IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Alfred Yoakim et al.	Confirmation No.: 5791
Application No.: 12/602,542	Group Art Unit: 1791
Filing Date: December 1, 2009	Examiner: Stephanie A. Cox
For: METHOD FOR PREPARING A BEVERAGE OR LIQUID FOOD AND SYSTEM USING BREWING CENTRIFUGAL FORCE	Attorney Docket No.: 88265-8366

DECLARATION UNDER 37 CFR 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Alfred YOAKIM, do declare that:

1. I am a citizen of Switzerlandand reside at Ch. de la Routiaz 2 CH-1806 St-LEGIER-LA-CHIESAZ. I submit this declaration on behalf of Nestec, S.A. to provide my opinions regarding the patentability of the invention described in the above-identified application.

2. I have worked in the field of portioned beverage system since 1986. I have been responsible for Nespresso Research and Development for 24 years and I have been an inventor in numerous Nestec patents for beverage capsules, beverage systems and beverage delivery machines. I hold a degree in Electrical Engineering (IS/IT Master) .

3. I am currently Vice President at Nestec S.A. and I am Head of Nestlé System Technology Center at Orbe in Switzerland. My current responsibilities includes the management of a research and development center dedicated to beverage and food delivery systems and an inventive activity related to the same field.

4. I have reviewed and understand the above-identified patent application and pending claims thereof, as well as the current Office Action mailed January 30, 2014 and references cited by the Examiner therein. Specifically, these references include U.S. Patent No. 5,325,765 to Sylvan et al. ("Sylvan") and Belgian Patent No. BE894031 to Guerin ("Guerin"). I am making the following statements as a person of ordinary skill in the art in support of the patentability of the present claims.

5. It is thus my opinion, as one of ordinary skill in the art, that it would not have been obvious to modify or combine Sylvan and Guerin to arrive at the presently claimed method of preparing a food liquid such as coffee. There is no teaching in either disclosure to suggest this combination, and, the combination would not lead to a functional or practical result. In fact, I am not aware of any single-serving beverage extraction devices on the market that implement the Applicants' methods or have the same extraction potential. The Applicants have invented a beverage extraction method that pairs the application of centrifugal force with the formation of a plurality of liquid delivery outlets along the periphery of the sealing lid of a beverage capsule. This pairing is what allows for optimal pressure, liquid distribution, and liquid velocity throughout the capsule without oversizing the extraction device or driving the capsule at excessive rotational speeds. It is my belief that the Applicants' invention represents a significant advancement over the prior art, and there is no reading of Sylvan or Guerin that would render the present method claims obvious.

6. It is not logical to provide outlets at or near the lid of the Sylvan cartridge because it would not be possible to remove all the beverage from the cartridge. First of all, the liquid in Sylvan's device is introduced into the cartridge through the lid where it descends onto the beverage forming ingredients and forms a beverage after passing through those ingredients. Putting outlets on the lid would not efficiently extract a beverage since the cartridge would not be able to discharge its full beverage content.

7. The exact location of the outlet is certainly critical in Sylvan, as to modify Sylvan to place an outlet or outlets on the lid to remove the full beverage content through top openings would defy the laws of gravity. Furthermore, the structure of the Sylvan cartridge

collects the liquid below a filter such that the beverage would then have to travel back through the substance to be removed from outlets in the lid.

8. In addition, Sylvan's cartridge provides a cavity in the bottom of the cartridge below the filter so that a probe which perforates the base will not injure the filter itself. Modifying Sylvan to provide penetrators at the periphery of the cover would likely injure the filter and this clearly goes against the teaching of Sylvan to separate the filter from the part of the cartridge that is to be punctured.

9. There is no disclosure in Sylvan regarding cartridge rotation nor is there any structure in Sylvan's device that is capable of being rotated, centrifugally or otherwise. And according to Sylvan's teaching, the beverage or liquid food cannot exit the Sylvan cartridge during operation until after the bottom is pierced. The only logical interpretation of Sylvan to provide additional outlets to "allow the beverage to exit faster" would be to add those outlets to the bottom of the cartridge.

10. To be combined with Guerin, Sylvan's machine needs to be substantially modified and its principle of operation must be radically re-designed. This would not be a trivial exercise. The office action suggests that "probes positioned on each end wall" can be used to rotate is well known in Sylvan's cartridge but Guerin's rotation of the capsule is not conducted in that manner. And even if Sylvan was rotated in that manner the top "probe" would have to be a water injector and the bottom "probe" would have to be the liquid outlet for the beverage to be produced according to Sylvan's teachings. I do not see how it is possible to redesign the Sylvan cartridge in a routine manner to allow the beverage to exit the top of the cartridge.

11. By me or under my direction and control, a number of tests were conducted to show the unexpected benefits of the present invention compared to the Sylvan and Guerin disclosures. The tests are described in the attached Report entitled **Trials on a centrifugation coffee system – influence of capsules inlet and outlet on extraction efficiency and in-cup results – to support U.S. Patent Application of Alfred Yoakim et al. No. 12/602,542** (the "Report").

12. In this Report, capsules were made according to the present invention (with a plurality of outlets located at the periphery of the lid) and these were compared against capsules made based upon: Mode A - Guerin Embodiment A: wherein the upper and bottom walls are entirely porous; Mode B - Guerin Embodiment B: wherein the side walls are perforated and the upper wall is porous; and Mode C - Guerin Embodiment C: wherein the entire body of the capsule is porous.

13. Additional tests were conducted as Modes D, E1 and E2. In Mode D, a similar capsule was prepared to the Reference Capsule of the present application, but it was sealed with a filter paper covered by a pre-perforated top membrane; in Mode E1, a similar capsule was prepared by modifying the Reference Capsule to include only a single pre-perforated outlet hole in the top membrane at the periphery close to the flange of the capsule; and in Mode E2, a similar capsule to Mode E1 was prepared except that the single outlet hole was provided when the top membrane was placed in the machine rather than being pre-perforated as in Mode E1. Modes E1 and E2 are representations of a modified Sylvan cartridge with a single outlet at the top. Mode D is a representation of a capsule that has random outlets on the top membrane instead of outlets located at the periphery of the lid as in the present application.

14. Several capsules of each of Mode were prepared and placed in the test machine which provided a centrifugal rotation of the capsules after water was introduced therein. The only differences besides the capsule design was the way the water was introduced with the machine to facilitate the performance of the capsule in the extraction of the coffee that was produced.

