arthritis. To prepare the tea, you need a spoonful of the dried and crushed plant. Another way to cure the pain of rheumatism is to put the fresh plant in direct contact with the skin. The place of pain is beaten with the fresh plant until a kind of lump of blood. It has a very good effect even in cases of diarrhoea. For this problem to pass quickly and easily, you should drink nettle tea. (Heidelore Kluge:)) Taking this kind of tea should be considered an important measure for soothing the condition of mothers with small children, which helps in the production of milk, so important for the health of the child. In cosmetics, it helps against hair loss and dandruff. (David E. Boufford) People who have problems with dandruff are recommended to wash their heads with the juice obtained by mixing nettle leaves with hot water and leave it for a while until a homogenous solution is created, and the liquid obtained should be used for washing the hair twice a week and continue with it until the final elimination of dandruff. Washing the head with nettle water is also recommended for those who have problems

with slow hair growth. To have long and healthy hair, it is recommended to wash the hair with this plant. Nettle is known as a very good body tonic, it also helps those who have problems with colitis and other diseases of the large intestine. It is used in the form of tea as above. Daily consumption of nettle tea helps in the regeneration of blood cells and the skin. It is widely used in African and Latin American countries, and in England, too, it has shown very good effects on the digestive and cardiovascular systems. The constituent components that cause nettle and cause burning are Serotonin, Histamine, Acetylcholine, and Sodium formate. (Manfred A. Fischer, Wolfgang Adler, Karl Oswald.

The conductive components of this pharmaceutical plant are phenolic acids, lignans, and flavonoids such as Rutin and Isoquercitin, good isolation of these main components increases its healing activity. Urtica diocia grows as a perennial plant with a height of 10 to 300 cm, which is mainly leaves and a very small part is the stem. When they come into contact with the skin, they are very troublesome because they cause swelling of the skin, but not a real infection. At the top of the leaves in the main stem, they create very fine fruits in the form of flowers, which are not used as such. They have a very high reproductive capacity, grow mainly in places with medium humidity, and do not require special conditions for growth. In their composition, they have high amounts of Mg, Ca, and Si as well as vitamins A and C14, due to the presence of these vitamins, they are widely used in the food industry, where they are added in the form of spices or even used as food. (Chen Jiarui, Ib Friis, C. Melanie Wilmot-Dear: Urtica. In: Wu Zhengyi, Peter H. Raven, Deyuan Hong) It has the same taste as spinach but it is more aromatic, described as mildly sour. It is also used as an additional spice in some foods, but in many European countries, as well as in Canada, it is also used in the form of soup or even in the form of various salads (Heidelore Kluge).

This pharmaceutical plant in many countries of the world is also cultivated in various plantations, increasing its quality and purity from other plants, this creates much better opportunities for use as a raw material in the pharmacy. After its harvesting, this plant is left to dry for two to three days. After drying, it is cleaned and ground to different levels, depending on what is used further (Eva Hanke, Ernst Wegner). For household use or different teas, it is ground at a higher level, but it is not practised for use in the pharmacy due to the problems in the technological process. In many plantations where this plant is cultivated, after grinding, it is also subjected to chemical treatment for cleaning in terms of microbiological cleaning, especially if it is used in pharmaceutics (Renate Spannagel). The chemical composition of nettle that is produced in plantations and the uncultivated wild one does not differ much, except for the mechanical purity that favours cultivation in plantations.

A well-prepared extract is a raw material for use in the cosmetic industry, in the first place for producing different shampoos with the ingredient of nettle extract, which has a very good ability to preserve hair as well as regenerate it. Today, in many countries of the world, there are produced shampoos, in which the composition has noticed the presence of nettle extract, but it is not a standardized extract, thus, these shampoos have less healing ability. (Wolf-Dieter Storl)

