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Review article

OPTIMIZATION OF THE EXTRACTION PROCESS OF THE LEAVES OF MATES FOR DIFFERENT RAW MATERIAL RATIOS TO THE SOLVENT

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Abstract

Leaves of Mate are leaves of the pharmaceutic plant Ilex paraquariensis. Mate is a raw material and is widely used in medicine. Mate leaves are mainly the ones that in its content have important substances, and in this group are Caffeine Theobromine Theophylline, Chlorogenic Acid, and Etheric oil. Long ago the leaves of Mate were used only as ground and mixed with water, known as mate tea, which also has a curative effect. Nowadays, are required standard methods a lot, to get an extract of Mate, so that the dosage is more accurate, on the other side main substances to be standardized and dissolved equally in the extract. There is a possibility even percolation extraction to be used for this because we have leaves, however in this case the extraction is made by maceration using specific conditions, first of all, different rations of raw material and the solvent used for extraction, reduced grinding degree and low concentration of the solvent. Maceration as a form of extraction, allows the main components of Mate leaves to be completely extracted and the extraction coefficient is higher, on the other side technological process is further realized without any problems.

Keywords: extract, maceration, percolation

1. Introduction

Leaves of Mate have been known since the past times and the same were used mainly for tea, without using any complex process, it was only mixed an amount of leaves with hot water. Preparation of Mate is realized in three stages: harvesting, pre-drying, and the drying of the leaves. Each stage is important in itself since the green leaves lose a relatively big amount of caffeolynquinic acid after the drying process, which is destroyed by oxidation, on the other side, the well-dry leaves have stable ingredients such as caffeine and other chlorogenic acids. Another characteristic of Mate leaves is the presence of Saponins in their composition, which complicates the extraction process.(Haaf, Melanie: Ilex *paraguariensis* St.-Hil. (Mate) The processing of Ilex paraguariensis starts with three successive steps of preparation:

pre-drying, drying, grinding.

Today, more advanced methods are always required to obtain the extract of Mate from its leaves, based on the old methods of obtaining the extract, but advancing those old methods with more advanced methods, which methods depend on the preparation of the raw material and the concentration of the solvent (M. Haaf, K.M. Fisch, S. Plos, W. Knöss): A large number of researches have been done to verify the antioxidant properties of Mate leaves. A general rule to obtain extracts is for the degree of grinding to be higher so that the surface of the grains of raw material has a larger contact with the solvent used for extraction, but in this specific case of Mate leaves, an average grinding of the leaves is required since the extraction coefficient itself is high and on the other hand it hinders the extraction of undesirable substances. Extraction can be done with ethyl ethanol

with a low concentration of 15% ethanol. Extraction also depends on many other factors, such as the ratio of the raw material to the amount of solvent used for extraction, which ranges from 1:6 to 1:10. , and each has its advantages and disadvantages. The lowest amount of solvent can have the consequence of the extraction process reaching the equilibrium quickly and reaching the oversaturation of the solvent, where the extraction process is stopped before the due time, this reduces the extraction coefficient. The 1:10 ratio, on the other hand, leads to the extraction of undesirable substances that carry the ingredients such as sugars, chlorophyllin, etc., which complicate the further technological process, but has the advantage of extracting the full amount of the raw materials in Mate leaves. The extraction temperature is from 20-25 °C for 60 min, with an equal mixing.

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To realize the extraction process, a raw material-to-solvent ratio of 8:1 was created with a solvent concentration of 15% ethanol. In a laboratory container of 2000 ml, there were weighed 1800 ml of 15% ethanol and 210 g of ground Mate leaves. Before starting with the maceration process, Mate leaves are prepared, and in this particular case, the leaves are ground to a certain level of grounding. Granulometric analysis was made with an average degree of grinding suitable for extraction Tab. 1 Diag. 1. From the table and diagram it can be concluded that the ideal size of ground grains is between 2-0.125 mm

The mixture of the solvent with the Mate leaves is subjected to mixing at about 400 Spin/min, and on the other hand, the solution is heated to 50 °C, where the extraction process begins, the same lasts about 30 min.

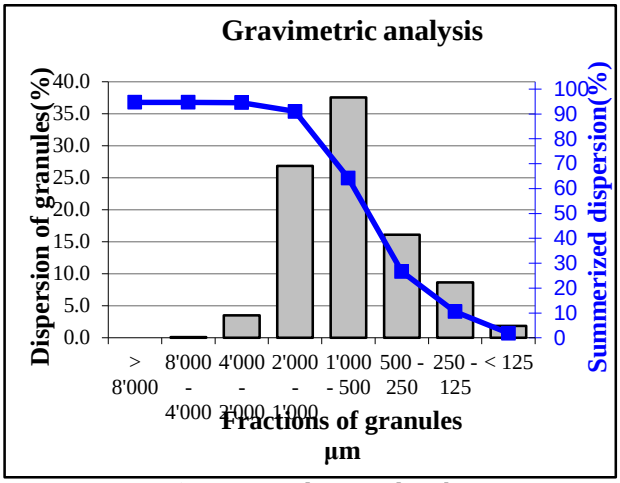
For optimization of the extraction process, they were made three analyzes with the same size of the grains, by changing the ratio of the raw material to the solvent, where the dry mass is measured for all three analyses, following also the fluidity of the technological process. From the results of the three analyses, it can be concluded that sample No. 1 has a lower dry mass and at the same time the lowest extraction coefficient, but it has a higher amount of extract obtained, this does not mean that it is more suitable for the next technological process and the advantages from this analysis are less compared to the disadvantages in the technological process. The first argument is that with the amount of solvent in the raw material, are also extracted unwanted raw materials. The amount of solvent is high and due to the low concentration of the solvent, 15%, high energy is required, and also a long time for distillation of the solvent. From the results of the analysis when the raw material ratio is 1:6, it can be seen that the amount of obtained extract is low as a consequence of the fact that the extraction process did not continue till the end, the oversaturation of the solvent was created, and the extraction reaction has remained in equilibrium, a process that is not desirable for the extraction process.