15. The results show that the capsule of the present application provided enhanced extraction and a uniform production of the beverage, whereas the capsules representative of Guerin or Sylvan had low extraction and inconsistent beverage preparation even if they could be made at all. The Report details all the differences of the beverages that were able to be produced from the capsules that were tested.

16. Based on these tests, I conclude that the Sylvan and Guerin disclosures do not disclose the capsules and methods of the present application, nor do they teach or otherwise provide capsules for use in a centrifugal rotation machine to provide beverages that have uniform

extractions and organoleptic properties. The best beverages are obtained from the use of a plurality of outlets on the capsule wherein the outlets are located at the periphery of the lid so that the application of centrifugal force by rotation of the capsule along its longitudinal central axis urges the water to flow through the substance and radially outwardly in a centrifugal flow path towards the peripheral outlets in order to obtain an optimal extraction for the beverage that leaves the capsule through the peripheral outlets.

17. The tests were conducted with a device that provided the outlets in the top lid when the water was injected into a central part of the capsule, but it would be expected that the results would be essentially the same if the outlets are formed during rotation of the capsule as the pressure increases therein. Although in the tests above the membrane lid was perforated by the closure of the machine rather that by the pressure exerted in the capsule by the injected fluid, a skilled artisan would expect similar performance considering the water flow in the capsule and the extraction results. Thus, the provision of the opening members that do not puncture the lid when the device is closed, but where they are in position to form the outlets during operation, is expected to provide similar results to providing openings in the lid membrane before centrifugal rotation.

18. I further declare that all statements made herein of my knowledge are true and all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

Dated: 18.06.2014

Alfred YOAKIM

Trials on a centrifugation coffee system – influence of capsules inlet and outlet on extraction efficiency and in-cup results – to support U.S. Patent Application of Alfred Yoakim et al. No. 12/602,542

OBJECTIVES

Provide trials and evidence, in particular, demonstrating that the location of the outlets at the periphery of the capsule is important for the extraction of the coffee beverage and is not a mere variant of Guerin patent document BE 894,031 and/or Sylvan US patent 5325765.

SUMMARY

The different tests confirmed that the location of the outlets at the periphery of the capsule is important for carrying out a good and clean coffee extraction.

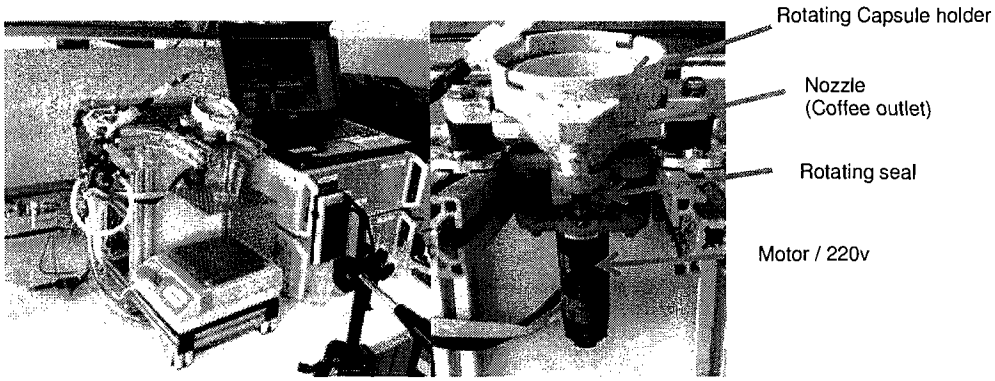
Only outlets on the periphery of the capsule gave repeatable coffee extraction results, in particular, regarding coffee crema, coffee extract concentration and coffee extraction yield without blocking the machine.

TRIALS

I. Conditions

The trials were conducted on a centrifugal beverage preparation machine prototype corresponding to the description of the U.S. patent application US 12/602,542.

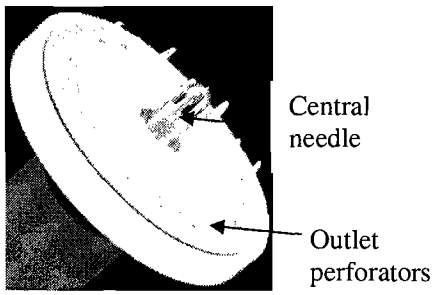
The machine was referenced: Copernic NT bench n° 3 and comprised a centrifugal brewing unit: NT014-A.



The extraction of coffee from the capsules used in the following tests were obtained from this machine operating under the same conditions. The only difference was the design of the interface that contacted the top of the capsule as explained further below.

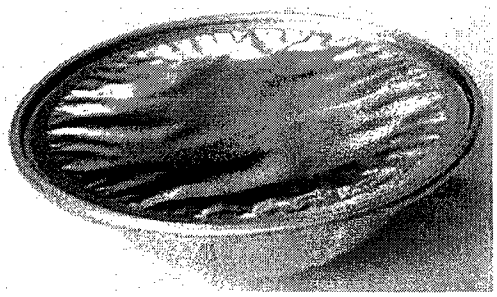
1. Mode REF; Method of Reference according to the patent application US 12/602,542

The machine comprised a **rotating injection-extraction interface**, illustrated below, comprising a central hollow needle for perforating the top membrane of the capsule at its centreline and for supplying water in the capsule. It also comprised a series of peripheral perforators for perforating outlets in the top membrane of the capsule:

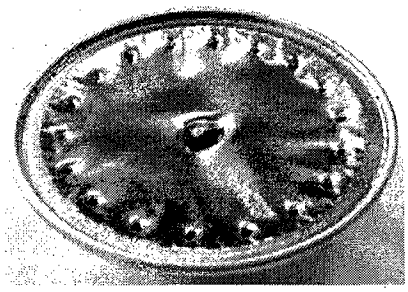


A Reference Capsule according to the invention was prepared as shown below:

- Before insertion in the machine: a lid of a top aluminum membrane is sealed to the flange of a cup-shaped body.



- After insertion in the machine: the membrane lid is perforated by the rotating injection-extraction interface, with the central needle (for water delivery) puncturing the center of the membrane and the multiple outlet perforators puncturing the periphery of the membrane.



