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Original scientific paper

INCREASING THE EXTRACTION COEFFICIENT OF THE RAW MATERIAL CENTELLA ASIATICA BY OPTIMIZING THE GRANULE SIZE OF THE RAW MATERIAL

Mahi LATIFI[1], Ejup LATIFI[2], Nazif JASHARI[3] , Njomza LATIFI[4]

1 Max Zeller Sohne AG Pflanzliche Heilmittel Romanshorm
2 Rruget shteterore te Maqedonise Veriore-- University of Tetova
3 NPK Tetovë –Tetovo-- University of Tetova
4 Model AG-Weinfelden

Abstract

The preparation of the pharmaceutical plant raw material Centella asiatica is one of the key factors affecting the extraction coefficient and optimizing the extraction process. Regardless of the extraction method used, the granule size must be optimal for the process to be effective. This is primarily because an optimal granule size increases the active surface area of the raw material when it comes into contact with the solvent. While this is a general rule for the extraction process, it does not fully apply to Centella asiatica due to practical challenges. During extraction, granules can clump together, forming separate focul that hinder the process and reduce the extraction coefficient. Therefore, achieving an optimal granule size is crucial. On one hand, it ensures the extraction process is completed effectively; on the other hand, it maximizes the extraction coefficient by isolating the desired active substances from the raw material while preventing the extraction of undesirable accompanying substances, such as sugars, chlorophyll, and others, which can complicate the subsequent technological process.

Keywords: extract, granules size, Extraction coefficient

1.Introduction

Centella Herba Asiatica is part of the group of pharmaceutical plants with a very complex form because its leaves are like they are folded one on top of the other, with a thin stem, which is characterized by high elasticity, a feature that complicates the refining process, which often requires two-stage refining, in the first stage it is done only a coarse refinement. After all, as a whole, it interrupts the production process or adequate refining(Gadahad, MR, M. Rao and G. Rao, 2008). Exist about twenty types of Centella, so depending on the place where it grows it is recognized for its features, but the composition of substances of the main component is almost the same, but with different content (Mohandas Rao, KG, S. Muddanna Rao. and S. Gurumadhva Rao, 2009, It mainly grows in swampy places, so this type of the variation of Centella asiatica grows in South Asian countries such as Sri Lanka, India, and China, as well as in some Latin American countries. It has a spicy taste and a nice smell. The raw material is usually collected in the above-mentioned places throughout the year, and then they undergo a drying process in the sun or drying machines with a maximum moisture content of 10%. The leaves of Centella Asiatica are 3 to 6 cm long and 1.5 to 5 cm wide, and a circle-like stem of 5 to 10 cm. They produce oval or round fruits in between two folded leaves, one on top of the other with a white or pink color. (Muangnongwa, S., 2004) The extract of Cetella Aziatica is widely used in Phytopharmaceutics due to the contents of this raw material. In its composition, there is present a considerable amount of essential oils such as Etheric, Flavonglycoside-Quercetin, and triterpene acids-(Rao, MK, MS Rao and GS Rao, 2007). It is used in various fields of pharmaceutics, beginning from the treatment of mental illnesses, multiple sclerosis, and various skin diseases, for removing facial wrinkles, and acne, as well as removing venous diseases, making good blood circulation. The use of Centella Asiatica originates from ancient times when the Chinese used the leaves to heal inflammation and burns on the skin, without making any special preparation of this pharmaceutical plant. At the beginning of the 19th century, the first researches were made by studying the main components of Centele, by trying the extraction to obtain an extract where all the main components would be present, determining the quantitative ratio of the components (-Balick JM and PA Cox, 1996. Plants. Various methods have been tried until nowadays to obtain a standardized extract, but there were also difficulties in having a proper technological process.

