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(54) **IMPROVED METHOD OF MANUFACTURING CONTAINER CANDLES AND TEALIGHTS**

- (57) A method for manufacturing container candles and tealights, comprising the steps of: (i) providing one or more liquid fuel components, the one or more liquid fuel components having a first viscosity; (ii) cooling the liquid fuel components, increasing the viscosity of the
- one or more liquid fuel components to a second viscosity; (iii) filling the liquid fuel components into a receptacle; and (iv) cooling the liquid fuel components in the receptacle to form a candle; wherein the ratio between the second viscosity and the first viscosity is at least 1.2.

Description

TECHNICAL FIELD

[0001] The invention relates to an improved method for manufacturing container candles and tealights.

PRIOR ART

[0002] The traditional production of poured candles, in containers or tealights, has an intrinsic number of drawbacks. For example, the candles must be filled very hot, with the cooling time being very long. This is even when they are actively cooled by an active cooling process, such as fans or an active cooling chamber. In addition, the (rapid) crystallization gives rise to shrinkage behavior and visual defects. Therefore, after the solidification of the first layer, a second layer is applied to cancel out these effects. This layer ensures that the total cooling and production process is very long. The cooling rate also determines the crystallization behavior and thus the appearance of the candle. For example, candles produced in summer will react differently than in winter. In addition, the heat contained in the fuel mixture (blend) is lost to the environment. This makes this type of production process not very sustainable.

[0003] In a second production method - slurry production process -, as described for example in US7846372, the candle is first cooled below the crystallization temperature, after which the containers are filled with a (limited) crystallization. This process has the advantage that the candles are cooled faster than the traditional production process as described above. They can also usually be filled in one layer. However, a major disadvantage of this process is the fact that the process is difficult to control and is less flexible regarding raw materials than a traditional liquid pouring process. Not every mixture (blend) can be filled via a slurry process. If the crystallization occurs quickly and to a large extent, the slurry will become too thick, causing visual and process problems. This occurs, for example, when paraffin, stearin or hydrogenated vegetable fats are present. Another disadvantage is that by pouring the slurry the visual appearance is different and that the amount that can be poured must be taken into account. In this case, for example, candles are usually poured, wherein a pressed or cast core is first applied around the wick, after which the rest of the glass is filled with slurry. Another disadvantage of the traditional slurry process is that it is much more difficult to mix in fragrance and color. Because part of the mixture has already crystallized out, the color will always be paler than with a cast candle according to the first process. The odor will also be difficult to capture. This is especially the case at higher odor concentrations.

[0004] US7128766 discloses a traditional method of candle making in which hot wax is cooled to a certain pouring temperature, which is above the solidification temperature of the wax. Here, the solidification temper-

ature is determined by testing a sample of the wax used according to ASTM D-938, after which the pouring temperature is selected with a margin. Disadvantages are associated with this method, such as: the pouring temperature is always much higher than the solidification temperature due to the margin taken, the addition of additives, such as migration inhibitors, is limited as they can influence the solidification temperature, the sample must always be representative of the wax, and the testing must be performed for each wax prior to performing the method, making for a very inefficient production method. In addition, the method is only applicable to triacylglycerol based wax.

[0005] There is a need for an improved method of manufacturing container candles and tealights.

[0006] The present invention aims to find a solution for at least some of the above problems.

SUMMARY OF THE INVENTION

[0007] The invention relates to an improved method for manufacturing container candles and tealights according to claim 1. Preferred forms of the method are set out in claims 2 up to and including 8.

[0008] In a second aspect, the invention relates to a device for manufacturing container candles and tealights according to claim 9. Preferred forms of the invention are set forth in claims 10 up to and including 11.

[0009] The improved method in devices allows container candles and tealights to be manufactured in a more efficient manner than is traditionally done. By first cooling and then filling instead of the other way around, a lot of advantages can be identified. The method described uses a viscosity measurement to determine the exact point of adding the candle mixture to the receptacle. Filling takes place in a device built for this purpose. This way of working ensures that the liquid is still sufficiently liquid when it is filled, after which it enters the container (receptacle) and quickly crystallizes. Due to the rapid way of crystallization, the cooling process is shortened and visual effects such as post-crystallization are also suppressed. As a result, many more samples can be filled on the same dimensions of the cooling line and production efficiency can increase dramatically. The total cooling process is short with less post-crystallization occurring. This also reduces or avoids visual defects.