The following conditions were applied for the Reference Capsule:

Conditions	**Value**
Capsule volume	23 ml
Roast and ground coffee	8g Nespresso Arpeggio blend (commercially available); Mean particle size value of coffee D[4:3]: ~275µm
Rotational speed (rpm)	6000
Water mean flow rate injected (ml/s)	1.34
Coffee flow rate (ml/min)	80
Coffee extract delivered	40ml
Number of capsules to be tested	20

The collected data were:

- Extraction data recorded on laptop (pressure, rotational speed, flow rate)
- Picture of the cup after extraction (side + top)
- Total solids of the liquid coffee extract delivered
- Problems met in the machine when issues are observed (e.g. dirtiness of the brewing unit, blockage, etc.) and evidenced by photos

2. Comparative methods of the prior art:

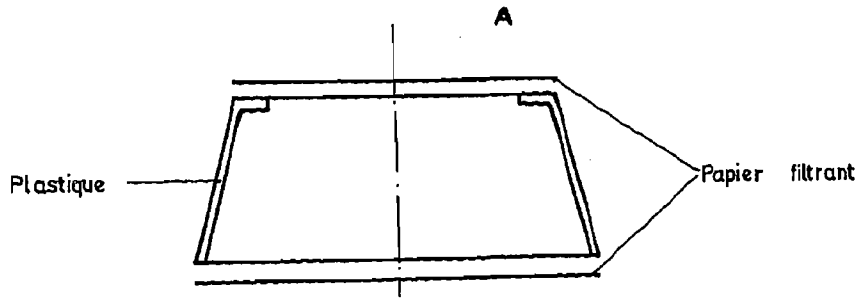
Comparative capsules were built based on the teaching on the prior art, namely, US patent 5,325,765 ("Sylvan") and Belgian Patent No. BE894031 ("Guerin").

For enabling a meaningful comparison, the capsules for the implementation of the method of the prior art were modified from the Reference Capsule and extracted in the same machine except that the **rotating injection-extraction interface** was modified accordingly to reproduce what is taught by the prior art.

In particular, the reference capsules were modified with a paper filter (according to what is understood to have been disclosed in Guerin), and with a sidewall of polypropylene of 100µm density commercialized under the brand VistaMaxx™ from company ExxonMobil.

2.1. Mode A; Guerin Embodiment A:

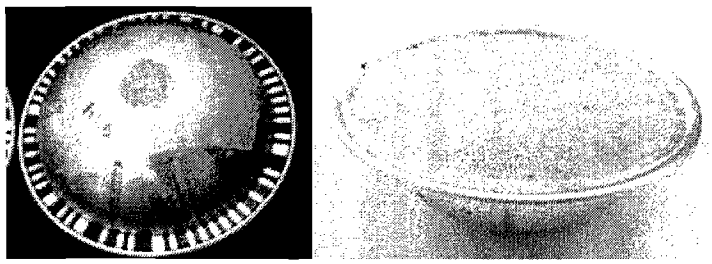
This Guerin capsule was made according to figure A duplicated below, and comprises a plastic open cup and a paper filter on the top and bottom sides, as shown:



The Guerin capsule of figure A was built as a modification of the Reference Capsule in which openings were provided before extraction in the top membrane and in the bottom of the cup. The outlets were homogeneously distributed in the top membrane and in the bottom of the cup.

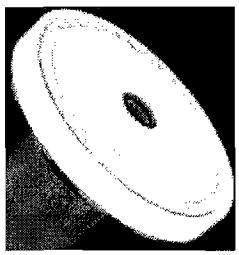
On the bottom (left handside figure), a piece of paper filter was glued (using silicon) to the bottom of the pre pierced capsule body to cover the bottom opening.

On the top (right hand side figure): filter paper was directly sealed onto the rim to obtain a capsule which is in accordance with what is disclosed in Guerin, as shown below:



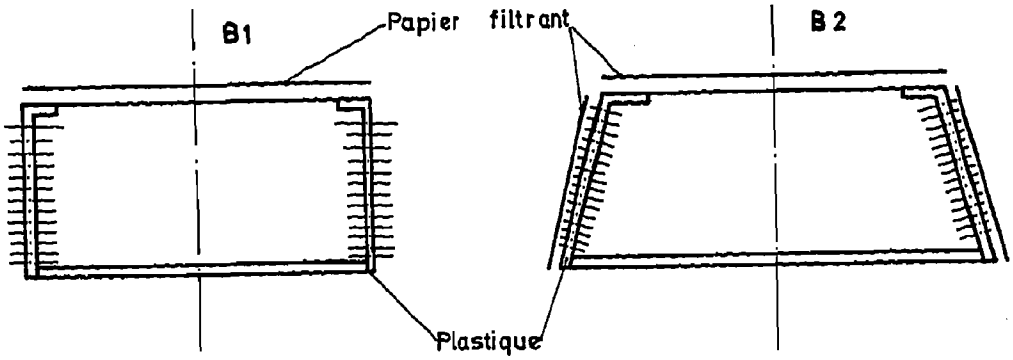
The rotating injection-extraction interface was modified by removing the central injection needle and the peripheral outlet perforators to avoid any risk of perforation of the top filter paper because Guerin does not disclose such features.

The modified injection-extraction interface is photographed below:

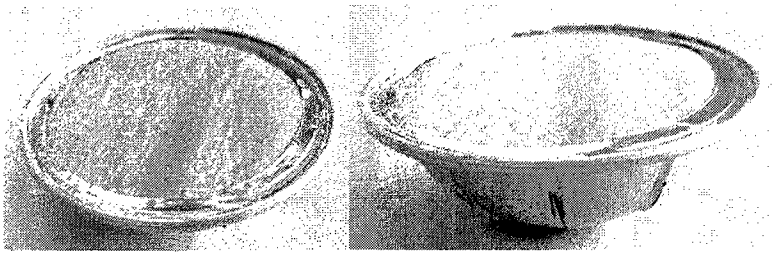


2.2. Mode B1-B2; Guerin Embodiment B

These Guerin capsules were made according to figures B1 and B2, and comprise a top and sidewall with openings covered by filter paper, but the bottom is not perforated:

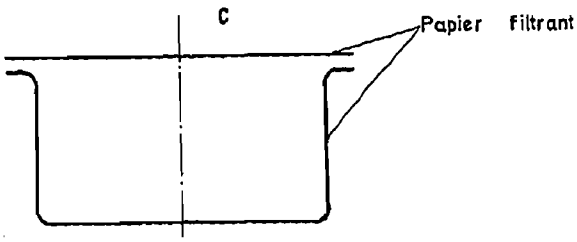


The Guerin capsule of figure B1 and B2 was built as a modification of the Guerin capsule of figure A except with the addition of several vertical slits in the sidewall that were covered by filter paper that was sealed inside the capsule body. The slits are ~10 mm long and ~0.5-1 mm wide. Filter paper was also provided on the top and bottom of the capsule as in the capsule for figure A.



