

COFFEE CONTAINER FOR BEVERAGE PREPARATION AND METHOD OF MANUFACTURING A COFFEE CONTAINER

5 **Field of the invention**

The present invention relates to an optimized coffee container such as a capsule or pod containing coffee ingredients in a specific compacted form and a manufacturing
10 process of such container. The coffee container is designed for being extracted in a beverage preparation device for preparing a coffee beverage.

Background of the invention

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Coffee containers for being used in conjunction with a beverage preparation device are well known and widely available on the market. Thereby, such containers are usually designed for being injected with a heated, pressurized liquid
20 in order to prepare a beverage upon interaction of beverage ingredients within the container with the provided liquid. Such interaction may take place upon dissolution and/or extraction of the provided beverage ingredients under liquid contact. The containers usually comprise a pre-defined
25 amount of ingredients for preparing a single-serve beverage portion.

The coffee containers of the known beverage preparation systems usually comprise a single container size compatible
30 with a particular beverage preparation device of the system. This leads however to disadvantages when preparing different beverages such as short or long cups, i.e. an espresso-type beverage and a lungo-type beverage, the latter ideally requiring a larger amount of injected liquid and a larger
35 amount of coffee ingredients within the container compared

to the first one. A compromise then has to be found when providing coffee ingredients for preparing different types of beverages within the same container size respectively the same available volume for the ingredients in the container.

5 In particular, either a smaller amount of coffee ingredients such as 5 to 6 grams is provided in order to optimize the provided beverage ingredients for the preparation of an espresso-type beverage, but obtain a comparatively weaker lungo-beverage, or a larger amount of coffee ingredients is
10 provided in order to optimize the beverage result for the lungo-beverage, but waste coffee ingredients when preparing an espresso-type beverage with the same container in the given beverage preparation system.

15 In addition, different beverage types such as espresso and lungo beverages also have different ideal requirements regarding the applied beverage preparation process inter alia with regards to required extraction pressure, the liquid contact time respectively the extraction time, the
20 extraction yield and the resulting beverage crema. The known beverage containers of unitary size do however not address these different requirements. This also applies for known containers for the same beverage preparation system which have different amounts of beverage ingredients provided
25 within an otherwise unitary container volume.

The present invention seeks to address the above-described problems. The invention also aims at other objects and particularly the solution of other problems as will appear
30 in the rest of the present description.

Object and Summary of the invention

In a first aspect, the invention relates to a method of
35 manufacturing a coffee container for preparing a coffee

beverage upon injection of liquid such as water into the container, the method comprising the steps of:

- selecting and providing container wall means for enclosing a predefined container volume,

- 5 - compacting an amount of bulk coffee material such as roast and ground coffee particles to a coffee tablet under predefined compaction force in the container volume between the container wall means, wherein the applied compaction force is set based on at least the provided container volume
- 10 and/or on a particular type of beverage to be prepared from the resulting container type respectively the resulting container volume, and wherein the applied compaction force is set to a value between 0.5kN and 15kN, most preferably between 1 and 10kN.

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According to the invention, the compaction force for the coffee material provided in the respective container volume is specifically adapted to a predefined value in order to optimize the beverage preparation parameters for the particular container or container type respectively for the beverage intended to be prepared from this particular container. This is due to the fact that the compaction force onto the bulk coffee material respectively a resulting compaction rate of the coffee material in the manufactured container strongly influences the beverage process parameters when injecting liquid into the container by means of a known beverage preparation device or system. In particular, the obtained extraction pressure, the obtained flow time, the extraction yield and/or the obtained crema are influenced based on the applied different compaction force. As these process parameters may however be suitably influenced by the adjustment of the compaction force for different containers, an optimized beverage result may be obtained with the produced beverage container for different beverage types such as in particular short beverages, e.g.

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espresso or ristretto type coffee beverage, and long beverages, e.g. a lungo type coffee beverage. For example, a high pressure and a stiff crema may be obtained for an espresso type beverage contained in a respectively smaller container volume, whereas for a lungo type coffee beverage contained in a respectively larger container volume overextraction notes may be avoided.

In a preferred embodiment, the applied compaction force onto the bulk coffee material is set also based on the granulometry of the provided bulk coffee material and/or on the roasting degree of the bulk coffee material. Accordingly, the resulting beverage process parameters during beverage preparation by means of the container can be further optimized.