From the analysis ratio of the raw material to the solvent 1:8 we can conclude that the amount of solvent about the raw material is optimal, the extraction reaction continues to the end and the amount of obtained extract is higher resulting in a ratio of the raw material with the obtained extract is optimal 2.6:1.

3. Table Figures and Equations

Table 1 Granulometric analysis of ground leaves of Mate

Size of strainer	Measuring vessel gr	Vessel + raw material gr	Netto
8.00 mm	448.1	Vessel + raw material gr	0
4.00 mm	430.82	430.88	0.06
2.00 mm	399.7	401.46	1.76
1.00 mm	362.8	376.23	13.43
0.50 mm	322.5	341.27	18.77
0.25 mm	290.1	298.15	8.05
0.125 mm	279.48	283.82	4.34
Sludge	400.88	401.82	0.94



Diag.1 Granules size distribution

Table 2 results for different ratio raw material- solvent during maceration

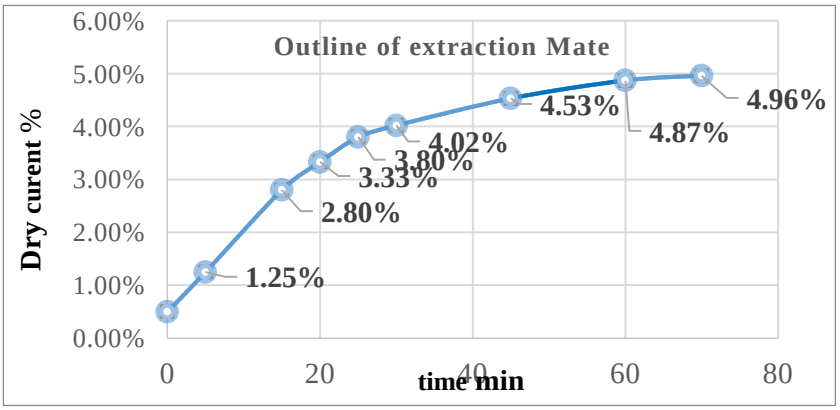
RLPT		1:10	1:8	1:6
		Dry mass of the macerated extract	Dry mass of the macerated extract	Dry mass of the macerated extract
	Time min	Probe 1	Probe 2	Probe 3
1	20	4.15	5.69%	4.32%
2	60	4.38	5.89%	4.74%
3	90	4.40	5.95%	4.95%
Raw material Mate		210gr	210 gr	210 gr
Solvent 15% Ethanol		2100 ml	1680 ml	1260 ml

Table 3 results for different ration raw material: solvent, after filtration

Ration raw material : solvent	Amount of raw material gr	Ethanol 15% m/m ml	Extract mass gr	Dry mass Of extract after filtration	Theoretical amount of dry extract gr	Ration raw material : extract
1:6	210	1260	1180.0	5.25%	61.95	**3.3 : 1**
1:10	210	2100	2015.0	4.46%	89.86	**2.3 : 1**
1:8	210	1680	1580.0	5.21%	81.27	**2.6 : 1**

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

Time in min	Dry curent %
0	0.50%
5	1.25%
15	2.80%
20	3.33%
25	3.80%
30	4.02%
45	4.53%
60	4.87%
70	4.96%



Diag 2. Outline of extraction Mate

4. Conclusions

- The extraction of the raw material of Mate leaves should be done by maceration since the ratio of the amount of Mate leaves used with the obtained extract is lower. and supports the flow of the technological process and has a full economic rationale.
- the size of the ground grains should be between 0.1 mm and 0.125 mm. due to the high degree of extraction ability of Mate leaves
- The ratio of raw material: to solvent should be 1:8 since the amount of filtered extract is optimal for the raw material. The ratio of the raw material to the solvent shouldn't be 1:10, even though the results show a higher extraction coefficient, however, in the later stages of the technological process the loss is very

high and makes the process impossible due to the foam that appears in the extract as a result of the presence of saponins in Mate leaves.
-Maceration time can be continued for a maximum of one hour to extract the remaining substances that have not been well extracted, but not more than one hour due to the extraction of unwanted substances such as sugars, clorophyllin, etc.
-It may continue for a maximum of one hour to extract the remaining substances that have not been extracted, but not more than one hour due to the extraction of unwanted substances such as sugars, clorophyllin, etc.

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