[0010] The method has the advantage that a very rapid cooling of the mixture can be realized with minimal heating through crystallization. In addition, there is minimal shrinkage of the mixture as a result of the improved method.

[0011] The method also allows a very great flexibility of fuel components. Any candle blend (fuel mixture) can be poured according to the method of the present invention. For example, paraffin blends, paraffin wax blends, vegetable and animal wax blends and 100% natural blends with and without all necessary additives.

[0012] In addition, the method also reduces or avoids

the occurrence of polymorphism.

[0013] Another advantage of the method is that color and fragrance can be dosed without the problems associated with a slurry process. The color will be clear and not a paler "whiter pastel" like in a slurry process. The fragrance will be better absorbed compared to a slurry candle.

[0014] The containers are also filled in one layer, in contrast to the traditionally poured candles, which are always filled in two layers with the visible transition between the two layers.

DETAILED DESCRIPTION

[0015] The invention relates to an improved method for manufacturing container candles and tealights.

[0016] Unless otherwise defined, all terms used in the description of the invention, including technical and scientific terms, have the meanings as commonly understood by those skilled in the art of the invention. For a better understanding of the description of the invention, the following terms are explained explicitly.

[0017] In this document, "a", "an" and "the" refer to both the singular and the plural, unless the context clearly presupposes otherwise. For example, "a segment" means one or more than one segment.

[0018] The terms "comprise", "comprising", "provided with", are synonyms and are inclusive or open-ended terms that indicate the presence of what follows, and which do not exclude or prevent the presence of other components, characteristics, elements, members, steps, as known from or disclosed in the prior art.

[0019] The terms "contain", "containing", "consist of", "consisting of", "include", "including" are synonyms and are exclusive or closed-ended terms indicating the presence of what follows, and which preclude or prevent the presence of other components, features, elements, members, steps known or described in the art.

[0020] Quoting numeric intervals by the endpoints includes all integers, fractions, and/or real numbers between the endpoints, including those endpoints.

[0021] In a first aspect, the invention relates to a method for manufacturing container candles and tealights.

[0022] In an embodiment, the method comprises the steps of:

- i. providing one or more liquid fuel components, the one or more liquid fuel components having a first viscosity;
- ii. cooling the liquid fuel components, wherein the viscosity of the one or more liquid fuel components to a second viscosity is increased;
- iii. filling the liquid fuel components into a receptacle; and
- iv. cooling the liquid fuel components in the receptacle; thereby forming a candle;

[0023] In a preferred embodiment, the ratio between

the second viscosity and the first viscosity is at least 1.2.

[0024] Without further specification, the term "viscosity" generally refers to dynamic viscosity. This is the resistance that a fluid offers to a shearing force, for example under the influence of moving objects. However, for this invention, the viscosity can be determined in any way possible as long as it clearly and correctly represents the viscosity jump as a function of the selected shear stress. Possible methods are capillary viscosity measurement, rotational viscosity measurement or vibrational viscosity measurement. The viscosity measurement can be done in accordance with NEN-EN-ISO 3104:2021 (ASTM D 445).

[0025] The term "fuel components" refers to components that are solid at room temperature suitable for processing into a candle, and thus forming the wax mass of the ultimately obtained candle. The fuel components have a melting point and a crystallization temperature. Solid fuel components become liquid above their melting point (melting temperature). Liquid fuel components crystallize (solidify) below their crystallization temperature.

[0026] In step (i) of the method, one or more liquid fuel components are provided with a first viscosity.

[0027] The method is applicable to all types of fuel components suitable for use in a candle, such as, for example, but not limited to, petrochemical waxes, paraffin, natural microwaxes, natural fuel components (animal and/or vegetable), or a combination thereof.

[0028] Examples of vegetable fuel components are stearin, palm oil, rapeseed oil, sunflower oil, shea butter, corn oil, coconut oil, soya bean oil or a combination thereof.

[0029] The term "paraffin", as used in the text, is intended to mean a mixture of crystalline linear alkanes having 17 to 57 carbon atoms and linear or branched chains, which are solid at room temperature and obtained from petroleum fractions and brown coal tar. The general molecular formula of such linear alkanes is $\text{CH}_3(\text{CH}_2)_n\text{CH}_3$.

[0030] In a preferred form, the fuel components are selected from the list of: petrochemical wax, natural wax, or a combination thereof. More specifically, the fuel components may be selected from the list of: paraffin, paraffin wax, vegetable wax, animal wax, or any combination thereof.