The granulometry of the bulk coffee material preferably lies between 150 to 800 μ m, more preferably between 150 and 600 μ m.

The roasting value or degree of the bulk coffee material is preferably between 50 and 120 CTN. Thereby, the term "CTN" refers to empirical unit that characterizes the intensity of monochromatic light that is reflected by a sample of roasted and grounded coffee when measured with a spectrophotometer such as Color Test II of Neuhaus Neotec. For example, a lower CTN value of e.g. about 45 relates to a dark roasted coffee, while a higher CTN of e.g. about 150 relates to an extremely light roasted coffee.

The applied compaction force may be set dependent on the particular container volume, the granulometry, the roasting degree and/or the weight of coffee material provided in the volume. Thereby, the compaction force is preferably set according to predefined values that have been found to

provide for optimized beverage parameters with a given beverage preparation device or system.

The applied compaction force is preferably set lower for a small particle size and set higher for a larger particle size.

The applied compaction force may be set relatively lower for a smaller container volume respectively a lower amount of coffee material enclosed in the container volume and set relatively higher for a larger container volume respectively a larger amount of coffee material enclosed in the container volume.

The different selectable container wall means are preferably designed for forming alternative types of containers such as at least a first and a second predefined container type for preparing a short and a long coffee beverage, and optional at least a third predefined container type for preparing a medium size coffee beverage.

The weight of the coffee material enclosed in the respective container volume is preferably comprised between 4 to 15grams, preferably between 5.5 to 12 grams.

The coffee material provided in the container is preferably designed for reconstituting a single-serve portion of beverage upon interaction with liquid such as water provided to the capsule. The coffee material is preferably roast and ground coffee particles designed for preparing a coffee beverage such as a ristretto, espresso or lungo coffee beverage.

In a preferred embodiment, the volume for a container intended for preparing a short coffee beverage is between

5ml and 15ml, more preferably between 9ml and 11ml. The volume for a container intended for preparing a long coffee beverage is preferably between 15ml and 50ml, more preferably between 16ml and 20ml, and wherein the volume for a container
5 intended for preparing a medium size coffee beverage is preferably between 13ml and 16ml.

For the sake of clarity, it shall be considered that the volume of coffee beverage prepared from a pod, that is
10 dispensed into the cup is as follows: for "short coffee beverage", a volume in the cup comprised between 15ml and 50ml, for "medium size coffee beverage", a volume in the cup comprised between 51ml and 150ml, and for "long coffee beverage", a volume in the cup comprised between 151ml and
15 1 liter.

In a preferred embodiment, the compaction force for a container volume designed for preparing a short coffee beverage is set to a value between 0.5kN and 10kN, more
20 preferred between 1kN and 2.5kN. For a container volume designed for preparing a long coffee beverage the compaction force is preferably set to a value of between 0.5kN and 15kN, more preferred between 2kN and 5kN. For a container volume designed for preparing a medium size coffee beverage the
25 compaction force is preferably set to a value between 1kN and 7kN.

In a particular preferred embodiment, the compaction force for a container volume designed for preparing a short coffee
30 beverage is set to a value between 1 to 2.5kN with a granulometry of the bulk coffee material between 200 and 300 μ m, more preferably of about 250 μ m.

In a particular preferred embodiment, the compaction force
35 for a container volume designed for preparing a long coffee

beverage is set to a value between 2.5 to 3.5kN with a granulometry of the bulk coffee material between 300 and 400 μ m, more preferably of about 350 μ m.

- 5 It is noted that in the above-described preferred embodiments a relatively smaller container volume is intended for preparing a short beverage such as espresso coffee and that a relatively larger container volume is intended for preparing a long beverage such as a lungo type coffee. The
10 required compaction force is then set to a suitable value in order to optimize the result of the intended beverage preparation from the respective container.

In an alternative embodiment, it may however as well be
15 applicable that a larger container volume is provided and which is designed for preparing a highly intense espresso and thus a short beverage. In this case and in line with the invention, the provided compaction force is set based on the intended type of beverage to be prepared from the particular
20 container, whereby the compaction force will be set relatively lower compared to other embodiments in which the larger container volume is intended for preparing a long coffee beverage. In another preferred alternative embodiment, a larger container volume may be provided for
25 preparing an Americano coffee beverage, in which it is aimed at extracting a large quantity of solids in a short extraction. Hereby, coffee material of relatively fine granulometry such as between 200 and 300 μ m is provided at a relatively low compaction force usually applied for smaller
30 container volumes respectively for containers for preparing a short beverage.