2.3. Mode C - Guerin Embodiment C:

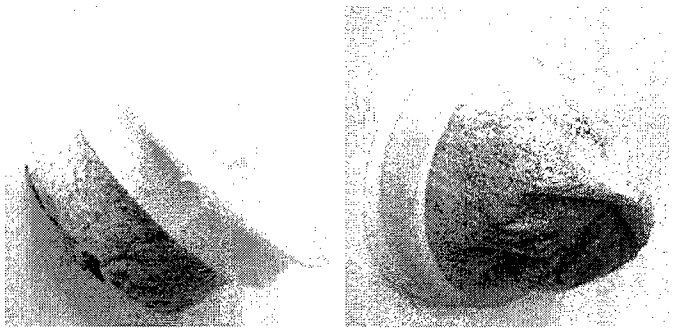
The Guerin capsule made according to figure C duplicated below comprised a top wall, a sidewall and a bottom wall all made of filter paper.



The Guerin capsule of figure C was built from the Reference Capsule.

For this, a full paper filter pod was built with a plastic ring-shaped insert for supporting the filter paper, as shown below.

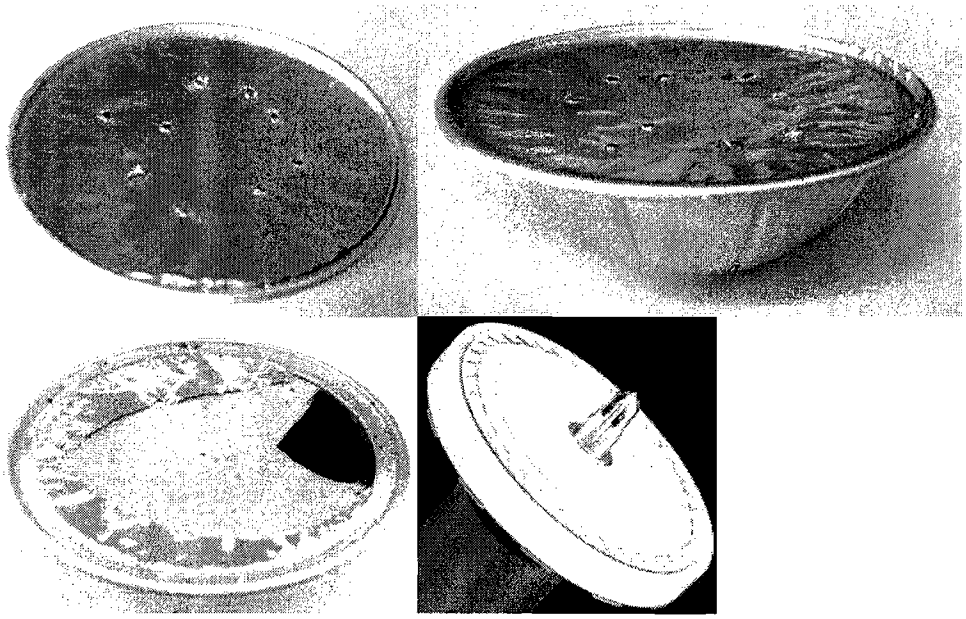
The modified rotating extraction interface for the machine was identical to the one utilized in the previous modes, i.e., for Guerin capsule - Figure A, B1 and B2.



Guerin capsule of figure C

2.4. Mode D; Outlets perforated in the middle of the top membrane:

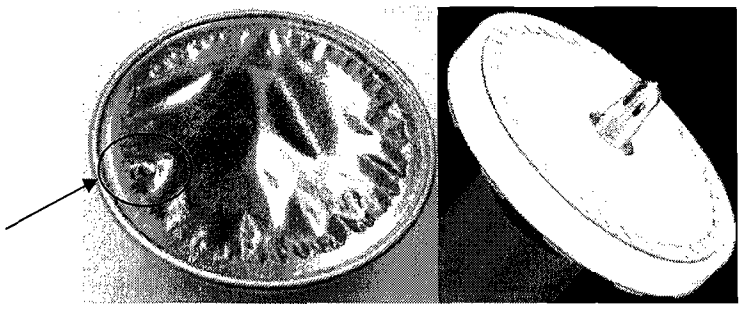
For comparison, the Reference Capsule was modified to form a capsule that is sealed with a filter paper covered by a pre-perforated top membrane, as shown below:



The rotating injection-extraction interface was modified from the Reference used in the present method by removing the peripheral outlet perforators to avoid making additional outlets: thus, it only contained the single center water injector as shown.

2.5. Mode E1; Pre-perforated single outlet in periphery of top membrane:

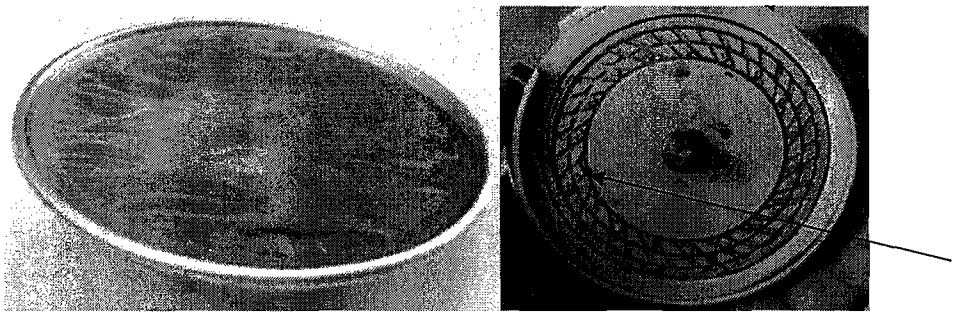
For further comparison, the Reference Capsule was modified by providing a single pre-perforated outlet hole in the top membrane at the periphery close to the flange of the capsule, as shown:



The rotating extraction interface was identical to the one used for Mode D.

2.6. Mode E2; capsule perforated by single outlet perforator:

For further comparison, the Reference Capsule was modified by perforating a single outlet hole in the top membrane at the periphery close to the flange of the capsule by the rotating injection-extraction interface. The interface was modified with a single outlet perforator placed offset to the rotating disc to provide the single outlet hole when contacting the membrane lid. The central needle was kept for perforating the top membrane and for providing water to the capsule.