[0031] In the method, one fuel component or several fuel components may be provided as the basis for the candle. In an embodiment, the fuel components are provided in liquid form. In a preferred form, solid fuel components are heated to above the melting point of the fuel components, whereby liquid fuel components are obtained.

[0032] In the embodiment with multiple fuel components, each fuel component is liquefied by heating and then blended into a mixture of fuel components. Preferably, the fuel components are mixed into a homogeneous mixture, i.e. in a homogeneous mixture the components

are perfectly mixed and preferably indistinguishable from each other even at a microscopic level. This is necessary to obtain a uniformity in the wax mass of the ultimately obtained candle.

[0033] In an embodiment, microwaxes are also added to the mixture. These microwaxes aid in the subsequent crystallization process. They provide many crystallization nuclei and minimal crystal growth. This is ideal for a candle mixture, as the more crystals present, the softer the appearance of the candle.

[0034] The first viscosity is therefore the viscosity of the homogeneous mixture comprising fuel components provided in step (i).

[0035] Preferably, the fuel components are provided at a temperature between 60 and 70°C, more preferably at a temperature between 61 and 69°C, even more preferably at a temperature between 62 and 68°C, even more preferably at a temperature between 63 and 67°C, even more preferably at a temperature between 64 and 66°C.

[0036] The first viscosity is the viscosity measured at the temperature at which the fuel components are supplied and mixed.

[0037] In step (ii) the liquid molten fuel components are cooled, increasing the viscosity of the one or more liquid fuel components to a second viscosity.

[0038] When the second viscosity is reached, the liquid fuel components are filled into a receptacle. The second viscosity is preferably the viscosity at the filling temperature. The filling temperature is the temperature at which the filling in step (iii) takes place. The control based on the viscosity value therefore determines the filling temperature. The filling temperature will be such that the viscosity in this range is still low enough that the mixture is liquid when filled. The size of the receptacle determines the deviation relative to the viscosity jump. With a large receptacle it will be slightly larger than with a small receptacle. All this to obtain a homogeneous mixture and appearance. In an embodiment, the temperature difference amounts to 1-3°C.

[0039] According to an embodiment, the liquid molten fuel components are cooled to a filling temperature above the crystallization temperature of the fuel component or the crystallization temperature of the mixture of fuel components. The crystallization temperature of a liquid or a molten solid is the point (the temperature) at which crystallization occurs and it therefore shows solidification phenomena.

[0040] The filling temperature is above the crystallization temperature so that the fuel components can be filled while just in liquid form.

[0041] In a preferred form, the cooling of the liquid fuel components (step ii) takes place in a rotating cooling device, the fuel component or mixture of fuel components being cooled very homogeneously. The use of the cooling device ensures that the fuel component or mixture of fuel components cools very homogeneously without the formation of an excess of crystals. In an embodiment of this invention, the temperature can be selected with min-

imal crystal formation to accelerate crystallization after filling.

[0042] When referring to "mixture", it may comprise one or more fuel components.

[0043] In a preferred embodiment, the ratio between the second viscosity and the first viscosity is at least 1.2; preferably at least 1.3; more preferably at least 1.4; most preferably at least 1.5. Even more preferably at least 2, at least 3, at least 4, at least 5, at least 10 or even at least 20.

[0044] In a preferred embodiment, the viscosity of the liquid fuel components is measured during cooling (step ii), whereby a viscosity curve is obtained.

[0045] This way of working ensures that the liquid is still sufficiently liquid when it is filled, after which it enters the receptacle and quickly crystallizes. Due to the rapid way of crystallization, the cooling process is shortened and visual effects such as post-crystallization are also suppressed. As a result, many more samples can be filled on the same dimensions of the cooling line and production efficiency can increase dramatically.

[0046] The viscosity curve is the curve obtained when the measured viscosity is plotted as a function of falling temperature. In an embodiment, the viscosity is determined by means of a viscometer, preferably a rotary viscometer. The viscosity can be measured continuously from the mixing temperature or determined only in the crystallization transition zone via any other measurement, e.g. via a DSC analysis (Differential Scanning Calorimetry) or rotary crystallization point.

[0047] With this viscometer, a spindle rotates at a predetermined speed in the liquid to be measured. The force or torque in the shaft of the spindle is measured and converted to viscosity. With a rotary viscometer, the viscosity can be accurately determined during the cooling of the mixture.