2. Body of Manuscript

In the past, to get this extract, water was used as a solvent at a certain temperature, which has its origins in the preparation of teas from this plant's raw material. Extraction with water has many disadvantages, because the process is carried out to the end without technical problems, but the obtained extract has a very low dry mass and a very low extraction coefficient, which, from a scientific point of view, makes the process not well realized. Although the leaves of this plant have a very good extraction ability, the water cannot be used as an appropriate solvent for extraction, because it further complicates the technological process of removing the water by

evaporation, either one-stage evaporation or two-stage evaporation. Therefore, it is not preferable to use water as a solvent, so we tried to use ethyl alcohol solvent with a lower concentration, which performs a complete extraction and has a higher level of extraction. There were tried, Various methods of extraction were tried, and each method has its advantages and disadvantages in a technological process. First, there are problems with the low rate of the extraction coefficient, leading to a complete interruption of the extraction process as a result of not appropriately adjusting the extraction parameters. Extraction by maceration is a form of extraction for many types of pharmaceutical plants that requires to react with other factors such as temperature, constant mixing, keeping a certain temperature for a certain time as well as cooling before filtration, but in this specific case of this pharmaceutical plant does not need to act from outside since the extraction ability is high and makes possible to use percolation extraction. In principle, in pharmaceutical plants where the composition of the raw material is mostly leaves, the same is extracted using the CO2 extraction method, where the raw material is rinsed with liquid carbon dioxide at high pressures above 70 bar, the process is completely hermetic, due to high costs of extraction and extraction of all the constituent substances in the raw material, including undesirable ones in the extract, the extraction by percolation has been tired, where ethyl ethanol is used as a solvent with a concentration of 40/, quite good method and more economical for two samples with different levels of grinding by monitoring the extraction curve as well as the ratio raw material: extract, by rinsing several times with an amount of pure solvent to achieve a higher level of extraction. Both extraction methods were tried with different levels of grinding by maceration and percolation, and the most appropriate extraction method was chosen according to the results. To make a comparison with the maceration extraction, the extraction by percolation with 40% Ethanol solvent. The maceration process is realized in a beaker of 2000 ml, where 200 g of ground material was weighed, adding 1750 ml of 40% ethyl alcohol. After weighing the amount of the raw material and the solvent, first is added the raw material and then the solvent is continuously monitored with a mixer at about 400 rpm for a time interval of 60 min. After the maceration process is performed, filtration is performed with a filter paper. At different times since the start of maceration, it is taken by one sample and compared to the amount of dry mass per unit of time. All the samples taken before measuring the dry mass were subjected to filtration with filter paper. After the end of the extraction, the calculated extraction coefficient and the extraction curve were obtained. After filtration, the mixture was rinsed with a solvent of 60 ml of 40% ethanol, for both samples, and a sample was taken for a certain time of maceration, measuring the amount of dry is extracted. The extraction curve was used to see which raw material was appropriate for a higher extraction coefficient.

During the extraction by percolation, there were weighed 200 grams of ground raw material Urtica diocia was mixed with 1750 ml of Ethanol 40%. The percolation process lasts four days at room temperature. The process was carried out in a laboratory percolator, where samples of the obtained extract and the dry mass were measured for different percolation times. During the whole process, for each day periodically, there were added 60 ml of pure solvent was added in a way that the percolation process did not shift in equilibrium, and the extraction was carried out until the end. There were analyzed two samples with different granule sizes were analyzed, as with the first method, and ethyl alcohol 40% was used as a solvent.

For the first sample, Chart 1, Figure 1, it can be noticed that there is a high level of grinding, and the same has been subjected to the maceration process. It was found that the maceration process cannot be continued until the end, because granules stick to each other and reduce the active contact surface between the raw material and the solvent, this interrupts the extraction process and the process remains in equilibrium, this is a fact that we have low coefficient of extraction Chart 3 Figure 3 at the same time the technological process becomes difficult to realize.

For the second sample, Chart 2 Figure 2, there is a low level of grinding where the size of granules is between 3-0.1 mm, this size of granules allows the extraction process to be realized until the end, which results in a higher dry mass and higher extraction coefficient. Although the high size of granules is not in favor of extraction for other cases, this type of plant is special because of the problems during extraction. Chart.4 Figure 4.
For the first sample during percolation with a high level of grinding Chart.1 Figure 1 results in a lower dry mass and lower extraction coefficient Chart.5 Figure 5, whereas for the second sample, Chart2 Figure 2 granule size has a wider range of granules size ¨ which results in a higher value of the dry mass Chart.6 Figure. 6. From the results, it is noticed that the percolation method for extraction is much more appropriate for this type of pharmaceutical plant Urtica, because of the dry mass, which is higher and has a higher extraction coefficient, the process is also realized without any obstacles, and it is cheaper, too.