The container wall means preferably comprise a first and a second enclosing sheet. The first and second enclosing sheet
35 are preferably made from an at least partially deformable

material. The container wall means are preferably made from a material comprised within the list of mono- or multi-layer film comprising paper or similar cellulosic material, polyethylene (PE), polypropylene (PP), polyethylene-
5 terephthalate (PET), a starch-based material, polylactic acid (PLA), and/or aluminium. The container wall means preferably comprise barrier means against oxygen and/or moisture.

At least the first and/or second container wall means
10 respectively the first and/or second enclosing sheet may vary in its size or diameter in order to provide for different container volumes to be enclosed between the respective container walls. The container wall means are preferably of essentially circular shape.

15 The method preferably further comprises the step of sealingly connecting the first and second enclosing sheet constituting the container wall means about a circumference of the enclosed amount of coffee material respectively about the
20 enclosed coffee tablet under formation of a circumferential flange-like rim portion of the container.

In a preferred embodiment, a first and second enclosing sheets are selected dependent on a desired volume of the
25 resulting container type and/or on the particular type of beverage to be prepared from the resulting container. Then, in a next step the first enclosing sheet is preferably provided in a dedicated recess, matrix, mould or die of a suitable manufacturing device. In a next step, a predefined
30 amount of bulk coffee material is provided to an upper surface of the first enclosing sheet. The bulk coffee material is then compacted to a compacted coffee tablet by means of a compaction press or other suitably compaction means under a predefined compaction force against the
35 provided recess, matrix, mould or die of the device and based

on at least the selected container volume. In a further step, the second enclosing sheet is then sealingly connected to the first enclosing sheet, e.g. by means of a gluing or welding technique. Thereby, the compacted coffee tablet is preferably enclosed in such a manner that the complete inner container volume is filled with the coffee tablet. Accordingly, preferably no free space, i.e. which is not filled by the coffee tablet, is available in the resulting container. Further, the enclosing of the compacted coffee tablet within the first and second sheets preferably does not further alter a compaction rate of the coffee tablet in the container.

Instead of one, two or more compacted coffee tablets may be formed in accordance with the above described compaction process and provided and enclosed within the same container. The two coffee tablets may be formed under different predefined compaction force. Also, in such embodiment, the coffee tablet preferably completely fills the container volume.

In a further aspect, the invention relates to a container obtainable by the method as described hereabove. Further features of the container according to the invention are described hereunder. Notably, the description of the features of the container below are applicable also to the manufacturing process as described above and vice versa.

A coffee container for preparing a coffee beverage upon injection of liquid into the container according to the invention comprises container wall means enclosing a predefined volume of between 5ml to 50ml filled with compacted coffee material such as roast and ground coffee particles, wherein the coffee material is present in a form

compacted under a compaction force of 0.5 to 15kN, preferably of 1kN to 10kN.

5 The container wall means are made of a sheet material as described above with regards to the method according to the invention. The container wall means are preferably sealingly connected about a circumference of the enclosed compacted coffee material under formation of a circumferential flange-like rim portion. Thereby, a first sheet of material forms
10 an inlet face of the container and a second sheet of material forms an outlet face of the container. The container wall means are preferably designed for being piercable or otherwise openable by means of dedicated opening means of a beverage preparation device.

15 The container is preferably rotational symmetric about a central axis that is preferably substantially parallel to an intended direction of the circulation of liquid through the compacted coffee material.

20 The height of the container is preferably comprised between 5 mm and 30 mm, preferably between 10 mm and 22 mm. A diameter of the container is preferably comprised between 30-70mm, preferably between 35mm to 55mm.

25 In a particular preferred embodiment of the invention, the container comprises a volume of between 5ml and 15ml, preferably between 9ml and 11ml and the coffee material is present within said volume at a compaction rate of between
30 40 to 65%, preferably between 49-59%. Such container is preferably designed for preparing a short cup, i.e. a ristretto or espresso type coffee beverage.