Outlet perforator

II. Results:

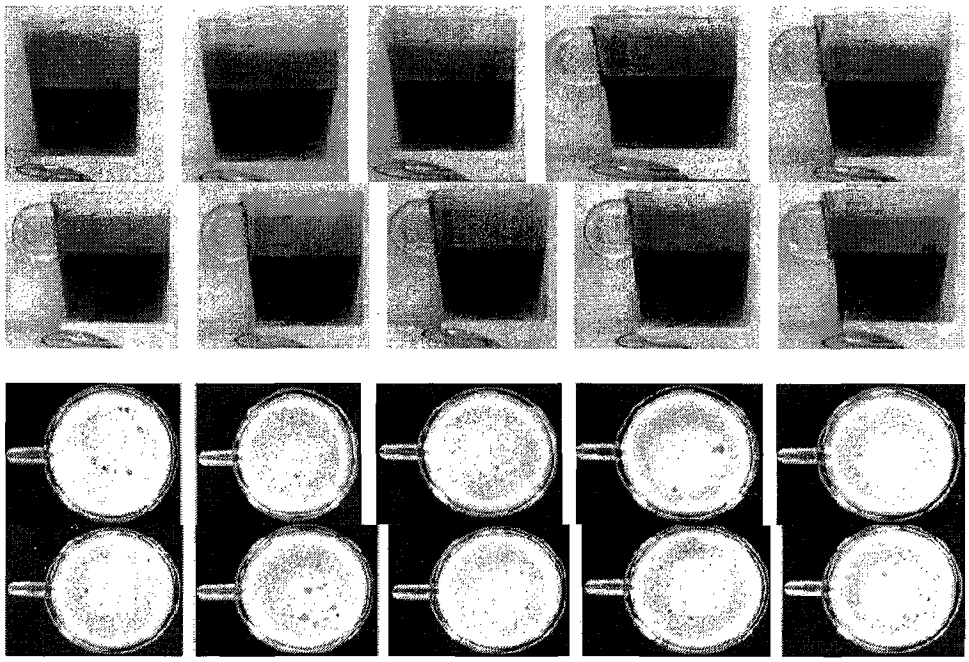
1. Mode REF (representing the Invention)

For the method of the present invention (termed Reference), the following in-cup results were obtained.

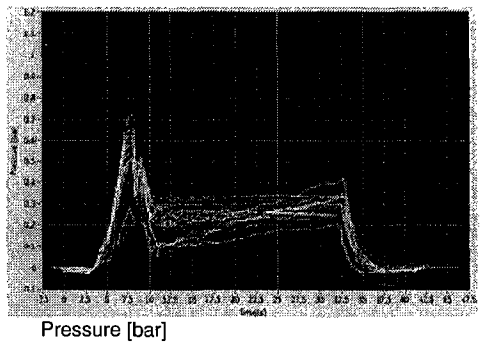
Description	Results	
Appearance of the crema (Top head of foam)	Brown crema, repeatable quantity	
Flow Time avg [s]	29.8s	
Flow Time StDev [s]	0.8	lowest standard deviation
Extract weight StDev [g]	1.3g	lowest standard deviation
Coffee Total Solids (dry mater) [%]	5.7%	(StDev: 0.48%)
Coffee Extraction Yield [%]	27.5%	(StDev: 1.81%)

These results reflect a good extraction of a coffee of espresso style.

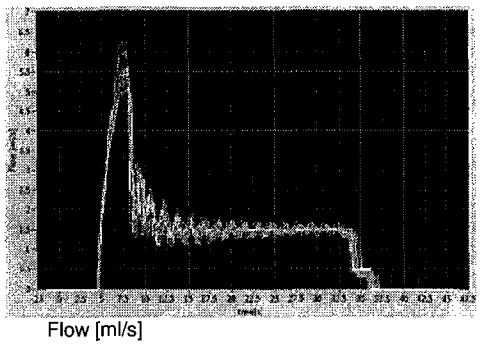
The crema of a brown colour was stable with a consistent, repeatable appearance and quantity, as shown below by the preparation of a beverage from 10 Reference Capsules according to the invention:



The extraction data were good, both as to capsule pressure and flow rate.



Pressure [bar]

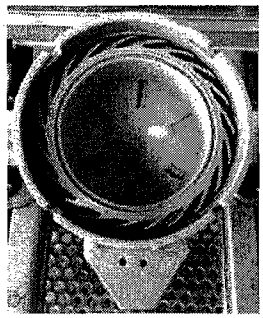


Flow [ml/s]

On the pressure graph (at the left), it can be observed that extraction pressure is between 0.2 and 0.5 bar during stable phase with a pressure peak well below the machine maximum limit of 1 bar.

Within this pressure range, the coffee liquid is properly extracted, reaching a satisfactory concentration (in total solids) and extraction yield.

The machine remained perfectly clean with no residues soiling the cup holder or the capsule holder, as shown below:

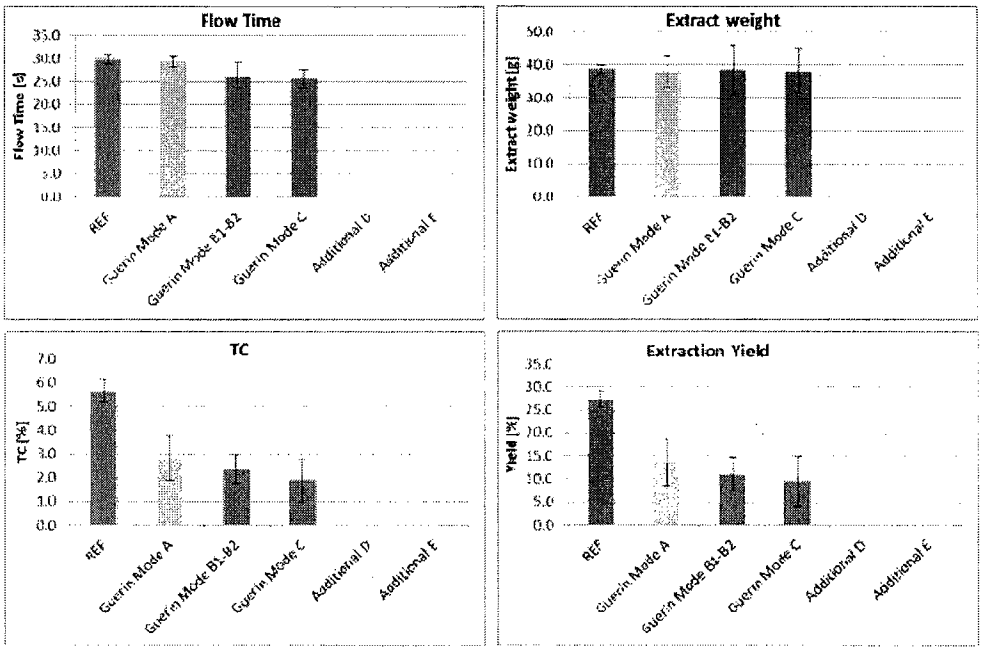


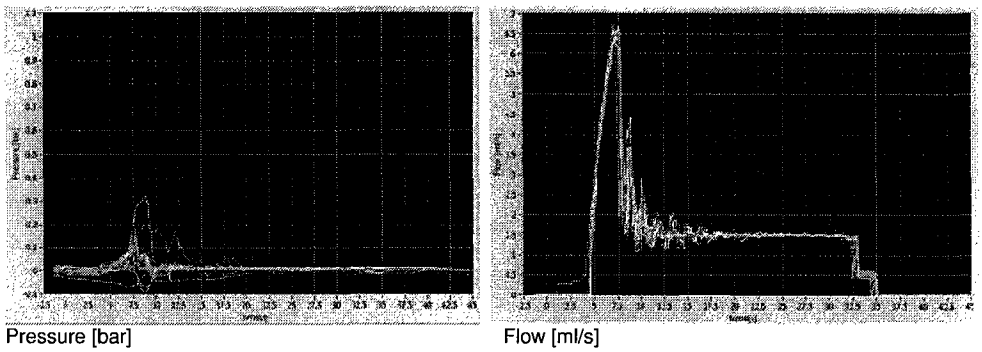
2. <u>Mode A; Guerin Embodiment A capsule:</u>

<u>30 capsules were tested.</u>

Regarding coffee quality, the coffee obtained was not well extracted at all.

As shown by the green bars, the coffee extract had a low amount of coffee solids (TC) and lower than 3.0 % (about half of the Reference Capsule). The coffee yield was very low as well to only about 13%, also less than half of what was provided by the Reference Capsule under the same operation conditions.



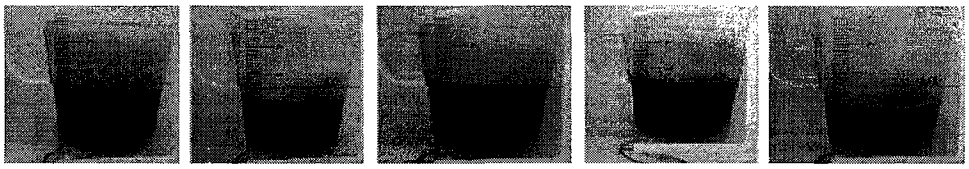


Pressure [bar] Flow [ml/s]

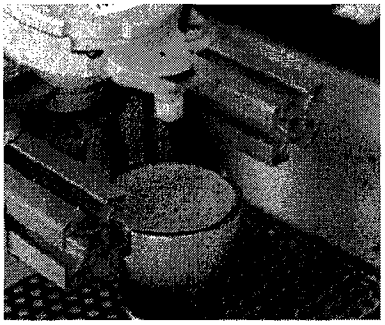
The extraction pressure (left graph) was very low (less than 0.2 bar), and the coffee extraction was not repeatable for the 30 capsules that were tested.

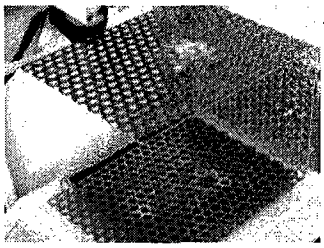
The crema color and height also were not repeatable: a few cups had a brown crema while some had a white/grey crema.

Crema volume varyied significantly from cup to cup: some cups overflowed due to too much crema production. This is shown in the following 10 representative samples of the 30 that were tested:



Due to the high uncontrolled amount of foam produced, several critical issues in capsule performance were observed:
The foam overflowed (spray) over the nozzle.
Cup overflowed due to crema overproduction. The area around the cup was soiled.



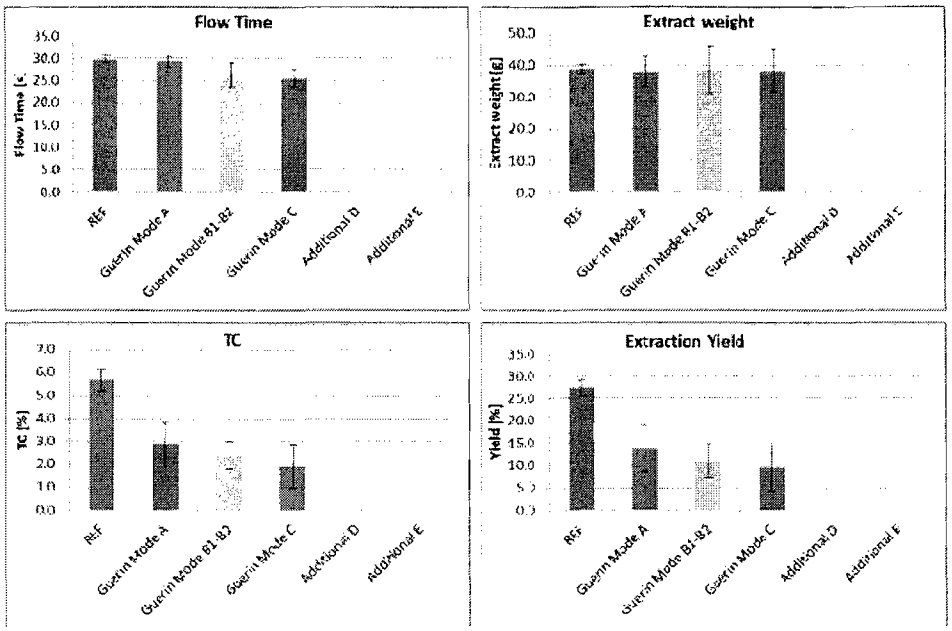


These issues are undesirable for proper preparation of a beverage or liquid food in a beverage preparation device from a predetermined dose of a beverage or food substance contained in a capsule.

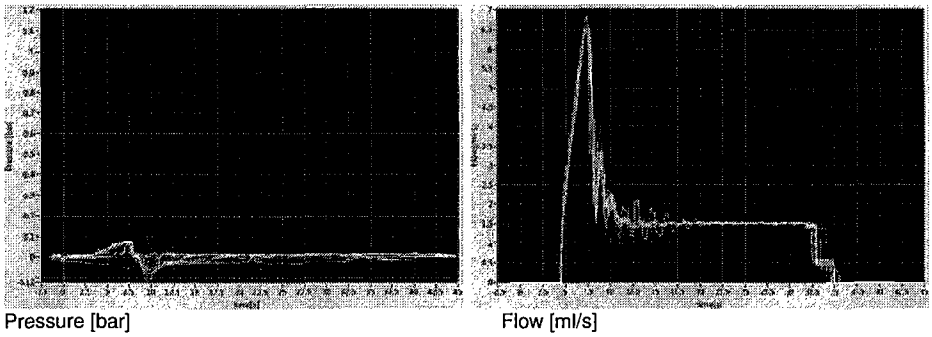
3. <u>Mode B1-B2; Guerin Embodiment B:</u>

25 capsules were tested.