[0048] The viscosity can be measured in-line or off-line. Preferably, the viscosity is measured in-line to compensate for fluctuations in the composition of the mixture and environment.

[0049] If the viscosity is measured off-line, a Brookfield viscometer can be used, which is preferably equipped with a thermostatic bath and a set of spindles (LV, RV or vane spindles) depending on the type of mixture. The mixture is slowly cooled liquid and the viscosity is measured. The plotted curve then determines the ideal point of filling. This can be used for any type of fuel component mixture. This temperature point is then used to control the industrial process and provides all the benefits described earlier.

[0050] If the viscosity is used in-line, any type of measurement can be used as long as the crystallization transition is clear. This involves measuring viscosity in the industrial process while the liquid mixture is cooled slowly. The plotted curve then also determines the ideal point of filling.

[0051] In an alternative embodiment, DSC (Differential Scanning Calorimetry) can be used to determine the

crystallization point. It can also alternatively be used to make a first estimate of the filling temperature.

[0052] In an embodiment of the method, the temperature is controlled to less than 5°C accuracy, preferably less than 4°C accuracy, more preferably less than 3°C accuracy, most preferably to less than 2°C accuracy. The method described here determines the point at which the mixture is filled. This point is in the low viscosity profile but just above the crystallization temperature. Optionally, a limited amount of crystals may be present to speed up the process.

[0053] In a preferred form, prior to cooling in step (ii), color components, fragrance components, or a combination thereof are added. In another or further preferred form, color components, fragrance components or a combination thereof are added just before filling in step (iii).

[0054] The color and fragrance components, as well as other additives such as migration inhibitors or crystallization enhancers, can be added at any time prior to filling, in contrast to known methods, because the viscosity is measured in real time. The influence that added substances have on the crystallization temperature (increase or decrease) will therefore be registered.

[0055] In an embodiment, crystallization enhancers are also added to the liquid fuel components. These help to reduce the crystal size during crystallization and thereby lower the enthalpy of solidification. As a result, the heat released during crystallization will be reduced, so less heat will be lost and a more sustainable process will be achieved.

[0056] In step (iii) liquid fuel components are filled into a receptacle when the second viscosity is reached. The filling is controlled by the viscosity measurement, the filling temperature being the point on the viscosity curve where the second viscosity is related to the first viscosity by a ratio of at least 1.2, preferably at least 1.3, more preferably at least 1.4, more preferably at least 1.5. Even more preferably at least 2, at least 3, at least 4, at least 5, at least 10 or even at least 20.

[0057] In a preferred form, the filling temperature depends on the mixture. In a preferred form, the filling temperature is lower than 65°C, preferably lower than 55°C, even more preferably lower than 53°C, even more preferably lower than 51°C, even more preferably lower than 49°C, even more preferably lower than 47°C, even more preferably lower than 45°C, even more preferably lower than 43°C, even more preferably lower than 41°C, even more preferably lower than 40°C.

[0058] The receptacle can then be filled and the fuel components will begin to crystallize out very quickly. The described process has the advantage that there is much greater flexibility regarding the mixtures of fuel components than in a slurry process. This flexibility is important for the future development of sustainable candles. In addition, the invention also provides visually very homogeneous candles throughout the entire production process.

[0059] After filling, pre-crystals are already present that

will grow quickly.

[0060] In step (iii) the liquid fuel components are cooled in the receptacle. In an embodiment, the fuel components are cooled to a temperature below the crystallization temperature of the fuel components, whereby the fuel components solidify, thus forming a candle. Due to cooling in the receptacle, the fuel components will crystallize and form a hard wax mass in the receptacle.

[0061] The term "receptacle," as used in the text, refers to any object in any material into which, in addition to the presence of a wick, a mixture can be poured. In an embodiment, the receptacle is made of aluminum, metal, plastic or glass.

[0062] In an embodiment, the receptacle is provided with a wick, which is preferably positioned upright on the bottom of the receptacle. After the wax has been filled, part of the wick protrudes above the wax mass and a wick is obtained with which the candle can be lit.

[0063] In a preferred form, the cooling of the liquid fuel components in the receptacle takes a maximum of 10 minutes, preferably a maximum of 5 minutes, more preferably a maximum of 4 minutes, even more preferably a maximum of 3 minutes and most preferably a maximum of 2 minutes.