2. Body of Manuscript

Various extraction methods have been tried, each method has its advantages and disadvantages in a technological process. First of all, there were problems with the low rate of the extraction coefficient to a complete interruption of the extraction process, as a result of not adequate adjustment of the extraction parameters. Quite good results have been achieved by percolation, but with this method, it is not possible to influence the accompanying factors of the extraction, such as temperature, mixing rate, and re-filtration, which reduce the extraction coefficient, so reached an extraction rate of up to 60%, that rises a lot the extract ratio to the raw material up to 1:20, therefore a large amount of the extract is lost, although the amount of main components is satisfactory, in this case, it has been tried the extraction to be realized by maceration, by making the adequate preparation of the raw material with various degrees of refining for four samples, with different degrees of refining, following the extraction curve and the ratio raw material: extract. This process is supported by other extraction parameters, such as higher temperature and more dynamic mixing with higher mixing speed, and also by rinsing with an amount of solvent during the filtration, which indicates a higher production by extracting completely the main components present in the raw material. There are weighed 190 grams of ground raw material Centella Asiaticae by mixing with 1520 gr Ethanol 70%. The maceration process lasts 60 minutes at a temperature of 35°C, with a mixing speed of 400 rpm/min. The maceration process happens in a chemical glass of 2000 ml placed in a heating chamber, and the aim is to keep the temperature at about 35°C. After weighing the quantity of the raw material and the solvent, the solvent is first poured into a glass, and then the solvent is continuously stirred with a mixer at 400 rpm/min. within 60 min. After the maceration process, filtration is done with a filter letter. In different periods from the beginning of maceration, there was taken by one sample was taken, and the amount of dry mass per unit of time. All the samples taken before the measurement of the dry weight, the same has undergone filtration with filter paper. After the extraction has finished, the extraction coefficient and the extraction curve are calculated. After filtration, the mixture is rinsed with 100 gr solvent Ethanol 70 %. There were prepared 3 Samples with various degrees of refining Table 1,2,3 with the same amount of raw material and solvent, which means that there were 190 gr of ground raw material and 1520 gr of solvent Ethanol 70%, for the same temperature and the same duration of maceration. For all samples, there are also measured the amount of dry mass and the extraction curve to see which raw material is adequate for a higher extraction coefficient.

For the first sample Table 1 Figure 1 it can be noticed that we have a high degree of refining and the same has undergone a maceration process. It was found that the maceration process cannot be developed until the end, as the granules stick to each other and reduce the active contact surface area between the raw material and the solvent, which interrupts the extraction process, so the process remains in equilibrium, this is a fact that we have low extraction coefficient in Table 2 Figure 2, at the same time it becomes complicated to implement the technological process.

For the second sample Table 3 Figure 3 we have a low degree of refinement where the size of granules is between 1-0.5 mm, this size of granules allows the extraction process to be implemented till the end, which results in a higher dry mass, and higher extraction coefficient. Although the increased size of granules is not in favour of extraction for other cases, this type of plant is distinctive because of the problems during extraction. Table 4 Figure 4.

For the third sample Table 5, Figure 5 the size of granules has a wider field of the size of granules which results in an average value of the dry mass, but the filtration has more problems for the extraction process and has an average degree of extraction coefficient Table 6 Figure.6.

3. Table and figures

Table 1 Granulometric analysis of ground leaves of Centela sample1

Size of strainer	Measuring vessel gr	Vessel + raw material gr	Netto (gr)
8.00 mm	448.1	448.1	0
4.00 mm	430.82	430.88	0.06
2.00 mm	399.7	401.46	1.76
1.00 mm	362.8	365.21	2.41
0.50 mm	322.5	328.56	6.06
0.25 mm	290.1	310.11	12.01
0.125 mm	279.48	284.25	15.77
Sludge	400.88	414.31	11.43

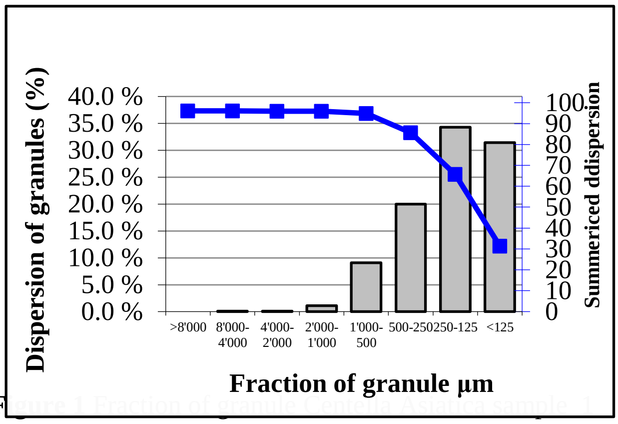

Figure 1 Fraction of granule Centella Asiatica sample 1

Table 2 results of dry mass in relation with the extraction time sample 1

Extr..Time	Dry current %	Temp °C
1	0.8	34
5	1.26	34
10	1.76	34
15	1.96	34
20	2.23	34
30	2.42	34
40	2.65	35
50	2.62	35
60	2.66	35

