A confectionery product coated with a polymer film and method of manufacture

A confectionery product comprises an edible core and an edible polymeric film coating wherein the core is formed from a material which exhibits cold flow. The film coating may comprises hydroxypropyl methylcellulose. The edible core may be a toffee, fudge or caramel. Also disclosed is the use of an edible polymeric film to inhibit cold flow in a confectionery product and a method of manufacturing a confectionery product comprising a core which exhibits cold flow and coating it with an edible polymeric film.
Figure 3

Figure 4
CONFECTIONERY PRODUCT

The present invention relates to novel confectionery products and to methods of making the confectionery products.

The continued deformation or creep over time of viscoelastic materials at ambient temperature under the stress of gravitational force is known as "cold flow". Cold flow of viscoelastic materials continues until the gravitational force is in equilibrium with the forces that resist flow, which are related to properties of the material such as viscosity and elasticity.

Cold flow is common in chewy confectionery products such as soft, chewy, grained or milk free toffee or caramel and chewy fudge, but is also seen in some hard candy. Cold flow prior to crystallisation during the manufacture and storage of such products makes it difficult to preserve their initial formed shape. In addition, chewy confectionery products are "sticky" and have a tendency to adhere to one another, which can give rise to problems during their manufacture.

In order to preserve their initial shape and/or to prevent them from adhering to one another, it is known to individually wrap confectionery products in an envelope or first wrap as they are formed. A number of the individually wrapped pieces can then be packaged together before being sold. However, application of a first wrap not only increases the cost of manufacture, but also severely restricts the shape of the confectionery products that may be produced as conventional wrapping machinery can only be used to wrap simple shapes, such as cubes.
In order to overcome the problems associated with cold flow and stickiness, it is also known to apply a hard sugar coating to confectionery cores. The hard sugar coating must be sufficiently hard to withstand the cold flow forces without cracking and typically a high ratio of hard sugar coating to confectionery core is required. As a result, this known method also suffers from a number of disadvantages. Firstly, where the core is a chewy confectionery core, the application of a thick, hard sugar coating affects the organoleptic properties of the confectionery product formed, which can be undesirable. Secondly, where a hard sugar coating is applied to a confectionery core which is not simple in shape, the sugar tends to coat the core unevenly, smoothing out any fine detail and increasing the general roundness of the shape. Consequently, it is difficult to produce a confectionery core with a hard sugar coating whose overall shape conforms to that of the core if the core is significantly non-spherical.

For the reasons given above, chewy confectionery products such as toffees, caramels and fudges are conventionally simple in shape without any fine detail.

It has now been found that unconventionally shaped confectionery products having thin polymeric film coatings that do not adhere to one another and which are strong enough to resist cold flow forces without cracking and so fix the initial formed shape of the confectionery product may be produced.

According to a first aspect of the invention there is provided a confectionery product comprising an edible core and an edible polymeric film coating around the core, wherein the core is formed from a material that exhibits cold flow.
As used throughout the present specification, a material that exhibits cold flow is defined as a material whose height decreases over time, measured using the flow test described below.

Flow Test:
An upright hollow Teflon® or Teflon® coated cylinder having a height of 40mm and an internal diameter of 20mm is placed on a smooth flat level surface. The cylinder is filled with the molten material so that the surface of the material is level with the upper rim of the cylinder and there are no air bubbles. The filled cylinder is placed in ambient (25°C) air having a water activity equal to that of the material and the material is allowed to cool. Once the temperature of the material within the cylinder reaches 25°C, the cylinder is lifted away from the cooled material and the height of a point on the top of the exposed material immediately marked and measured using a micrometer having an accuracy of ±10μm or better. The height of the marked point is measured repeatedly over a subsequent period of at least 10 days. The material exhibits cold flow if the height of the marked point decreases over the period of measurement.

The present invention is particularly applicable to materials exhibiting cold flow whose height, as measured using the flow test described above, decreases by at least 1%, more particularly by at least 5% over the period of the measurement. When measured using the flow test described above, the height of chewy confectionery products such as toffees, caramels and fudges, typically decreases by between about 5% and about 60% over the period of the measurement.