The compaction rate T of the compacted coffee respectively
35 the compacted coffee tablet enclosed in the container is

defined as the ratio of the apparent density d_a to the real density d_v of the compacted coffee tablet ($T = (d_a/d_v) * 100$), see also calculation with respect to Example 1 described further below. Notably, the compaction rate does
5 not only depend on the compaction force of the enclosed coffee material, but also on further parameters such as in particular the coffee particle size, the roasting degree and the density of the coffee particles in the container volume.

10 In another preferred embodiment of the invention, the container comprises a volume of between 15ml and 50ml, preferably between 16ml and 20ml, and the coffee material is present within said volume at a compaction rate of between 35-60%, preferably between 39-49%. Such container is
15 preferably designed for preparing a long cup, i.e. a lungo type coffee beverage.

In yet a further aspect, the invention relates to a kit of coffee containers comprising at least two, preferably three
20 and more preferably at least 5 containers as described above respectively as obtainable by means of the described manufacturing method, wherein the respective containers differ in their container volume enclosed by the respective container wall means and/or in a particular type of beverage
25 to be prepared from the respective containers, and wherein the coffee material in the respective containers is present in a form compacted under a different compaction force respectively present in a different compaction rate.

30 The respective containers of the kit according to the invention preferably differ in their height but comprise an equal outer diameter.

In a preferred embodiment, the kit comprises a first
35 container having a container volume of between 5ml and 15ml,

preferably between 9ml and 11ml, for preparing a short coffee beverage, a second container having a container volume of between 15ml and 50ml, preferably between 16ml and 20ml, for preparing a long coffee beverage, and optionally a third
5 container having a container volume of between 13ml and 16ml for preparing a medium size coffee beverage.

Preferably, the compaction force for the coffee material in the container volume designed for preparing a short coffee
10 beverage lies between 0.5kN and 10kN, more preferred between 1 and 2.5kN. The compaction force for the coffee material in the container volume designed for preparing a long coffee beverage preferably lies between 0.5kN and 15kN, more preferred between 2.5kN and 5kN. The compaction force for
15 the coffee material designed for preparing a medium size coffee beverage preferably lies between 1kN and 7kN.

The different containers of the kit preferably comprise coffee material of different granulometry, preferably
20 between 100 to 800 μ m, more preferred between 150 and 600 μ m. and/or of different roasting degree, preferably between 50 and 120CTN. A relatively smaller particle size and thus finer granulometry is preferably provided for bulk coffee material in a container designed for preparing a short beverage,
25 whereas a relatively larger particle size and thus coarser granulometry is preferably provided for bulk coffee material in a container designed for preparing a larger beverage.

The invention further relates to the use of a coffee
30 container as described hereabove and/or as obtainable by the method according to the invention for preparing a coffee beverage.

Brief description of the drawings

Further features, advantages and objects of the present invention will become apparent for a skilled person when
5 reading the following detailed description of embodiments of the present invention and when taken in conjunction with the figures of the enclosed drawings.

10 Fig. 1 shows preferred embodiments of containers with different volumes and/or designed for preparing different types of beverages according to the invention.

15 Fig. 2 shows alternative embodiments of containers with different volumes and/or designed for preparing different types of beverages according to the invention.

20 Fig. 3 shows a schematic flow diagram for a manufacturing process of a container in line with the invention.

25 Fig. 4 relates to measurement results for different containers comprising different applied compaction forces and showing the resulting flow time during injection into such containers dependent on the granulometry of the coffee material in the container.

30 Fig. 5 relates to measurement results for different containers comprising different applied compaction forces and showing the resulting yield of the extracted coffee beverage dependent on the granulometry of the coffee material in the
35 container.

Detailed description of the figures

Fig. 1 and 2 relate to preferred embodiments of containers
5 with different volumes according to the invention and which
are preferably designed for preparing different types of
beverages. Thereby, fig. 1a to 1d relate to a first set or
kit of containers 1a-1d. The containers 1a to 1d in Fig. 1a
to 1d each comprise container wall means 2 and wall means
10 3a, 3b, 3c, 3d respectively, which are connected at their
circumference under formation of a flange-like rim portion
4.

The container wall means 2, 3a-3d are preferably formed of an
15 at least partially deformable material sheet which is
preferably of circular shape. The container wall means
enclose a predefined volume and are made of a sheet material
comprised within the list of mono- or multi-layer film
comprising paper or similar cellulosic material,
20 polyethylene (PE), polypropylene (PP), polyethylene-
terephthalate (PET), a starch-based material, polylactic acid
(PLA), and/or aluminium.