[0064] In a further preferred form, the cooling of the liquid fuel components in the receptacle to a temperature below the crystallization temperature of the fuel components takes a maximum of 10 minutes, preferably a maximum of 5 minutes, more preferably a maximum of 4 minutes, even more preferably a maximum of 3 minutes and most preferably a maximum of 2 minutes.

[0065] The total cooling process is short with less post-crystallization occurring. This reduces or avoids the visual defects in the obtained candle. As a result, many more samples can likewise be filled on the same dimensions of the cooling line and production efficiency can increase dramatically.

[0066] During cooling and crystallization, it is normal for heat, namely cooling enthalpy and the heat of crystallization, to be released. In a preferred form, this heat released during the crystallization in step (iii) is recovered via a heat exchanger. This contributes to the sustainability of the method, as no heat and therefore energy is lost.

[0067] In an embodiment, cooling is actively continued after crystallization to speed up the process. Active cooling can be done, for example, by means of, but is not limited to, fans.

[0068] The present method is advantageous as cooling of the fuel components occurs to a point where a viscosity increase is observed. This way of working ensures that the liquid is still sufficiently liquid when it is filled, after which it enters the container (receptacle) and quickly crystallizes. Due to the rapid way of crystallization, the cooling process is shortened and visual effects such as post-crystallization are also suppressed. As a result, many more samples can be filled on the same dimensions of the cooling line and production efficiency

can increase dramatically. The total cooling process is short with less post-crystallization occurring. This also reduces or avoids visual defects.

[0069] In an embodiment, the method comprises the steps of:

- i. providing one or more liquid fuel components;
- ii. cooling the liquid fuel components, the viscosity of the liquid fuel components being measured during cooling, preferably being measured continuously, preferably the viscosity is measured continuously as a function of the temperature;
- iii. filling the liquid fuel components into a receptacle, whereby the liquid fuel components are filled; and
- iv. cooling the liquid fuel components in the receptacle to form a candle.

[0070] In a preferred embodiment, the filling is controlled by the viscosity measurement.

[0071] A continuous viscosity measurement refers to the continuous measurement and monitoring of the viscosity of the fuel components, where the viscosity is measured and recorded, for example, every second or every 0.1°C drop in temperature. In this way a viscosity curve can be drawn up.

[0072] In a preferred embodiment the method comprises the steps of:

- i. providing one or more liquid fuel components, the one or more liquid fuel components having a first viscosity;
- ii. cooling the liquid fuel components, the viscosity of the liquid fuel components being measured during cooling, preferably being measured continuously;
- iii. filling the liquid fuel components into a receptacle, whereby the liquid fuel components are filled; and
- iv. cooling the liquid fuel components in the receptacle, thereby forming a candle.

[0073] Preferably, the temperature of the liquid fuel components is also measured during cooling, preferably measured continuously.

[0074] In a preferred embodiment, the filling is controlled by the viscosity measurement, the filling temperature being the point on the viscosity curve where the first viscosity has increased by at least a factor of 1.2; preferably at least 1.3; more preferably at least 1.4; most preferably at least 1.5; even more preferably at least 2, at least 3, at least 4, at least 5, at least 10 or even at least 20.

[0075] In a preferred embodiment, the filling is controlled by the viscosity measurement, the liquid fuel components being filled when a viscosity increase of at least 20%, at least 30%, at least 40%, at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 100%, at least 150%, at least 200%, at least 1000%, at least 2000%, preferably at least 1000%, is recorded during a temperature interval of at most 5°C, at most 4°C, at most 3°C, at most 2°C.

[0076] In a second aspect, the invention relates to a device for manufacturing container candles and tea-lights.

[0077] In an embodiment, the device comprises the following components:

- a cooling device suitable for receiving and cooling one or more liquid fuel components, and
- a filling device, coupled to the cooling device, and suitable for filling the liquid fuel components.

[0078] In a preferred embodiment, the device further comprises a viscometer, coupled to the cooling device such that the viscometer is suitable for measuring the viscosity of the liquid fuel components in the cooling device.

[0079] In a preferred form, the cooling device is a rotary cooling device, which can rotate in an operative state and is suitable for mixing the fuel components during cooling.

[0080] In a preferred form, the viscometer is a rotary viscometer.

[0081] In a preferred form, the viscometer is suitable for continuously measuring the viscosity. In a preferred form, the viscometer is a continuous viscometer.

[0082] In a preferred form, the viscometer is an in-line viscometer.