Preferably, the core is a substantially crystallised material that exhibits cold flow prior to crystallisation.
Preferably, the tensile strength at break of the edible polymeric film coating is greater than 1MPa, more preferably between about 10MPa and about 40MPa, most preferably between about 15MPa and about 25MPa. Throughout the specification the tensile strength at break values referred to are those measured using the ASTM D882-02, “Standard Test Method for Tensile Properties of Thin Plastic Sheeting”, ASTM International.

The edible polymeric film coating must be sufficiently strong to resist cold flow forces without cracking. For a given core, the thickness of a weak polymeric film coating, having a relatively low tensile strength at break, will need to be greater in order to withstand the cold flow forces than that of a strong polymeric film coating, having a high tensile strength at break.

Preferably, the thickness of the edible polymeric film coating is between about 5µm and about 500µm, more preferably between about 10µm and about 100µm.

Preferably, the edible polymeric film coating is about 10% or less by weight of the confectionery product, more preferably about 1% or less by weight of the confectionery product.

Preferably, the edible polymeric film coating comprises hydroxypropyl methylcellulose.

Preferably, the core comprises glucose syrup, sugar, fat and water.

To produce sugar free confectionery products, the sugar in the core may be replaced by one or more polyols such as sorbitol, xylitol or isomalt or other sugar replacers such as hydrogenated glucose syrup. To produce fat free confectionery products, the fat may be omitted from the core
or replaced by one or more "fat replacers" such as polydextrose.

The core may include milk protein.

The core may further comprise emulsifiers such as lecithin and glyceryl monostearate and hydrocolloids such as gelatine, modified starches, pectin, agar and carrageenan. Where the core comprises hydrocolloids, preferably the hydrocolloids are present in an amount of up to about 2% by weight.

Preferably, the core is a toffee, caramel or fudge.

Preferably, the water content of the core is between about 3% to about 10% by weight.

Preferably, the core comprises sugar, glucose syrup and fat in a ratio of about 10:10:1.5

According to a second aspect of the invention there is provided a toffee, caramel or fudge having an edible polymeric film coating.

Preferably, the tensile strength at break of the edible polymeric film coating is greater than 1MPa, more preferably between about 10MPa and about 40MPa, most preferably between about 15MPa and about 25MPa.

Preferably, the thickness of the polymeric film coating is between about 5μm and about 500μm, more preferably between about 10μm and about 100μm.

Preferably, the polymeric film coating comprises hydroxypropyl methylcellulose.
According to a third aspect of the invention there is provided use of an edible polymeric film coating composition to inhibit cold flow in a confectionery product.

 Preferably, the polymeric film coating composition comprises hydroxypropyl methylcellulose.

 According to a fourth aspect of the invention there is provided a method of manufacturing a confectionery product comprising: forming an edible core from a material that exhibits cold flow; and applying an edible polymeric film coating composition to a surface of the core to form a film thereon.

 Preferably, the film has a tensile strength at break of greater than 1MPa, more preferably between about 10MPa and about 40MPa, most preferably between about 15MPa and about 25MPa.

 Preferably, the polymeric film coating composition comprises hydroxypropyl methylcellulose.

 Preferably, the edible polymeric film coating composition is sprayed onto the core.

 The edible polymeric film coating composition may include a variety of colourants, flavourings, acidulants, artificial sweeteners and other edible additives.

 Application of edible polymeric film coating compositions to confectionery cores by the method of the invention allows the production of confectionery products having very thin polymeric film coatings. By reducing the thickness of the coating required to resist cold flow forces, the invention enables confectionery products to be produced in which the proportion of the confectionery product made up of the core
may be greatly increased compared to hard sugar coated confectionery products.

Confectionery products according to the present invention having edible polymeric film coatings do not adhere to one another. The polymeric film coating fixes the initial formed shape of the confectionery core to which it is applied and acts as a protective barrier. The present invention, therefore, allows the production of confectionery products that do not require a first wrap.