The containers differ in their respective sizes and thus in
25 the respective volume enclosed therein. Thereby, all of the
containers 1a-1d are preferably formed of the same first
material sheet 2 of essentially convex form and uniform
height h1, and a suitable second material sheet 3a, 3b, 3c, 3d
of essentially convex form but of differing size respectively
30 providing a different resulting height h1, h2, h3, h4. The
container 1a is preferably symmetric about a central plane
in which the flange-like rim 4 is arranged.

The first and second material sheet 2 respectively
35 3a, 3b, 3c, 3d preferably comprise a centrally arranged

essentially planar portion 5,6. The first material sheet 2 is preferably designed for providing an outlet face of the container in a dedicated beverage preparation device, while the second material sheet 3a,3b,3c,3d is designed for providing an inlet face of the container in a dedicated beverage preparation device.

The overall height of the container 1a-1d is preferably comprised between 5 mm and 30 mm, more preferably between 10 mm and 22 mm. A diameter d2 of the respective container is preferably comprised between 30-70mm, more preferably between 35mm to 55mm. An inner diameter d1 of the respective container is preferably comprised between 20-60mm, more preferably between 30 to 50mm.

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The different containers preferably comprise a compacted coffee tablet in the container volume, which has been compacted during a manufacturing process of the container with a force between 0.5 and 15kN, more preferably between 0.1kN and 10kN.

The compacted coffee tablet is preferably completely filling the inner volume of the container. The coffee material within the container volume preferably comprises a granulometry of between 150 to 600 μ m. The coffee material enclosed in the respective container is preferably of a roasting value of between 50 and 120CTN.

The different containers as shown in fig. 1a-1d preferably differ at least in the weight of the coffee material enclosed in the provided volume, in the granulometry of the enclosed coffee material and in the applied compaction force during manufacturing of the container when forming the compacted coffee tablet. The different containers may as well differ in the roasting value of the coffee material. Optionally,

also different coffee material respectively different blends of coffee material may be present in the respective containers. A preferred example for the above-indicated different parameters of the respective containers in fig. 5 1a-1d is shown in table 1 below.

	1A	1B	1C	1D
Volume (ml)	10.53	13.55	18.05	20.8
Coffee weight (g)	5.5	7	8.5	10
Granulometry (D [4,3] - μm)	210	300	350	420
Compaction force (N)	1500	2500	2500	3000
Final in-cup beverage volume (ml)	40	110	200	350
Coffee blend	50% Brazil WA 30% Ivory Coast R 20% Papupa New Guinea	100% Colombia WA	40% Brazil UWA 30% Tanzania WA 30% Guatemala WA	60% Colombia WA 40% Mexico WA
Roasting colour (CTN)	70	85	80	75

Table 1

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By means of adapting the respective compaction force applied when manufacturing the container based on at least the provided volume of the container for providing a particular beverage type and/or the granulometry of the contained 15 ingredients, the beverage result for a particular container can be optimized for the intended purpose.

For example, an optimized result for a short cup, i.e. a ristretto or espresso type coffee beverage may be obtained 20 with the container of example 1A. Thereby, the fine grind enables the acceleration of solids extraction in order to provide an intense cup. Further, a relatively lower

compaction force leads to an increased yield during beverage preparation.

5 An optimized medium size beverage may be obtained by the containers of example 1B and 1C. Thereby, an intermediate particle size and moderate compaction force ensure a smooth extraction over the complete extraction time in order to obtain a balanced medium coffee beverage.

10 An optimized long cup, i.e. a lungo type coffee beverage, may be obtained by the container of example 1D. Thereby, a large particle size in combination with a relatively higher compaction force will avoid over-extraction for a very large serving while avoiding undesired off-notes.

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The adaption of the compaction force based on the provided granulometry, the roasting value and/or the particular coffee blend and weight enables a further optimization of the obtained beverage result.

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Fig. 2a-2c relate to alternative embodiments of a dedicated container respectively a kit comprising different containers 1e,1f,1g, which differ in the respective container volume.