[0083] In a preferred form, the device further comprises a thermometer, coupled to the cooling device such that the thermometer is suitable for measuring the temperature of the liquid fuel components in the cooling device.

[0084] The term "thermometer" is synonymous with "temperature sensor" by which is meant any instrument suitable for measuring the temperature of the fuel components in the cooling device, preferably a temperature in degrees Celsius.

[0085] In a preferred form, the thermometer is suitable for continuously measuring the temperature. In a preferred form, the thermometer is a continuous thermometer. In a preferred form, the thermometer is an in-line thermometer.

[0086] The thermometer is preferably suitable for transmitting information to the viscometer, so that, for example, a viscosity can be recorded for every 0.1° drop in temperature.

[0087] In what follows, the invention is described by way of non-limiting examples illustrating the invention, and which are not intended to and should not be interpreted as limiting the scope of the invention.

EXAMPLES

Example 1 and Comparative Example 2

[0088] The term "blend", as used in the text, means a mixture of one or more fuel components which, after solidification, will form the wax mass in the ultimately obtained candle.

[0089] A 100% natural blend based on rapeseed, soya

or sunflower is prepared at 65°C where all components and additives are mixed into a homogeneous mass.

[0090] This mass is poured in a pouring process (Comparative Example 2) at 60-65°C, after which the mixture cools to a temperature below the crystallization temperature. A 2nd thinner layer is then poured onto the hard cooled mixture.

[0091] In an embodiment of the method according to the present invention (Example 1) the mixture is first subjected to a viscosity measurement with a Brookfield viscosimeter with a suitable spindle. It can be deduced from the measured viscosity curve that the viscosity increases sharply at 37°C (at the specified speed of 10rpm). Thus, at this point, the liquid mass begins to solidify rapidly. The mixture is therefore cooled to 38-39°C, depending on the size of the receptacle (container). The glass containers are then filled at this temperature. The filled glasses are solid within 2 minutes and will cool further quickly depending on the ambient temperature. It is normal that during the crystallization process the temperature can rise again briefly to remove the crystallization heat. If necessary, cooling can be done actively after crystallization to speed up the process. The gained temperature jump of +/- 25°C is recovered via a heat exchanger. The glasses can be filled in one go and are visually optimal.

[0092] The viscosity curve is shown in Figure 1.

Example 3

[0093] The raw materials for a paraffin-natural mixture are melted and mixed at 65°C. The mixture concerns a 20-50 m% paraffin and 50-80 m% natural wax (palm, rapeseed, soya, sunflower, or coconut) with some 1-5% petrochemical or natural microwaxes. These microwaxes aid in the crystallization process. They provide many crystallization nuclei and minimal crystal growth. This is ideal for a candle blend, as the more crystals present, the softer the appearance of the candle. The mixture is first cooled to 45°C, after which the containers are filled. Also in this example the filling temperature is determined by the viscosity curve that is recorded as described in Example 1. Here, too, the dosing temperature is selected in function of the viscosity. In the case of a mixture with paraffin, the choice of this temperature is even more important because otherwise the container will show shrinkage phenomena. The temperature here is chosen 1°C above the viscosity increase.

Example 4 and Comparative Examples 5 and 6

[0094] Example 4 concerns the addition of a high level of fragrance (6-14 m%) or a color to the mixture of Example 3. The color and/or fragrance component can be dosed both before and after cooling, depending on the structure of the installation.

[0095] In a slurry process, the color and fragrance are typically added after crystallization (Comparative Example 5). In a pouring process, the fragrance and color are

typically added at 65°C (Comparative Example 6).

[0096] In an embodiment of the method according to the present invention (Example 4) this can be done in both ways. Adding the color after cooling can be done via a small mixing reactor or via a static in-line mixer. The color formed will have the depth of one such as during a traditional pouring process.

[0097] The present invention should not be construed as being limited to the embodiments described above and certain modifications or changes may be added to the examples described without having to re-evaluate the appended claims. For example, the present invention has been described with reference to a 100% natural blend and a paraffin-natural blend, but it should be understood that the invention can be applied to e.g. a 100% natural blend or a paraffin-natural blend or a 100% paraffin blend or any combination of paraffin and natural blend or any other blend such as, paraffin blend, paraffin wax blend, vegetable and animal wax blends and 100% natural blends with and without all necessary additives.