In addition, in contrast to hard sugar coated chewy confectionery products, chewy confectionery products according to the present invention having thin plastic polymeric film coatings have very similar organoleptic properties to uncoated chewy confectionery cores.

Polymeric film coating compositions may be sprayed as a fine mist or otherwise applied to confectionery cores to produce confectionery products according to the present invention. Unlike hard sugar coatings, the edible polymeric film coatings may be applied evenly to the surfaces of confectionery cores that are not simple in shape.

The invention will be further described, by way of the following examples of specific embodiments thereof, with reference to the accompanying drawings, in which:

Figure 1 shows confectionery products of the invention;

Figure 2 shows a transverse cross section of a confectionery product of the invention;

Figure 3 is a graph showing the results of stability tests on a first and second confectionery product of the invention; and
Figures 4, 5 and 6 show various embodiments of confectionery products of the invention.

**Example 1**

A mixture of 20% by weight water, 40% by weight sucrose and 40% by weight glucose syrup was placed in a vessel and heated at 124°C while stirring for about 10 minutes, until the solids content of the mixture was approximately 92%. 6% by weight of hydrogenated vegetable fat, followed by 1% by weight of 50% gelatine (100 bloom) solution in water was added to the mixture and the mixture was then allowed to cool to about 80°C. About 1% by weight of citric acid, 0.4% by weight of flavouring and 0.25% by weight of a 10% allura red water solution was added to the mixture and the mixture was then allowed to cool further to 55°C. The resulting toffee was worked on a pulling machine for 2 to 3 minutes and then pulled into ropes and cut into approximately 4g pillows.

1.5kg of the pillows were loaded into a rotating 40cm diameter solid wall sugar coating pan. Air at a temperature of 35°C was blown onto the pillows to increase the plasticity of the pillows during tumbling. After 5-10 minutes, when the pillows were sufficiently rounded, the air temperature was reduced to 20°C.

66.5g of a mixture having the composition listed in Table 1 was mixed with 433.5g of cold water in an IKA mixer with standard propeller for approximately 30 minutes, until all of the ingredients had dissolved.
<table>
<thead>
<tr>
<th>Ingredient</th>
<th>% by weight</th>
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<tr>
<td>Pharmacoat® 606G hydroxypropyl methylcellulose</td>
<td>61</td>
</tr>
<tr>
<td>Radianuls Acetem 2134 acetylated monoglycerides</td>
<td>6</td>
</tr>
<tr>
<td>Carmine red lake</td>
<td>13</td>
</tr>
<tr>
<td>Tartaric acid</td>
<td>20</td>
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</table>

**Table 1**

The resulting film coating solution was pumped using a Watson-Marlow Bredel 101U/R peristaltic pump to a Schlick 970/7-1575 spray gun supplied by compressed air at 2 bar and sprayed at 1g/minute onto the pillows. After approximately 5 minutes, once an initial layer of the film coating composition had formed on the pillows, the spraying speed was increased to 4g/minute. Spraying was stopped after approximately 15 minutes, once 56.4g of the film coating solution had been sprayed onto the pillows.

**Example 2**

Film coated toffee pillows were formed as in Example 1, but the spraying was stopped after approximately 25 minutes, once 90.2g of the film coating solution had been sprayed onto the pillows.

Examples 1 and 2 produced rounded toffee pillows with a firm, continuous thin film coating over their entire surface. The film coating formed about 0.5% by weight and 0.8% by weight, respectively, of the coated toffee pillows of Examples 1 and 2.
Figure 1 shows a number of film coated toffee pillows produced by the method of Example 2 using film formulations comprising different lake colours. A transverse cross section of a rounded toffee pillow produced by the method of Example 2 is shown in Figure 2.

The tensile strength at break of films having a thickness of 100μm produced using the film coating composition employed in Examples 1 and 2 was between 15MPa and 25MPa, as measured using the ASTM D882-02, “Standard Test Method for Tensile Properties of Thin Plastic Sheeting”, ASTM International.