25 By contrast to the embodiment in fig. 1 the respective containers 1e,1f,1g comprise a first essentially planar material sheet 2a and different essentially convex shaped material sheets 3e,3f,3g. The latter are preferably of different size such that the resulting container comprise
30 different heights h_5, h_6, h_7 . An inner and outer diameter of these containers d_3, d_4 is preferably constant. The inner and outer diameter preferably corresponds to the respective diameters d_1, d_2 of the containers according to Fig. 1a-1d. The height of the containers is preferably in the ranges as
35 indicated above with respect to fig. 1.

As explained with respect to the containers of Fig. 1a-1d, the containers of Fig. 2a-2c differ at least in the applied compaction force of the coffee tablet provided in the container. The containers may additionally differ in the nature and weight of the coffee material enclosed in the provided volume, in the granulometry of the enclosed coffee material, and/or in the roasting value of the coffee material.

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Fig. 3 relates to a schematic representation of a preferred embodiment of a manufacturing process for forming the container according to the invention.

15 In the manufacturing process, a first step (not shown) relates to selecting a first and second enclosing sheets such as e.g. sheets 2 and one of sheets 3a-3d of fig. 1 based on a desired volume of the resulting container respectively based on the beverage intended to be prepared by means of the resulting container. This first step preferably further comprises a determination and/or selection of the nature and weight of the coffee material enclosed in the provided volume, a selection of the granulometry of the coffee material, a selection of the roasting degree of the coffee material. Further, the compaction force to be applied during the manufacturing process is determined and set based on at least the selected container volume and/or based on the beverage intended to be prepared by means of the resulting container.

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Then in a following step 7, the first enclosing sheet constituting e.g. a bottom foil of the container is formed and provided in a dedicated recess, die or mould of a suitable manufacturing device.

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In a subsequent step 8, a predefined amount of a particular roast and ground coffee bulk material of predefined granulometry is provided on a surface of the first enclosing sheet.

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In the next step 9, compaction of the coffee bulk material takes place under the set compaction force in order to compress the bulk material into a coffee tablet based on the intended container volume. This is obtained e.g. by means of a known compaction press which is pressed against the recess, die or mould in which the first enclosing sheet and the coffee bulk material is present. The applied compaction force is measured by a force measuring device connected to the compaction press.

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In an alternative embodiment, the coffee bulk material is provided in a dedicated compaction press for being compacted under the predefined compaction force and the compacted coffee tablet is then provided onto the surface of the first enclosing sheet.

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In a further step 10, the second enclosing sheet, e.g. a top foil, is then sealingly connected to the first enclosed sheet, for example by means of a gluing or welding technique.

Thereby, the compacted coffee tablet is preferably enclosed in such a manner that the complete inner container volume is filled with the coffee tablet. Accordingly, preferably no free space, i.e. which is not filled by the coffee tablet, is available in the resulting container.

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Example 1 - container for short cup

In the following, a preferred example for a container according to the invention is described, the container comprising a volume of 9.42 cm³ filled with coffee material

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of between 5.41 and 5.81g and designed for preparing a short cup such as a ristretto or espresso type coffee beverage. The coffee material is preferably present in a granulometry of between 250 and 350 μm [D(4,3)]. The roasting degree lies
5 between 70 and 80.

The compaction rate of the coffee material in the container lies between 40%-65%, preferably between 49-59%. This corresponds to an applied compaction force during the
10 manufacturing process of between 1kN and 2.5kN. It is noted that the compaction rate of the coffee material in the final container does not necessarily correlate with the compaction force applied during the manufacturing process of the container, as the compaction rate not only depends on the
15 compaction force but also on further parameters such as in particular the coffee particle size, the roasting degree and the density of the coffee particles in the container volume.

The above indicated compaction rate for the coffee tablet in
20 the container is measured as follows. Notably, for compacting the coffee tablet a known hydraulic compaction press may be used which comprises a fixed upper punch member or die and a fixed lower punch member or die with a spring-loaded rod.

25 A real density value d_v of the uncompressed bulk coffee material may be obtained by means of a helium pycnometer, e.g. an Ultrapycnometer 1000 of Quantachrome according to the following method.

30 The working principle of this measurement is to inject a gas such as helium with a given pressure into a reference chamber, then to expand this gas in the measuring chamber containing the sample by measuring the new gas pressure in this chamber. This method is particularly suitable for

measuring the volumes and densities of divided or porous solids, as the gas penetrates into the cavities.