Example 7

[0098] Example 7 concerns a continuous viscosity and temperature measurement during cooling of a blend as described in Example 1. The measurement continues until a viscosity increase of greater than 50% (factor 1.5) is recorded compared to the initial viscosity. At this point, the liquid fuel components are filled into containers, after which further cooling to room temperature can take place. The viscosity curve obtained is shown in Figure 2.

[0099] The obtained candle showed no post-crystallization or polymorphism and had no visual defects.

Claims

1. A method for manufacturing container candles and tealights, comprising the steps of:
 - i. providing one or more liquid fuel components, the one or more liquid fuel components having a first viscosity;
 - ii. cooling the liquid fuel components, wherein the viscosity of the one or more liquid fuel components is increased to a second viscosity, the viscosity of the liquid fuel components being measured during cooling (step ii), wherein a viscosity curve is obtained, and wherein the viscosity is determined by means of a viscometer;
 - iii. filling the liquid fuel components into a receptacle; and
 - iv. cooling the liquid fuel components in the receptacle, thereby forming a candle;

wherein the filling is controlled by the viscosity measurement, the filling temperature being the point on the viscosity curve where the second viscosity is re-

lated to the first viscosity according to a ratio of at least 1.5.

2. Method according to claim 1, wherein the viscosity is measured in-line. 5
3. Method according to claim 1 or 2, wherein the filling takes place at a temperature of at most 65°C, preferably at most 55°C, even more preferably at most 50°C. 10
4. Method according to any one of the preceding claims, wherein the cooling of the liquid fuel components in the receptacle (step iv) takes a maximum of 10 minutes, preferably a maximum of 5 minutes. 15
5. Method according to any one of the preceding claims, wherein the crystallization heat released during the crystallization in step (iv) is recovered via a heat exchanger. 20
6. Method according to any one of the preceding claims, wherein the viscosity is measured with a rotary viscometer. 25
7. Method according to any one of the preceding claims, wherein the cooling of one or more liquid fuel components (step ii) takes place in a rotary cooling device. 30
8. Method according to any one of the preceding claims, wherein the viscosity is measured continuously.
9. Method according to any one of the preceding claims, the filling temperature being the point on the viscosity curve where the first viscosity has increased by at least a factor of 1.5; more preferably at least 2, at least 3, at least 4, at least 5, at least 10 or even at least 20. 35 40
10. Method according to any one of the preceding claims, wherein the filling is controlled by the viscosity measurement, the liquid fuel components being filled when a viscosity increase of at least 50% is recorded during a temperature interval of at most 2°C. 45
11. Method according to any one of the preceding claims, the filling temperature being the point on the viscosity curve where the second viscosity is related to the first viscosity by a ratio of at least 10. 50
12. A device for manufacturing container candles and tea lights, comprising: 55

- a cooling device suitable for receiving and cooling one or more liquid fuel components,

- a filling device, suitable for filling the liquid fuel components,

characterized in that the device further comprises a viscometer, coupled to the cooling device such that the viscometer is suitable for measuring the viscosity of the liquid fuel components in the cooling device.

13. Device according to claim 12, wherein the cooling device is a rotary cooling device, suitable for mixing the fuel components during cooling.
14. Device according to claim 12 or 13, wherein the viscometer is suitable for continuously measuring the viscosity.
15. Device according to claim 12, 13 or 14, wherein the viscometer is an in-line viscometer.