The cold flow of the film coated toffee pillows produced was measured using a stability test in which the height of the pillows was measured initially and then repeatedly at 24 hour intervals; all measurements were taken at 23°C and 49% relative humidity. In Figure 3, the relative percentage height deformation compared to the initial height is plotted against time for the film coated toffee pillows of Examples 1 and 2 and for uncoated toffee pillows formed in the same way as in Examples 1 and 2.

As can be seen in Figure 3, over 2 days the height of the uncoated toffee pillows decreased by about 10% due to cold flow of the toffee prior to crystallisation. In contrast, the height of the film coated toffee pillows of Examples 1 and 2 increased in height by about 4%.

After about 2 to 3 days, the height of both the coated toffee pillows of Examples 1 and 2 and uncoated toffee pillows stabilised due to crystallisation of the toffee and hence cessation of cold flow.

Without wishing to be bound by theory, the increase in height of the coated pillows according to the invention is believed to be due to shrinkage of the film coating after application. Expansion of air that is trapped within the toffee as it is
worked on the pulling machine may also contribute to the increase in height.

Although in the above examples the cores were coated using an edible polymeric coating composition comprising hydroxypropyl methylcellulose the same techniques may be employed to coat confectionery cores with polymeric film compositions comprising other cellulosic polymeric film formers, for example hydroxyalkyl ethers of cellulose such as hydroxypropyl methylcellulose, hydroxypropyl cellulose and hydroxyethyl cellulose, alkyl ethers of cellulose such as methyl cellulose and ethyl cellulose, and monocarboxylic esters of cellulose such as carboxymethyl cellulose. Instead of, or as well as cellulosic derivatives, the polymeric film coating composition may also include a wide variety of other film formers known in the art such as, for example, sodium alginate, propylene glycol alginate and other alginate derivatives, polyvinylpyrrolidone, polydextrose, dextrin and maltodextrins, waxy maize starch, gelling starch, hydroxypropyl starch and other starch derivatives, kappa carrageenan, iota carrageenan, gellan gum and agar.

In the above examples, the edible polymeric coating composition further comprises acetylated monoglycerides as a plasticiser. It will be appreciated, however, that the polymeric film coating composition may further comprise other plasticisers such as, for example, polyethylene glycol, propylene glycol, triacetin, triethyl citrate, acetyltriethyl citrate and glycerin, as well as detackifiers such as, for example, lecithin and stearic acid, flow aids such as, for example, silicates, talc, fumed silicas and bentonite, lubricants such as, for example, stearines and waxes, and fillers such as, for example, microcrystalline cellulose.

Furthermore, while in the above examples, carmine red lake was included in the polymeric film coating composition, a
variety of lakes, dyes and other food colours including pearlescents may also be employed together with flavourings, acidulants, preservatives, artificial sweeteners, antioxidants and any other edible additives, provided that the quantity and type of additives included does not have an adverse effect on the tensile strength at break of the edible polymeric film which results in it being unable to resist cold flow forces without cracking.

The examples given above employ toffee cores, but it will be readily appreciated by those skilled in the art that thin, polymeric film coatings may similarly be formed on a variety of other edible cores such as, for example, caramels and fudges.

It will also be appreciated that while in the above examples polymeric film coatings are applied to rounded toffee pillows, edible cores having other shapes could alternatively be employed, such as, for example, toroidal, egg-shaped, star-shaped, almond-shaped, heart-shaped or leaf or flower-shaped cores. Examples of different shaped confectionery products according to the invention having polymeric film coatings are shown in Figures 4, 5 and 6. It will be seen that the present invention enables the production of unconventional shaped confectionery products having thin, plastic, polymeric film coatings that are strong enough to resist cold flow forces without cracking. The thin, plastic, polymeric film coatings of confectionery products according to the present invention do not adhere to one another and so the present invention also enables the production of confectionery products that do not require a first wrap.
CLAIMS

1. A confectionery product comprising an edible core and an edible polymeric film coating around the core, wherein the core is formed from a material that exhibits cold flow.

2. A confectionery product according to claim 1 wherein the core is formed from a substantially crystallized material that exhibits cold flow prior to crystallization.