Hence, in order to obtain the real density value d_v , the product to be analyzed is weighed in a cell. The cell is then placed in the measuring chamber of the pycnometer. The measuring chamber is then closed, and the measurement is started. At the end of the measurement the real density value of the analyzed product is obtained.

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An apparent density d_a of the compacted coffee tablet may be obtained based on the formula:

$$d_a = m/V = m/(S \cdot h),$$

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in which:

m is the product mass of the compacted solid coffee tablet in grams

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V is the volume of the compacted solid coffee tablet in cm^3 ,

S is the surface of the solid compacted coffee tablet in cm^2

h is the height of the solid compacted coffee tablet in cm measured e.g. with a caliper after ejecting the compacted coffee tablet from the press die used for compaction

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Based on the above-indicated apparent density value d_a and real density value d_v , the compaction rate of the coffee tablet enclosed in the container can be determined based on the following formula:

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$$T = (d_a/d_v) \cdot 100.$$

Exemplary measurement results for the compaction rate of a container according to Example 1 are shown in table 2 below.

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Compaction Rate Measurement					
Trial	R&G coffee weight (g)	Container volume (cm ³)	Apparent density (g.cm ³)	Real density (Pycnometer) (g.cm ³)	Compaction Rate (%)
1	5.81	9.42	0.62	1.09	56.4
2	5.75	9.42	0.61	1.05	58.4
3	5.62	9.42	0.60	1.20	49.6
4	5.41	9.42	0.57	0.99	57.8

Table 2

5 Example 2 - container for long cups

This example relates to another preferred container comprising a volume of 16.6 cm³ filled with coffee material of between 7.80 and 8.10g and designed for preparing a long cup such as a lungo type coffee beverage.

The coffee material is preferably present in a granulometry of between 300 and 650 μm [D(4,3)]. The roasting degree lies between 80 and 90. The present compaction rate for this container lies between 35-60%, preferably between 39-49%.

Compaction Rate Measurement					
Trial	R&G coffee weight (g)	Container volume (cm ³)	Apparent density (g.cm ³)	Real density (Pycnometer) (g.cm ³)	Compaction Rate (%)
1	8.10	16.6	0.49	1.229	39.70
2	7.80	16.6	0.47	1.071	43.87
3	8.00	16.6	0.48	1.181	40.80

Table 3

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The measurements of the trials for this example as indicated in the table above were obtained by means of the method as indicated above for example 1.

Fig. 4 relates to measurement results for different containers comprising different applied compaction forces and showing the resulting flow time during injection into such containers dependent on the granulometry of the coffee material in the container.

As can be seen from the graph in fig. 4, for higher compaction forces such as 10kN to 5kN (see curves 12a-12c) the flow time relatively decreases faster with larger particle size compared to lower compaction forces such as 2.5kN to 1 kN (see curves 12d and 12e). Thus, a smaller particle size has a higher impact on flow time increase at higher compaction forces compared to a bigger particles size. Therefore, the applied compaction force is preferably set relatively lower for a small particle size compared to a larger particle size.

Fig. 5 relates to measurement results for different containers comprising different applied compaction forces and showing the resulting yield of the extracted coffee beverage dependent on the granulometry of the coffee material in the container. Thereby, the yield for extracting a coffee beverage from the resulting container should ideally be above a value of 24% and preferably below 26%.

As can be seen in the graph in fig. 5, the yield of the resulting coffee beverage decreases with increase in the granulometry of the used bulk coffee material. Further, the yield generally decreases with lower compaction forces (see curve 15a relating to a relatively higher compaction force of 10kN to curve 15e relating to a relatively lower compaction force of 1kN). Thereby, the relative decrease in yield with lower compaction force appears relatively constant over the whole particle range.

Based on the graphs described in fig. 5 and 6, a particular preferred embodiment of the invention provides a container for preparing a short coffee beverage, wherein an optimized yield (24-26%) is reached with a reasonable flow time
5 (<40seconds for 40ml) at a compaction force of between 1 and 2.5kN with a granulometry of between 200 and 300 μm , more preferably of about 250 μm .

It should be understood that various changes and
10 modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the present invention and without diminishing its attendant advantages.