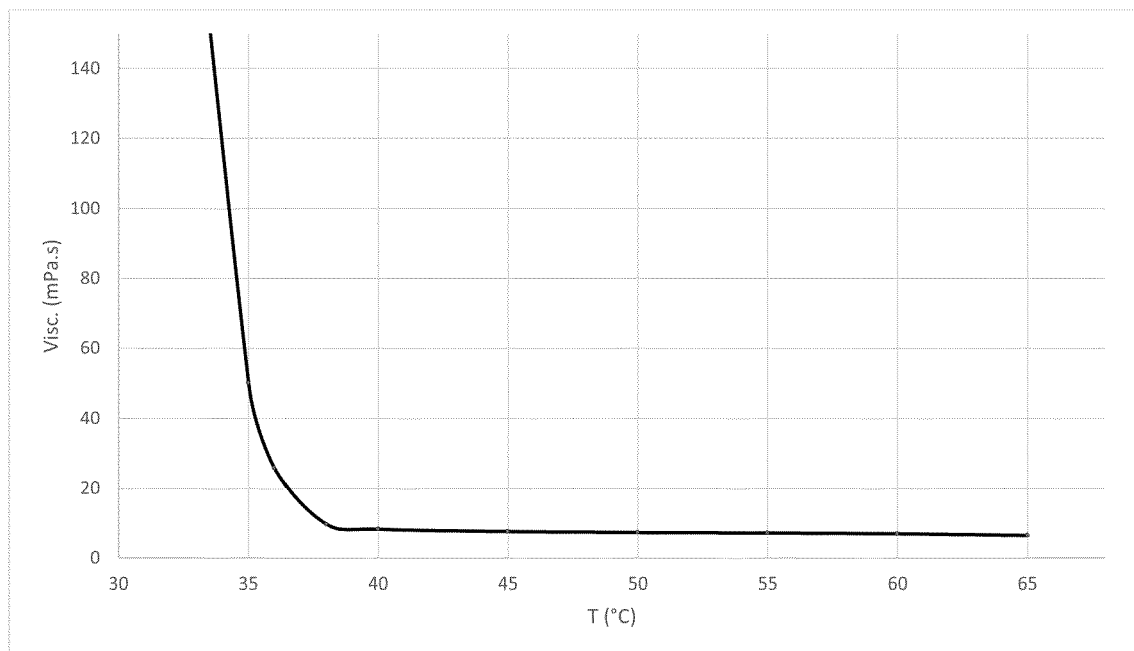


FIG. 1

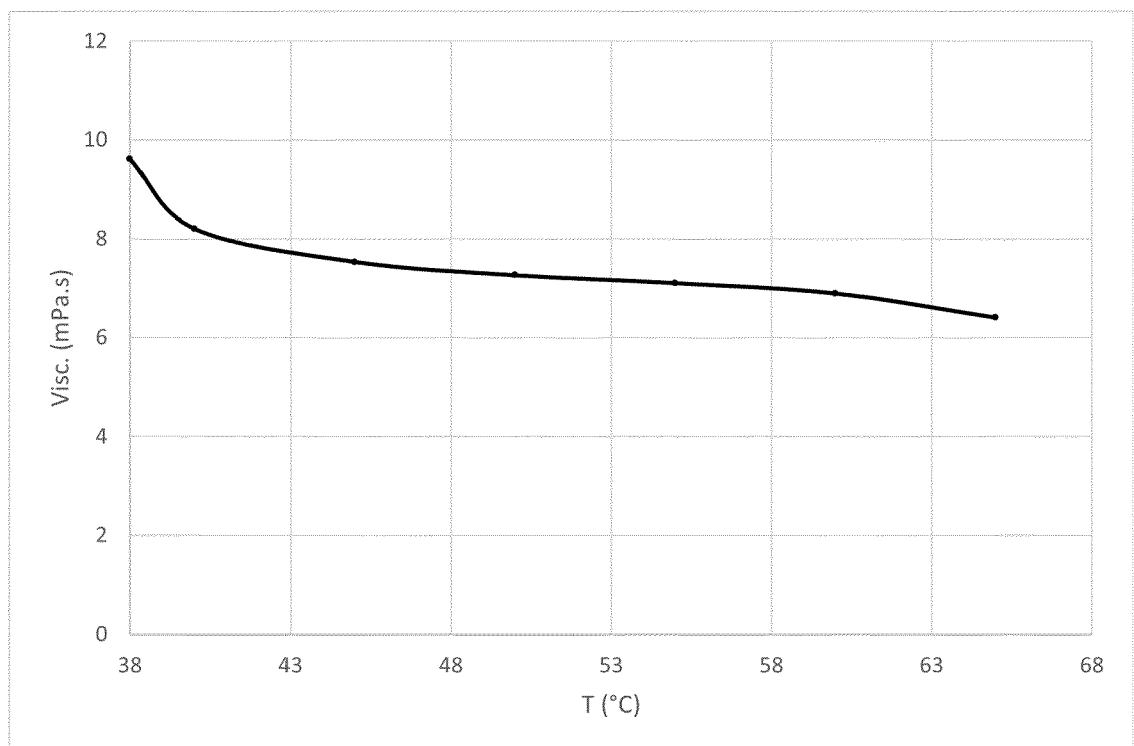


FIG. 2



EUROPEAN SEARCH REPORT

Application Number

EP 23 18 1842

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
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Place of search		Date of completion of the search	Examiner
Munich		4 October 2023	Smeets, Dieter
CATEGORY OF CITED DOCUMENTS			
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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04-10-2023

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			18-12-2008

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