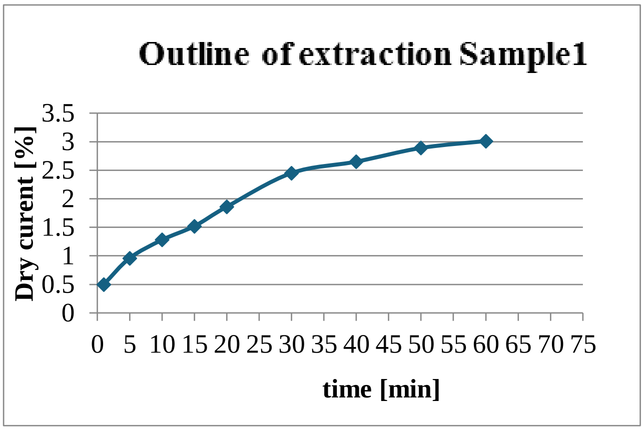

Figure 2 Outline of extraction Centella Asiatica sample 1

Table 3 Granulometric analysis of Centella sample 2

Size of strainer	Measuring vessel gr	Vessel + raw material gr	Netto gr
8.00 mm	448.1	448.4	0.3
4.00 mm	430.82	435.07	4.25
2.00 mm	399.7	409.15	9.45
1.00 mm	362.8	377.36	14.56
0.50 mm	322.5	334.93	12.43
0.25 mm	290.1	292.63	2.53
0.125 mm	279.48	282.94	3.46
Sludge	400.88	404.1	3.22

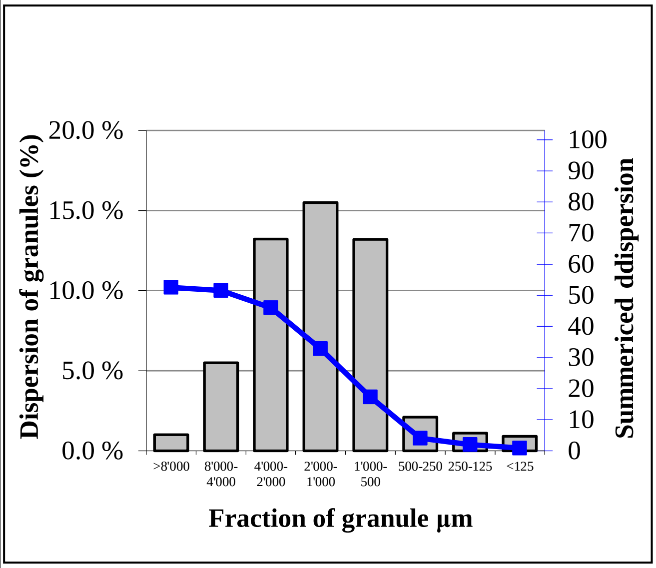

Figure 3 Fraction of granule Centella Asiatica sample 2

Table 4 results of dry mass in relation with the extraction time sample 2

Mac.time	Dry current%	Temp °C
1	0.5	34
5	0.96	34
10	1.28	34
15	1.52	33
20	1.86	33
30	2.45	34
40	2.65	34
50	2.89	35
60	3.01	35