Claims

1. A method of manufacturing a coffee container (1a-1g) for
5 preparing a coffee beverage upon injection of liquid
into the container, the method comprising the steps of:
 - selecting and providing container wall means
(2,2a,3a-3g) for enclosing a predefined container
volume,
 - 10 - compacting an amount of bulk coffee material such as
roast and ground coffee particles to a coffee tablet
under predefined compaction force in the container
volume between the container wall means (2,2a,3a-
3g),
 - 15 - wherein the applied compaction force is set based on
at least the provided container volume and/or on a
particular type of beverage to be prepared from the
provided container,
 - wherein the applied compaction force is set to a
20 value between 0.5 to 15kN, preferably between 1kN
and 10kN.
2. The method according to claim 1,
wherein the applied compaction force is set based
25 also on the granulometry of the provided bulk coffee
material and/or on the roasting value of the bulk coffee
material.
3. The method according to any of the preceding claims,
30 wherein a granulometry of the bulk coffee material
lies between 150 to 600 μm and/or wherein the roasting
value of the bulk coffee material lies between 50 and
120 CTN.
- 35 4. The method according to any of the preceding claims,

wherein the applied compaction force is set lower for a small particle size and set higher for a larger particle size of the bulk coffee material.

- 5 5. The method according to any of the preceding claims,
wherein the method comprises the step of sealingly connecting a first and second enclosing sheet (2,2a,3a-3g) constituting the container wall means about a circumference of the enclosed amount of coffee material
10 under formation of a circumferential flange-like rim portion (4) of the container.
6. The method according to any of the preceding claims,
wherein the different selectable container wall
15 means (2,2a,3a-3g) are designed for forming alternative types of containers such as at least a first and a second predefined container type for preparing a short and a long coffee beverage, and optionally at least a third predefined container type for preparing a medium size
20 coffee beverage.
7. The method according to claim 6,
wherein the container type for preparing a short coffee beverage has a volume of between 5ml and 15ml,
25 preferably between 9ml and 11ml, the container type for preparing a long coffee beverage has a volume of between 15ml and 50ml, preferably between 16ml and 20ml, and wherein the container type for preparing a medium size coffee beverage has a volume of between 13ml and 16ml.
30
8. The method according to claim 6 or 7,
wherein the compaction force for a container type designed for preparing a short coffee beverage is set to a value between 0.5kN and 5kN, for a container type
35 designed for preparing a long coffee beverage is set to

a value between 0.5kN and 15kN, and for a container type designed for preparing a medium size coffee beverage is set to a value between 1kN and 7kN.

- 5 9. A coffee container (1a-1g) for preparing a coffee beverage upon injection of liquid into the container,
the coffee container comprising container wall means (2,2a,3a-3g) enclosing a predefined volume of between
10 5ml to 50ml filled with compacted coffee material such as roast and ground coffee particles,
wherein the coffee material is present in a form compacted under a compaction force of 0.5 to 15kN, preferably of 1kN to 10kN.
- 15 10. The coffee container according to claim 9,
wherein the height of the container is comprised between 5 mm and 30 mm, preferably between 10 mm and 22 mm, and the diameter of the container is comprised between 30-70mm, preferably between 35mm to 55mm.
- 20 11. A kit of coffee containers (1a-1g) comprising at least two, preferably three containers according to any of claims 9 or 10,
wherein the respective containers differ in a volume
25 enclosed by the container wall means and/or in a particular type of beverage to be prepared from the respective containers, and wherein the coffee material in the respective containers is present in a form compacted under a different compaction force.
- 30 12. The kit according to claim 11,
wherein the respective containers differ in their height but comprise an equal outer diameter.
- 35 13. The kit according to claim 11 or 12,

wherein the kit comprises a first container having a container volume of between 5ml and 15ml, preferably between 9ml and 11ml, for preparing a short coffee beverage, a second container having a container volume of
5 between 15ml and 50ml, preferably between 16ml and 20ml, for preparing a long coffee beverage, and optionally a third container having a container volume of between 13ml and 16ml for preparing a medium size coffee beverage.

10 14. The kit according to any of claims 11 to 13,
wherein the compaction force for the coffee material in the container designed for preparing a short coffee beverage lies between 0.5kN and 10kN, for a container designed for preparing a long coffee beverage lies
15 between 0.5kN and 15kN, and for a container designed for preparing a medium size coffee beverage lies between 1kN and 7kN.

15. The kit according to any of claims 11 to 14,
20 wherein the different containers of the kit comprise coffee material of different granulometry, preferably between 150 to 600 μm and/or of different roasting value, preferably between 50 and 120CTN.

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