

SUCROSE ESTERS IN PANNING CONFECTIONERY



INTRODUCTION

Some confection is coated with a hard crystallised sugar (or polyol) layer. The coating protects the candy and provides a pleasant, often colourful, appearance and a nice crunch. The coating is created by spraying many (30 – 100) thin layers of a concentrated sugar solution on the candy and then drying it. This forces the sugar to crystallise on the candy. The panning process is very time consuming.

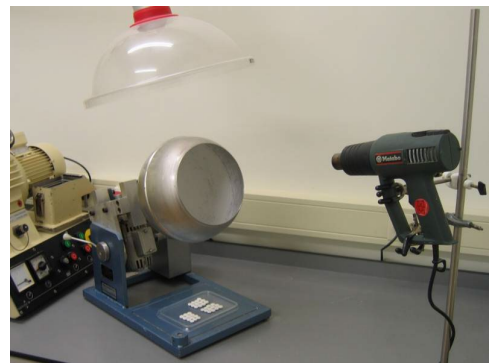
SUCROSE ESTER IN PANNING CONFECTIONERY

Sucrose esters are known for their effect on sugar crystallisation. The functionality lies in the fact that sucrose esters inhibit the growth of existing crystals, forcing the cooling syrup to form more new crystals. The more crystals the smaller the average crystal size will be. The concentration of the syrup remains higher in the presence of sucrose esters, increasing the viscosity quicker to a point of immobility (glass state). This phenomenon has remarkable effects on panning confectionery, on the processing as well as on the end-product. In this document all the effects of sucrose esters will be covered.

1. Shorter production time (9 -19% shorter)
2. Smoother surface (after the engrossing step)
3. Whiter appearance (replacing TiO₂)
4. Less permeable layer
5. Helping/replacing gum arabic
6. Sugar-free (polyols) and sugar-reduced (fibre) panning

To research the effects of sucrose esters (Sisterna SP50 and SP70, 0.25%, 0.35% and 0.5% in the panning solution), trials were done on four different scales:

- Lab-tests, max. 1 kg, sugar coating and xylitol coating
- Open pan, max. 10 kg, maltitol coating
- Driam perforated drum, 7,5 kg, isomalt coating
- Dumoulin IDA502X perforated drum, max. 500 kg, sugar coating
- Industrial test xylitol coating



1. SHORTER PRODUCTION TIME

A laboratory panning test (1 kg mints, 35% weight increase) with compressed mints (Ø 1 cm) proved that addition of 0.5% sucrose esters to the spraying solution (74°Brix, 70 layers) reduced the total engrossing time from 3:34 hr to 2:54 hr (19% reduction). 0.25% sucrose esters in the solution reduced the panning time with 12%. Besides this time benefit, the tablets were smoother and whiter when sucrose esters were used.

A production scale test with the same mints was performed in a Dumoulin continuous panning machine. The drying time and the total panning time of the mints, sprayed with a standard sugar solution or with a sugar solution containing 0.5% sucrose esters, were tested. All process parameters were identical, only the spraying time varied depending on the dryness (visual and IR) of the mints. The coated mints were tested on weight increase, doubles, whiteness, smoothness and stability.



Results of the Dumoulin test

- The drying time, in the engrossing step, was reduced from an average of 275 seconds/layer to 245 seconds/layer, by sucrose ester addition (>10% reduction).
- The total engrossing step was reduced from 3:39 hr to 3:18 hr by adding sucrose esters (10% reduction)
- The mints with sucrose esters were whiter (in both batches TiO₂ was used).
- After 2,5hr tumbling (60 rpm) of 1 kg mints, the damage on the mints with sucrose esters was slightly smaller.
- Other aspects like smoothness, number of doubles and average weight were equal.

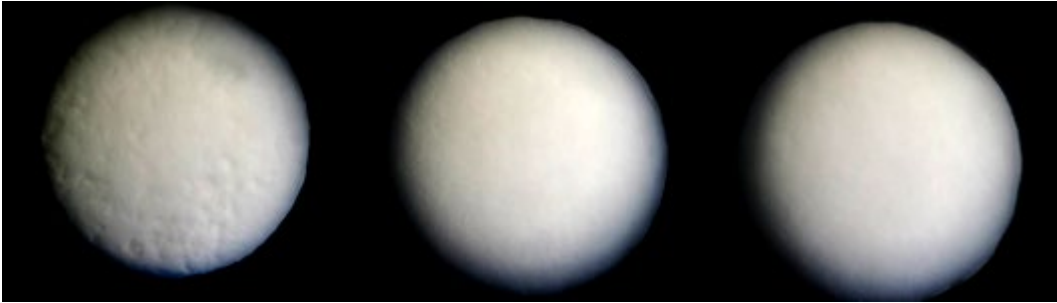
A third test was performed to study the benefit of quicker panning. A pilot trial of 2 kg gums in an open pan with maltitol (65.8% d.m., 25% weight increase) showed that the engrossing time was reduced by 17% when 0.35% sucrose esters was dissolved in the maltitol solution.