The coffee obtained was insufficiently extracted. As shown by the green bars, the coffee extract had low coffee solids (TC) and low yield values compared to that obtained from the Reference Capsule under the same operation conditions. The coffee yield was only about 10%.

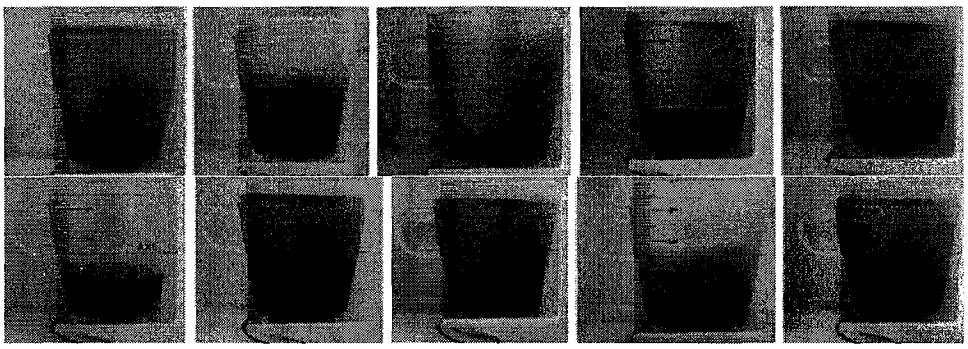


The extraction pressure (left) was also very low.

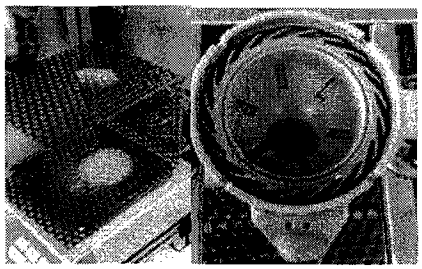


Pressure [bar] Flow [ml/s]

The crema color and height were not repeatable.
The volume of crema volume was varying significantly from cup to cup. Some cups overflowed due to too much crema production. This is shown in the following 10 representative samples of the 25 that were tested:



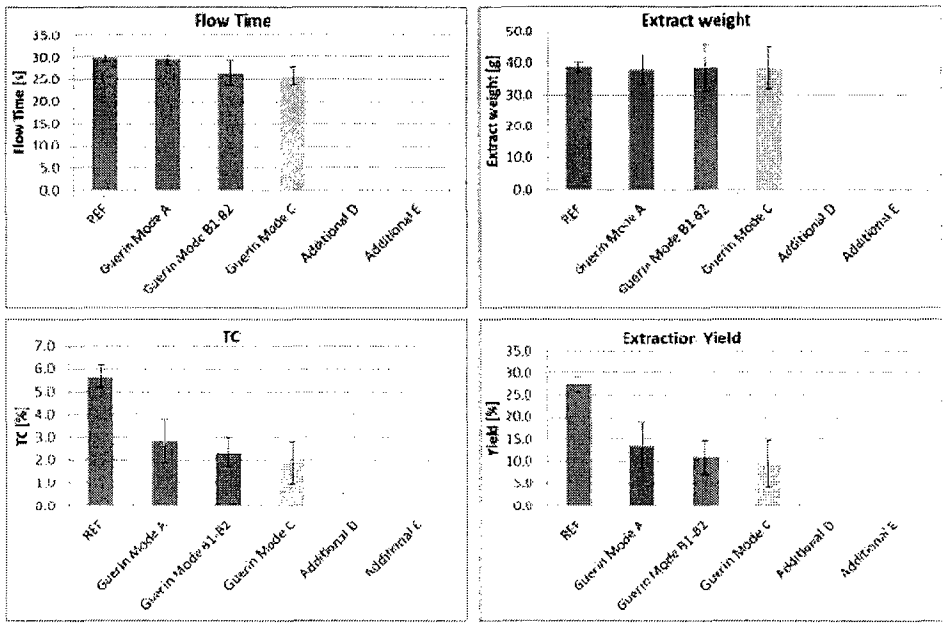
Both the capsule and cup holder were soiled due to the overflow of coffee liquid and crema.



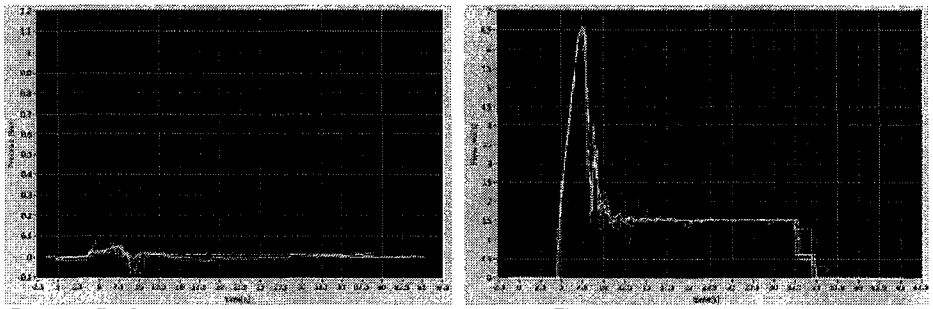
4. <u>Mode C; Guerin Embodiment C:</u>

   10 capsules were tested.

   The coffee extraction was the poorest of all of the Guerin capsules. The total coffee solids was lower than 2% wt. and the coffee yield did not even reach 10% wt.



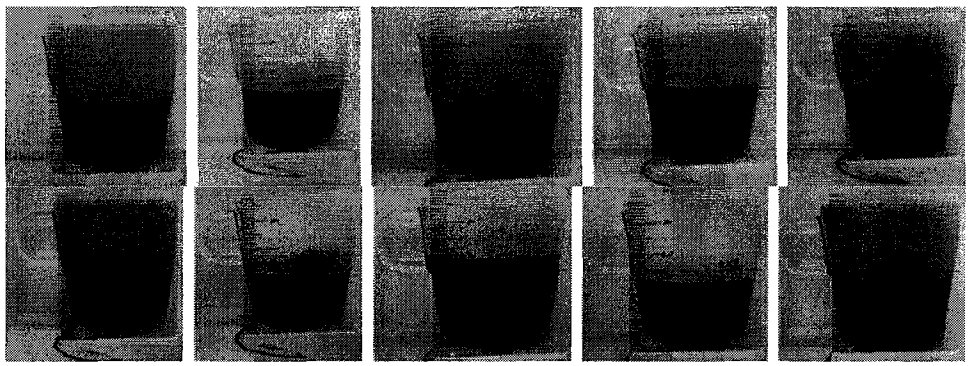
The extraction pressure was nearly atmospheric pressure.