3.Table und Figures

Table 1: Granulometric analysis of ground leaves Urtica diocia

Size of strainer	**Measuring vessel [gr]**	**Vessel + raw material [gr]**	**Netto [gr]**
8.00 mm	444.56	444.57	0.01
4.00 mm	426.85	426.85	0.00
2.00 mm	395.98	396.05	0.07
1.00 mm	358.89	358.94	0.05
0.50 mm	318.35	320.55	2.20
0.25 mm	285.72	299.79	14.07
0.125 mm	242.40	263.61	21.21
Sludge	400.80	413.27	12.47

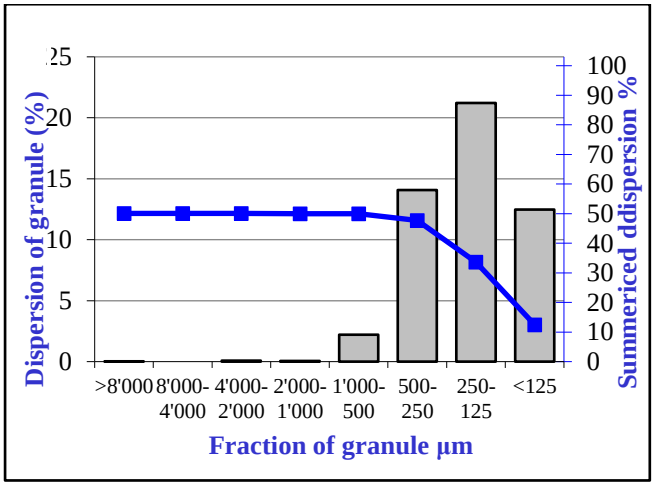

Figure. 1 Fraction of granule Urtica diocia sample 1

Table 2: Granulometric analysis of ground leav Urtica diocia

Size of strainer	Measuring vessel [gr]	Vessel + raw material [gr]	Netto [gr]
8.00 mm	448.08	448.08	0.00
4.00 mm	430.32	448.16	17.84
2.00 mm	400.30	419.14	18.84
1.00 mm	362.00	371.72	9.72
0.50 mm	322.69	325.17	2.48
0.25 mm	290.12	290.81	0.69
0.125 mm	279.70	280.00	0.30
Sludge	400.76	401.06	0.30

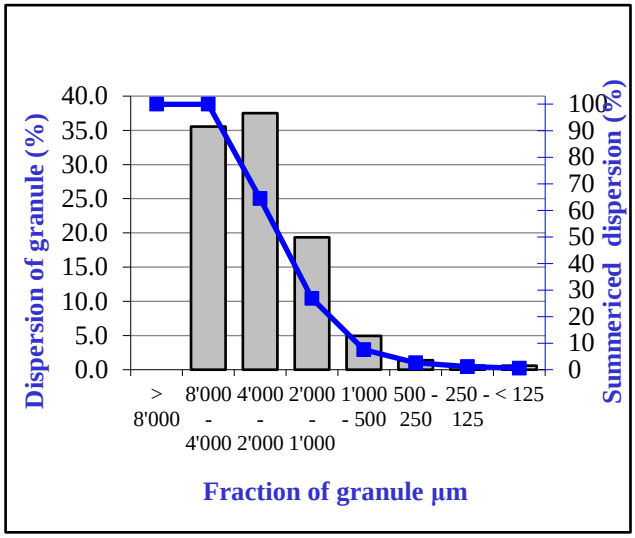

Figure .2 Fraction of granule Urtica diocia sample 2

Table 3: Results of dry mass in relation to the extraction time Sample 1-maceration

Time [min]	Dry content [%]
1	0.4
5	1.16
10	2.29
15	2.75
20	2.86
30	3.2
40	3.29
50	3.45
60	3.67