Conclusion

Adding 0.5% sucrose esters to the spraying solution can reduce panning time by 9-19%. For a typical 5 hour panning process, a reduction of 30-60 min. is possible.

2. SMOOTHER SURFACE (AFTER THE ENGROSSING STEP)

The lab-test clearly showed a smoother surface after panning with sucrose esters in the spraying solution.



Reference

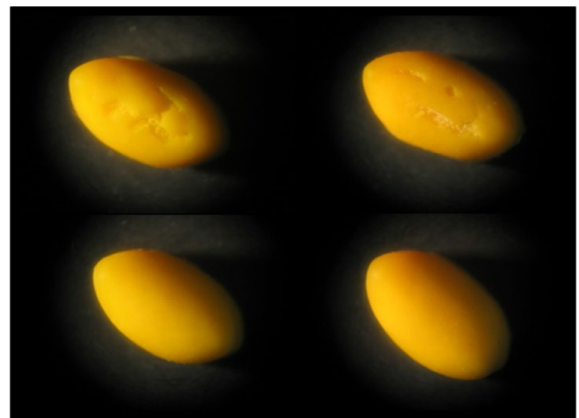
0.25% sucrose esters

0.5% sucrose esters

To study the effect on smoothness in more detail, a larger test was performed with a Driam continuous panning machine with isomalt (7.5 kg gums, isomalt solution 65% d.m., 33% weight increase). The engrossing time was set 19% shorter than usual for both the reference and the test with 0.5% sucrose esters. The results showed a large difference in smoothness.

Top: reference

Bottom: with 0.5% sucrose esters



Conclusion

Addition of sucrose esters results in a much smoother surface after the engrossing step. This can make the (even more time consuming) smoothening step no longer necessary, or at least reduce the smoothening step.



3. WHITER APPEARANCE

A white colour after the engrossing step will brighten the colours that are used in the outer layers. TiO_2 is often used to whiten the coating. However, many companies try to find a replacement for TiO_2 , because of the changed legislation (nano-particles). A comparison was made in a lab of panned sweets with 0.25% TiO_2 and with 0.5% sucrose esters. The sweets with sucrose esters were clearly whiter. The difference was quite noticeable.

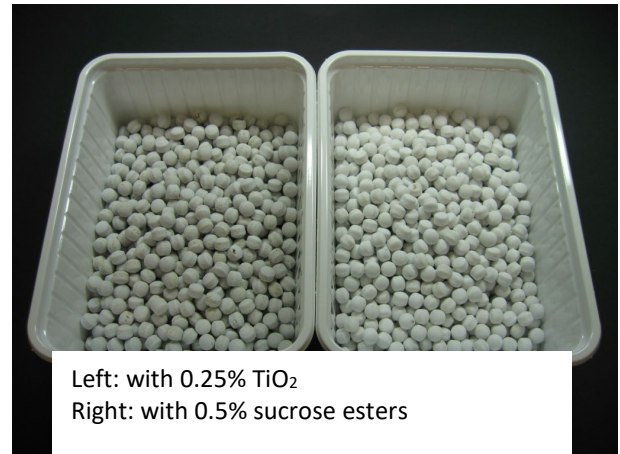
Another test compared 0.5% TiO_2 with 0.5% sucrose esters (no pictures available). It showed that the sweets with TiO_2 were slightly whiter.

Another observation was that the coatings with TiO_2 were much coarser, compared to coatings with sucrose esters, and coatings without any addition.

Conclusion

Addition of sucrose esters to the panning solution results in a whiter coating (larger number of smaller crystals). Sucrose esters can replace TiO_2 . 0.5% Sucrose esters results in a whiteness that can be reached with approx. 0.4% TiO_2 . When sucrose esters are used in the outer, coloured layers, the colour of the sweets can be slightly fainter.

Besides the effect on the colour, sucrose esters do not have the coarsening effect on the coating like TiO_2 has. In sugar-free this effect can even be larger, especially in xylitol coatings, that are rather yellow by itself. See picture at the end of this document.



4. LESS PERMEABLE LAYER

The effect on crystallisation of sugar by sucrose esters, results in a larger number of smaller crystals, and in more glass. This very viscous sugar matrix is more stable, and much less permeable. In the lab the absorption of (coloured) substances both from the inside of the sweets and from the outside of the sweets was tested.

From the inside

Coloured centres (liquorice compressed mints) were coated with 70 layers of sugar, in three variants:

- Sugar coating
- Sugar coating with 0.5% TiO_2
- Sugar coating with 0.5% sucrose esters

The effects were remarkable. After some hours the brown colour of the liquorice centres started to absorb through the coating in the variants with only sugar and sugar + TiO_2 . The variant with sucrose esters however, remained fully white. There was no permeation of colour through this coating.



