A Novel Carrageenan for Vegetable Gummy Candy Production

by Ledicia Pereira Gómez

Background of gummy candy production
Traditionally different gelling agents such as gelatine, pectin, gum arabic or starch have been used for gummy candy production. A mixture of sugars, water and the gelling agent is boiled until desired soluble solids are reached and deposited into starch moulds, where a specific shape is obtained. Then, candies are dried to their final moisture content and texture. Gelatine provides the gummy with a special elastic and chewy texture that is difficult to achieve with other hydrocolloids. However, with new developments in the carrageenan field, it is now possible to offer excellent solutions with carrageenan-based products.

Reasons for replacing gelatine
Nowadays it is important to offer an alternative to gelatine based gummy candy due to different causes.

First of all, the increasing prices of gelatine should be mentioned (see Fig 1) because of two reasons. On the one hand, the concern that the higher feed prices in Russia and EU may lead to less availability of animals for gelatine production, and on the other hand, stricter production standards in China have increased the production costs. It may also be interesting for producers to have the choice of selecting different gelling agents, depending on the actual raw material competitiveness which can be helpful in achieving more stable prices.

Finally, it is necessary to offer an alternative for a rising and attractive halal, kosher and vegetarian market. Technically carrageenan gives many advantages that will be described in the following sections.

Ceambloom 3243 development
For all above mentioned reasons we decided to create a new carrageenan confectionery type, now commercialized as Ceambloom 3243, taking benefit of recent new carrageenan extraction technology which provides close to gelatine-like texture. For years standard carrageenan has shown shortcomings when trying to achieve the right texture in order to substitute gelatine. Moreover, the high setting temperature that carrageenan naturally exhibits makes this task more complicated, as the depositing stage becomes more critical.

In order to improve these two points, a special iota type carrageenan was developed with outstanding characteristics, providing the gummy
with a strong texture and favorable special elasticity.

Figure 2 demonstrates a regular iota carrageenan compared to this new special iota extract when measured in a texture analyser. The new Iota also has a satisfactory setting temperature within the range that is possible for carrageenan.

In manufacturing the standardized commercial Ceambloom 3243, including the benefits of the new iota extract, one other important aspect has to be taken into account. Correct ratio between the iota extract and other carrageen extracts is very important, since a wrong ratio or poor standardizing could lead to a relatively soft gummy or to the opposite, a gummy with a short texture and with problems in the depositing stage. Iota gives the characteristic gummy texture, but stronger gelling kappa based extract types are additionally needed for shape definition and demouldability.

**Eating quality of gummy candy made with Ceambloom 3243 compared to using Gelatine.**

Some properties of Ceambloom 3243 in a use level of 1.4% compared to Gelatine 250 Bloom in a use level of 5.5% were determined by using a texture analyser (TA.XT.plus model).

Two different ways of measuring texture were used to define specific properties:

- 20% compression for 60 seconds and using a probe with a surface bigger than the piece of the gummy to be measured (Figure 3). This test is directly applied to the gummy candy in its final shape. It is important to select gummies with a homogeneous height in order to achieve representative results of the measurements. Properties that can be read from this test are **firmness**, which is the registered strength when 20% compression is achieved; and **springiness**, the ability to recover its original shape, which is read as the ratio between maximum force and force after a 60 second compression.

It can be observed in figure 3 that **firmness** is equal for both products, but Ceambloom has a better ability to recover its original shape.

- TPA test is a special test developed to imitate the movement of the teeth when biting. It consists of two penetration cycles of two centimeters (Figure 4). Several properties can be extracted with this test, but the more representative are hardness, adhesiveness and cohesiveness. **Hardness** is the maximum force at 2 centimeters depth in the first cycle, and this value should represent the feeling in the mouth when biting the gummy. **Adhesiveness** is read...
as the negative area measuring the effort made by the gummy to the probe in its way back between the two cycles. **Cohesiveness** is the way the gummy maintains its structure after the first cycle, and it is represented by the ratio between force in second cycle and first cycle.

It can be seen that hardness and cohesiveness are in the same range for both products and adhesiveness is lower for the Ceambloom (less negative area).

**Additional factors of importance when comparing Ceambloom 3243 to Gelatine**

An important parameter to highlight is the benefit in cost-in-use when using Ceambloom. In order to achieve the same hardness it is necessary to use four times more gelatine 250 bloom than Ceambloom. This means that to have equal production costs Ceambloom should be around four times more expensive than gelatine, and with the trend of gelatine prices nowadays, this will hardly happen.

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**Figure 5**: Difference in appearance of gummy candy made with gelatine (left) and with Ceambloom 3243 (right). Ceambloom provides a transparent and brilliant gummy.
Figure 6: Heat stability of Gelatine (5.5%) and Ceambloom 3243 (1.4%) after being heated for 2 hour at 35°C. Ceambloom 3243 keeps its properties.

Finally, gummy made with carrageenan provides heat stability upon storage. It can be seen in figure 6, how gummy candy made with carrageenan keep their properties after being heated at 35°C during 2 hours, while those made with gelatine loose their capacity to recover the original shape.

All these properties have been summarized in the below spider diagram (Figure 7)

Advice for gummy candy production with Ceambloom 3243

For a proper gummy candy production with Ceambloom 3243 it is recommended to follow the below points:

- Optimum use level: 1.4%
- Cook until 75° Brix. At this soluble solids level depositing stage is less critical. By drying, final soluble solids will be increased.
- Acid addition should take place at the very end of the cooking stage, in order to avoid carrageenan degradation at low pH combined with the high temperatures.
### Part A
- Sugar Syrup: 38.5
- Sugar: 33.0

### Part B
- Ceambloom 3243: 1.3 – 1.8
- Water: 41.0
- Tri-sodium citrate: 1.0
- Citric acid, H2O 50% W/v solution: 2.0
- Flavor and color: Optional

**Total ingredients**: 116.8 - 117.3
**Evaporation**: 16.8 - 17.3
**FINAL product/yield**: 100.0

**Ingredients**: Soluble solids: min 75 %  pH of final product: 3.5

**Process:**
1. Weigh out the sugars in Part A and blend well.
2. Heat the water in Part B until boiling.
3. Weigh out the Ceambloom 3243, the citrate and a small part of the sugar from part A and blend well.
4. Add this blend to the hot water and heat to 90°C while mixing (part B).
5. Heat part A to at least 95°C for dissolving the sugars, thereafter mix well with part B.
6. Heat the mixture stirring constantly until boiling, and boil until soluble solids reach 75%.*
7. Add citric acid, color and flavor.
8. Deposit hot at a minimum temperature of 90°C.
9. Dry at 30-40°C for 2-3 days until soluble solids reach 83 %.
* Note: lower depositing brix such as 75 %, followed by longer drying time is recommended for easier depositing process.

**Figure 9**: Suggested application guide-line for gummy candy production.

- Deposit hot (>90°C). Critical filling temperature is 85°C, but it is recommended to maintain a minimum temperature of 90°C during all the depositing stage and to have as short distance as possible between the cooking tank and the depositing device to avoid setting problems.
- Dry for 2-3 days at 40°C, this way final Brix degrees will be the re-commended 80-83 %

Application guide-line is available below. (Figure 9)

### Conclusion
The article concludes that Ceambloom 3243 was specially developed in order to meet the requirements of the confectionery industry achieving a gelatine-like texture and providing the producers with several advantages compared to gelatine. The most important benefits to highlight are the cost savings due to favorable cost-in-use, its vegetable origin, the improved transparency of the final product, the heat resistance and the excellent eating quality similar to gelatine.

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