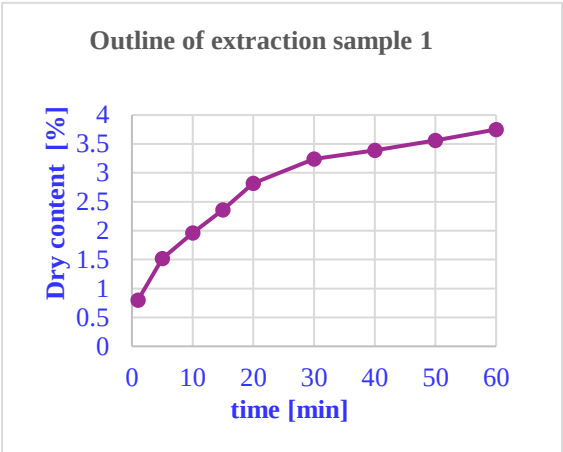

Figure 3: Outline of extraction of Urtica diocia sample 1 mazeration

Table 4: Results of dry mass in relation to the extraction time for sample 2-maceration

Time [min]	**Dry content [%]**
1	0.8
5	1.52
10	1.96
15	2.36
20	2.82
30	3.24
40	3.39
50	3.56
60	3.75

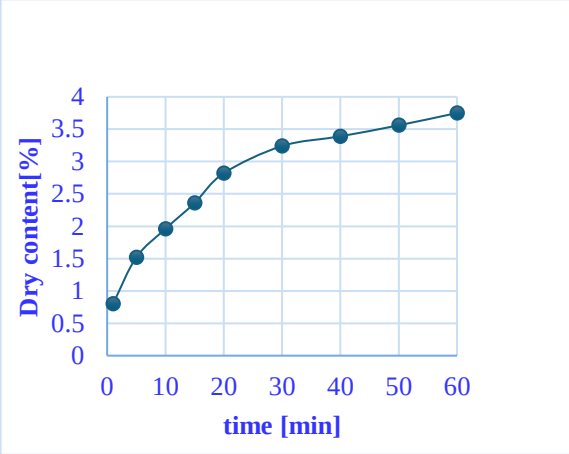

Figure 4: Outline of extraction Urtica diocia sample 2 maceration

Table 5: Results of dry mass in relation with the extraction time Sample 1- percolation

Time [min]	**Dry content [%]**
60	0.9
120	1.44
180	2.46
240	2.75
300	2.86
360	3.12
420	3.22
480	3.26
540	3.3
600	3.33

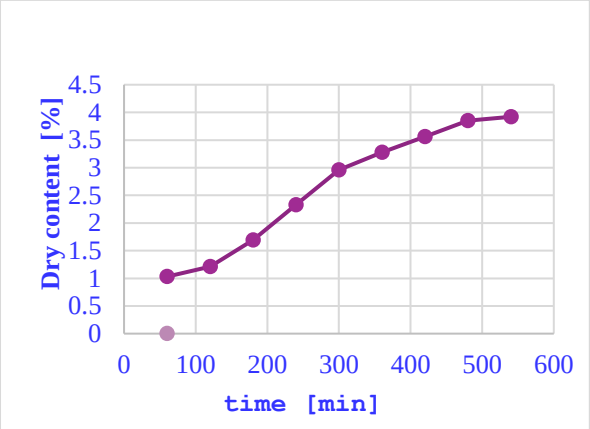

Figure 5: Outline of extraction Urtica diocia sample 1 perkolation

Table 6 results of dry mass in relation to the extraction time Sample 2- perkolation

Time [min]	**Dry content [%]**
60	1.03
120	1.21
180	1.69
240	2.33
300	2.96
360	3.28
420	3.56
480	3.85
540	3.92
600	4.02