Sugar coating
Brown, course

Sugar coating + 0.5% TiO_2
Brown, very course

Sugar coating + 0.5% sucrose esters
White, smooth

From the outside

After finding the large differences in permeability from the inside of the sweets, the absorption from the outside was tested. A drop of water soluble as well as fat soluble colour was applied on the surface of the coated candy.



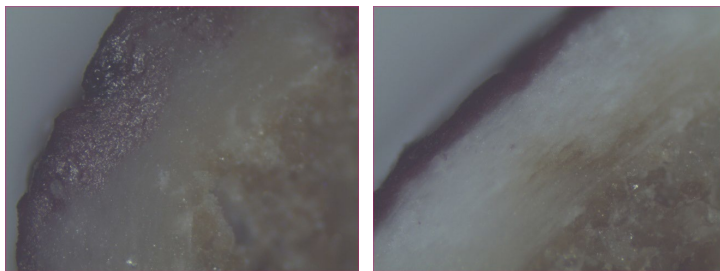
Water soluble red colour
Sugar coating Sugar coating with
0.5% sucrose esters



Oil soluble yellow colour
Sugar coating Sugar coating with
0.5% sucrose esters

Conclusion

Both from the inside as from the outside, substances like colours absorb quickly through the sugar coating. Sucrose esters prevent this permeability. Most probably because the ratio crystals : glass is moved to more glass, in the presence of sucrose esters. Glass is so viscous that no substances can enter/penetrate. These microscopic pictures show clearly the difference in permeability.



Water soluble red colour
Sugar coating Sugar coating with 0.5% sucrose esters

This prevention of absorbance of colours/substances can have beneficial effects on coloured candy. The colour remains on the outside of the candy, instead of moving to the inside where it is not visible. Colours from the inside (think of chocolate) will stay inside. Gum arabic is used for this reason as well. The effect of sucrose esters on the permeability of the sugar coating offers the possibility to (partly) replace gum arabic by sucrose esters (see next item).

5. HELPING/REPLACING GUM ARABIC

Gum arabic is used as a pre-coating before panning takes place. Gum arabic has several functionalities, like forming a film around the centre that is water tight and oil tight. It will also smoothen a rough surface and improve the “adhesion” of the sugar coating to the centre. Finally, the tumbling in the pan or machine will be better with gum arabic. The film-forming capacity can be fully or partly replaced by sucrose esters. Sugar coating with sucrose esters is less permeable for water and oil, so the film of gum arabic is less needed. When gum arabic is used as a pre-coating, the use of sucrose esters is still beneficial. The pre-coating of gum arabic can be damaged by the tumbling of the centres at the start of the panning process. Sucrose esters prevent (coloured) substances migrating from the inside to the outside of the coating. In a lab trial 700 g liquorice mints were pre-coated with gum arabic, and after this, these mints were coated with 50 layers of sugar. The sweets with sucrose esters in the sugar coating developed less spots (see pictures).



Pre-coated liquorice mints
 Sugar coating + 0.25% TiO₂
 In total 134 sweets with spots = 8.6%
 of all sweets (700 g)

Small spots (<1mm) Medium spots (1-4mm) Large spots (>4mm)



Pre-coated liquorice mints
 Sugar coating + 0.5% sucrose esters
 In total 42 sweets with spots = 2.5%
 of all sweets (700 g)

Conclusion

Using sucrose esters in the sugar coating makes the use of a gum arabic pre-coating less necessary. Sucrose esters make the sugar coating less permeable for water and oil soluble substances, by moving the ration crystals : glass to more glass. When gum arabic pre-coating is damaged, sucrose esters reduce the absorption through the coating.

1. SUGAR FREE AND SUGAR REDUCED PANNING

SUGAR FREE Panning tests were performed with Isomalt, Maltitol and Xylitol. These tests indicated similar results as sugar panning; shorter panning time (approx. 13 - 18% shorter), smoother surface, quicker closing of lips, whiter colour and comparable crunchiness. Also the decreased permeability of the panning layer in the presence of sucrose esters was observed in polyol panning. Below picture shows chewing gum panned with xylitol (lab scale).



Reference (production 90 min.)	With SP50 (production 73 min.)
Water soluble colour	Oil soluble colour
Oil soluble colour	Water soluble colour
Less white, less smooth, oil soluble, colour is easily absorbed	Whiter, smoother, both oil and water soluble, colours are not absorbed

A xylitol-coating has a rather yellow colour. Therefore chewing gums based on xylitol often contained TiO₂, to get a white colour. Now that TiO₂ is not permitted in most areas, sucrose esters are often used to reach a whiter colour. The effect of Sisterna SP50 is really significant. See picture of industrial tests.



Xylitol coating with Sisterna SP50

Xylitol coating blank

SUGAR REDUCED Panning tests were performed by replacing 10% of the sucrose solution by oligofructose syrup (Frutalose L92, Sensus). While the fibre inhibited the sugar crystallisation, sucrose esters promoted this, and a good, smooth sugar coating was formed. Replacing more sucrose with fibre is probably also possible.

Warranty

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