3. A confectionery product according to claim 1 or 2 wherein the tensile strength at break of the polymeric film coating is greater than 1MPa.

4. A confectionery product according to claim 3 wherein the tensile strength at break of the polymeric film coating is between 10MPa and 40MPa.

5. A confectionery product according to any of claims 1 to 4 wherein the thickness of the polymeric film coating is between 5μm and 500μm.

6. A confectionery product according to claim 5 wherein the thickness of the polymeric coating is between 10μm and 100μm.

7. A confectionery product according to any preceding claim wherein the polymeric film coating is about 10% or less by weight of the confectionery product.

8. A confectionery product according to claim 7 wherein the polymeric film coating is about 1% or less by weight of the confectionery product.
9. A confectionery product according to any preceding claim wherein the polymeric film coating comprises hydroxypropyl methylcellulose.

10. A confectionery product according to any preceding claim wherein the core comprises glucose syrup, sugar, fat and water.

11. A confectionery product according to any preceding claim wherein the edible core is a toffee, caramel or fudge.

12. A toffee, caramel or fudge having an edible polymeric film coating.

13. A toffee, caramel or fudge according to claim 12 wherein the tensile strength at break of the polymeric film coating is greater than 1MPa.

14. A toffee, caramel or fudge according to claim 13 wherein the tensile strength at break of the polymeric film coating is between 10MPa and 40MPa.

15. A toffee, caramel or fudge according to claim 12, 13 or 14 wherein the thickness of the polymeric film coating is between 5μm and 500μm.

16. A toffee, caramel or fudge according to claim 15 wherein the thickness of the polymeric coating is between 10μm and 100μm.

17. A toffee, caramel or fudge according to any of claims 12 to 16 wherein the polymeric film coating comprises hydroxypropyl methylcellulose.

18. Use of an edible polymeric film coating composition to inhibit cold flow in a confectionery product.
19. Use according to claim 18 of a polymeric film coating composition comprising hydroxypropyl methylcellulose.

20. Use according to claim 18 or 19 of a polymeric film coating composition to inhibit cold flow in a toffee, caramel or fudge.

21. A method of manufacturing a confectionery product comprising:
   forming an edible core from a material that exhibits cold flow; and
   applying an edible polymeric film coating composition to a surface of the core to form a film thereon.

22. A method according to claim 21 comprising applying an edible polymeric film coating composition to a surface of the core to form a film having a tensile strength at break of greater than 1MPa.

23. A method according to claim 22 comprising applying an edible polymeric film coating composition to a surface of the core to form a film having a tensile strength at break of between 10MPa and 40MPa.

24. A method according to claim 21, 22 or 23 comprising applying an edible polymeric film coating composition comprising hydroxypropyl methylcellulose to the core.

25. A method according to any of claims 21 to 24 comprising spraying the edible polymeric film coating composition onto the surface of the core.

26. A confectionery product substantially as described with reference to the accompanying drawings.
27. Use of an edible polymeric film coating composition substantially as described with reference to the examples.

28. A method of manufacturing a confectionery product substantially as described with reference to the examples.
**Patents Act 1977: Search Report under Section 17**

**Documents considered to be relevant:**

<table>
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<th>Category</th>
<th>Relevant to claims</th>
<th>Identity of document and passage or figure of particular relevance</th>
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</table>
| A        | 1                  | US6500462 A  
Augello et al; see column 1 lines 48-52                  |
| A        | 1                  | US4543370 A  
Porter et al; see column 1 lines 59-64                   |
| A        | 1                  | WO2005/055741 A  
BASF Aktiengesellschaft; see page 15 lines 10-19         |
| A        | 1                  | US5470581 A  
Grillo et al; see column 16 lines 14-19                   |

**Categories:**

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<th>X Document indicating lack of novelty or inventive step</th>
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<td>&amp; Member of the same patent family</td>
<td>E Patent document published on or after, but with priority date earlier than, the filing date of this application</td>
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**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC:

A2B

Worldwide search of patent documents classified in the following areas of the IPC:

A23G

The following online and other databases have been used in the preparation of this search report:

WPI and EPDOC