Pressure [bar] Flow [ml/s]

The crema color and height were not repeatable, and it was also visible that the color of coffee liquid was very light brown (i.e., too watery), exhibiting the lack of proper extraction.

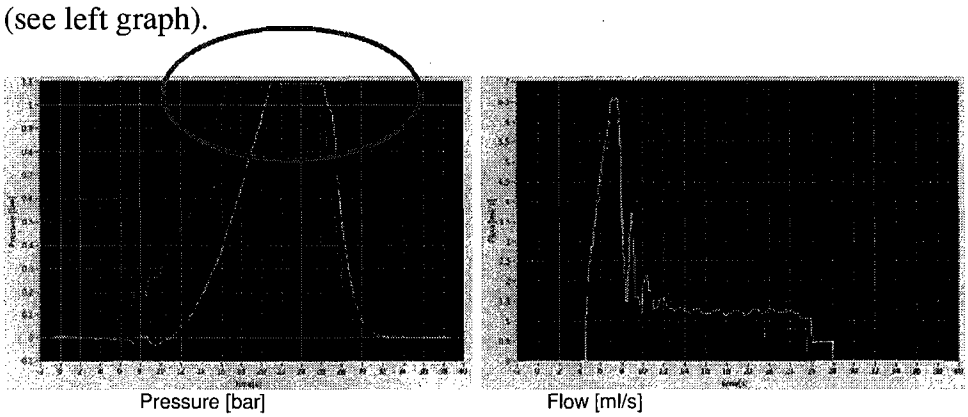
The volume of crema volume varied significantly from cup to cup and some cups overflowed due to too much crema production:



5. Mode D; Outlets perforated in the middle of the top membrane:

30 capsules were prepared, but the extraction reached exceptionally high pressures above the machine limit on the first two that were tested, so that the test was aborted as to the other 28 capsules.

The coffee extraction was not possible due to overpressure in the capsule. The liquid was blocked in and not able to leave the capsule due to high pressure building therein (see left graph).



Pressure [bar] Flow [ml/s]

6. Modes E1 and E2:

30 capsules were prepared, but the extraction reached exceptionally high pressures above the machine limit on the first four that were tested, so that the test was aborted as to the other 26 capsules.

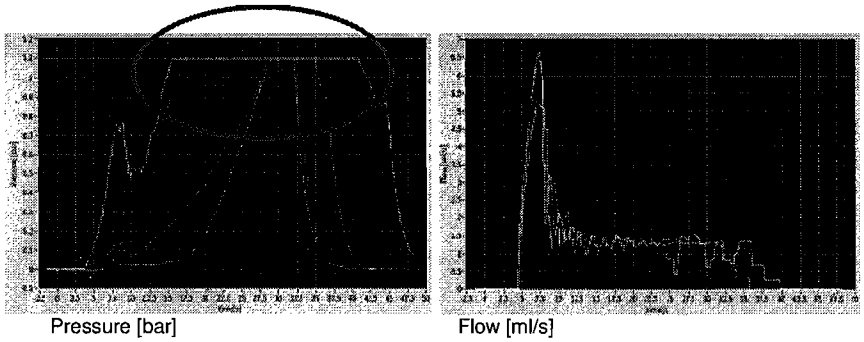
For these additional tests, both the E1 and E2 capsules provided blockages due to a too high pressure when used with a water injection needle.

The only way to avoid the over pressure in the capsule was to remove the needle, but in this case, the coffee concentration in the collected liquid extract was very low (i.e., the lowest total solids and yield of all capsule tests) as the roast and ground coffee was almost never properly in contact with water to form a proper beverage.

No extract was collected due to over pressure blockage (no flow).

6.1. Mode E1; Pre-perforated single outlet in periphery of top membrane:

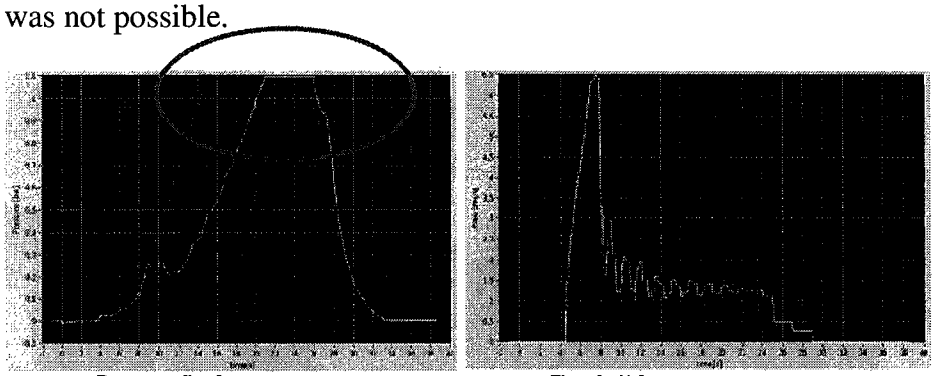
The flow in the capsule was blocked due to over-pressure. The coffee extraction was not possible.



Pressure [bar] Flow [ml/s]

6.2. Mode E2; capsule perforated by single outlet perforator:

The flow in the capsule was also blocked due to over-pressure. The coffee extraction was not possible.



Pressure [bar] Flow [ml/s]

Calculations and Data Explanation:

Coffee extraction yield:

The extraction yield is calculated by the relation:

$$\text{Yield } (\%) = M_e \text{ x } Tc/M_s$$

where M_e represents the wight of the coffee extract, Ms represents the weight of ground coffee contained in the capsule and T_c represents the percentage of total coffee solids in the coffee extract obtained after oven drying of the coffee extract. It is representative of the degree of coffee extraction.

TC:

The coffee total solids (TC) is defined as the weight of extracted solids contained in the extract divided by the total weight of the extract. This value is expressed in percentage and is representative of the coffee strength.

Pressure:

The pressure is the pressure of water as measured upstream the centrifugal extraction unit.

Flow rate:
The flow rate is the flow rate of water measured by a flow meter placed upstream the centrifugal extraction unit.