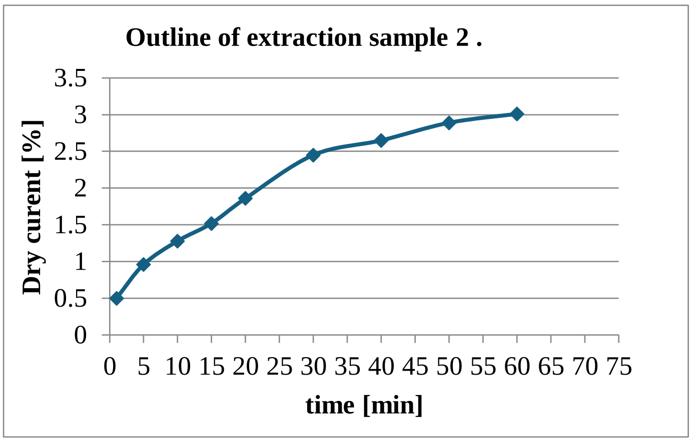

Figure 4 Outline of extraction Centella Asiatica sample 2

Table 5 Granulometric analysis of ground leaves of Centella sample.3

Size of strainer	Measuring vessel gr	Vessel + raw material gr	Netto Gr
8.00 mm	448.1	448.1	0
4.00 mm	430.82	430.88	0.06
2.00 mm	399.7	401.46	1.76
1.00 mm	362.8	367.05	4.25
0.50 mm	322.5	339.27	16.77
0.25 mm	290.1	303.46	13.36
0.125 mm	279.48	289.69	10.21
Sludge	400.88	403.70	2.82

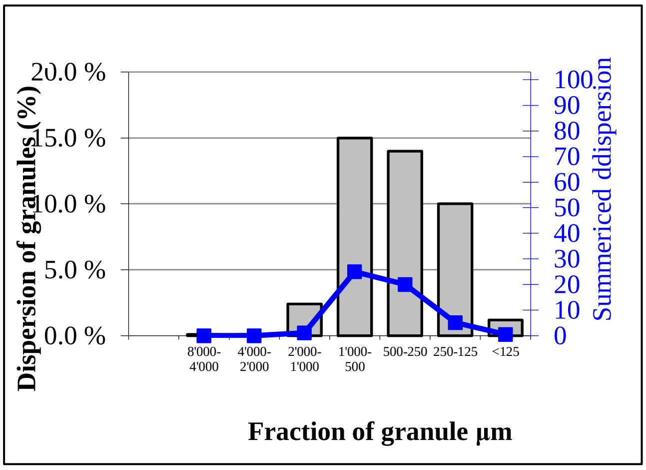

Figure 5 Fraction of granule Centella Asiatica sample 3

Table 6 results of dry mass in relation with the extraction time of Centella sample 3.

Extr..Time	Dry curent %	Temp °C
1	0.8	34
5	1.26	34
10	1.76	34
15	1.96	34
20	2.23	34
30	2.42	34
40	2.65	35
50	2.62	35
60	2.66	35

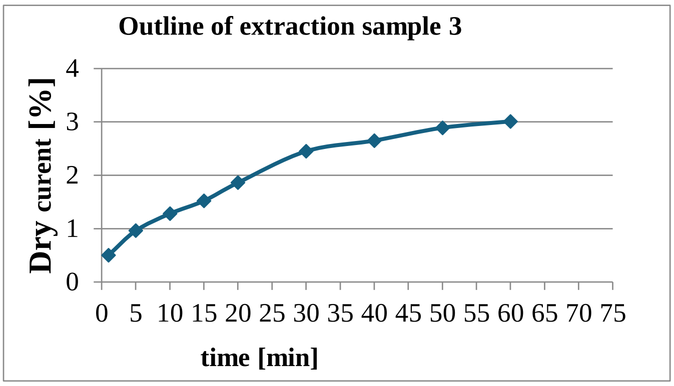

Figure 6 Outline of extraction Centella Asiatica sample 3.

4. Conclusions

The raw material should not be too ground, it should be between 4 and 0.5 mm.
The temperature should be between 30 and 40°C.
The duration of the maceration should not be more than 60 min as they begin to extract undesirable substances which complicates the technological process because there are created special stages such as dirt, which also withdraws a certain amount of the extract and makes it impure
The rotation rate of the mixer should not be higher than 400 rotations/min because as a solution increases the degree of refinement and the temperature increases mildly
It is preferable that after maceration, the extract be rinsed during the filtration process with an amount of about 100 ml of solvent Ethanol 70% so that eventually the residues of the constituent components of the raw material are drawn into an extract. This also results from the fact that it is not possible to observe with high accuracy reaching the equilibrium of the maceration reaction, so with this, we have a shift from the equilibrium, so the remaining amount of main components in the raw material is withdrawn.

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