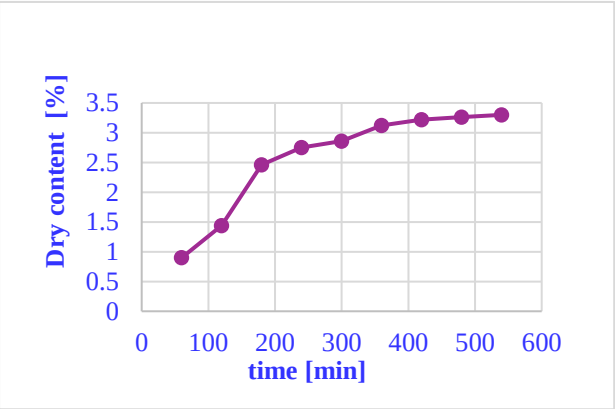

Figure.6 Outline of extraction Urtica diocia sample 2 perkolation

4. Conclusion

For the first sample with a high level of grinding, it is not preferred to extract by maceration, as a consequence of the creation of small balls in the solution, which stops achieving a higher extraction coefficient, and as such, the extraction process is not carried out till the, therefore we have a low degree of extraction coefficient. For the second sample with a low level of grinding during maceration extraction, it is noticed a continuous process of extraction but with not a very high degree of extraction coefficient. This can be implemented as a method, but it is not preferable as such, first because it costs more than the second, and the extraction coefficient is low. For the first sample with a higher level of grinding during percolation extraction, good results are reached, but the process as such has obstacles during its realization due to the creation of an inhomogeneous solution that stops the process from being realized to the end. For the second sample with a low level of grinding during percolation extraction, there are reached very good results are reached because the process is carried out without obstacles and a high level of extraction coefficient is achieved, as such, this method of extraction is preferable for this level of grinding. Choosing the extraction method indicates, also indicates the partial or complete realization of the extraction process. Extraction by maceration gives satisfactory values of extraction, but the process becomes difficult in the second half of the extraction time because, during consistent mixing, it starts grinding of granules, which inhibits the extraction process, and the solution may easily shift into equilibrium. Extraction by Percolation is one of the most appropriate extraction methods, which has the advantages of simplicity of the process, and also a high degree of the extraction coefficient.

References

[1] Chen Jiarui , Ib Friis, C. Melanie Wilmot-Dear: Urtica. In: Wu Zhengyi, Peter H. Raven, Deyuan Hong (Hrsg.): Flora China. Volume 5: Ulmaceae through Basellaceae. Science Press / Missouri Botanical Garden Press, Beijing / St. Louis 2003, , S. 76 (englisch,. (Abschnitte Beschreibung und Verbreitung

[2] David E. Boufford: Urtica. In: Flora of North America Editorial Committee (Hrsg.): Flora of North America North of Mexico. Volume 3: Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York / Oxford u. a. 1997 S. 401 (englisch,). (Abschnitte Beschreibung und Systematik

[3] Erich Oberdorfer: Pflanzensoziologische Exkursionsflora. Unter Mitarbeit von Theo Müller. 7., überarbeitete und ergänzte Auflage. Eugen Ulmer, Stuttgart (Hohenheim) 1994,

[4] Eva Hanke, Ernst Wegner: Die Heilkraft der Brennessel. Droemer Knaur, München 2000

[5] P. W. Ball, D. V. Geltman: Urtica. In: T. G. Tutin, N. A. Burges, A. O. Chater, J. R. Edmondson, V. H. Heywood

[6] Rudolf Schubert, Klaus Werner, Hermann Meusel (Hrsg.): Exkursionsflora für die Gebiete der DDR und der BRD. Begründet von Werner Rothmaler. 13./14. Auflage. Band 2: Gefäßpflanzen. Volk und Wissen, Berlin (DDR) 1987

7] D. M. Moore, D. H. Valentine, S. M. Walters, D. A. Webb (Hrsg.): Flora Europaea. 2., überarbeitete Auflage. Volume 1: Psilotaceae to Platanaceae. Cambridge University Press, Cambridge / New York / Melbourne 1993, S. 80

[8] Manfred A. Fischer, Wolfgang Adler, Karl Oswald: Exkursionsflora für Österreich, Liechtenstein und Südtirol. 2., verbesserte und erweiterte Auflage. Land Oberösterreich, Biologiezentrum der Oberösterreichischen Landesmuseen, Linz 2005,

[9] Heidelore Kluge: Brennessel: Heilpflanze und mehr. Haug, Heidelberg 1999

[10] Renate Spannagel: Heilkraut Brennnessel: Gesundheitspflege, Teezubereitung, kosmetische Anwendung. Weltbild, Augsburg 1998

[11] Wolf-Dieter Storl: Heilkräuter und Zauberpflanzen zwischen Haustür und Gartentor. AT Verlag, Aarau/Baden 2000