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Agave Inulin Application Case Study in Ice Cream

Innovation and Development of New Products IMAG

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Aim of the project

To evaluate overrun performance of Agave Inulin in vegan Ice Cream.

Formulation

For this essay were formulated four different Ice Cream, by adding Jerusalem Artichoke, Agave Inulin powder, partially hydrolyzed Inulin 40% and partially hydrolyzed Inulin 40% reduced 25%. The formulas are below.

Formula 1 (1kg)	
Jerusalem Artichoke Inulin	75.7 g
Agave Syrup	114 g
Stabilizer	4.5 g
Coconut milk	805.8 g

Formula 2 (1kg)	
Agave Inulin Powder	75.7 g
Agave Syrup	114 g
Stabilizer	4.5 g
Coconut milk	805.8 g

Formula 3 (1kg)	
Partially hydrolyzed Inulin (40%)	237.125 g
Stabilizer	4.5 g
Coconut milk	758.37 g

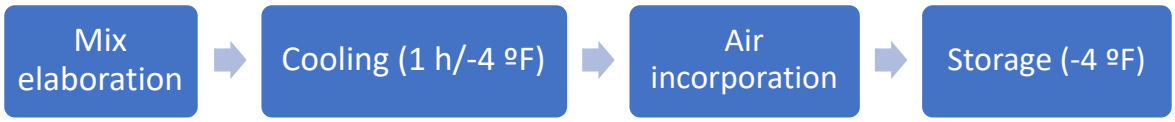
Partially hydrolyzed Inulin 40% is a liquid product that is composed of 40% Inulin and 60% free sugars, mainly fructose, as in Agave syrup. To reach Inulin and free sugars* content as the same as formula 1, was added 25% more weight, due the product has 75 ºBrix.

Formula 4 (1kg)	
Partially hydrolyzed Inulin (40%)	189.7 g
Stabilizer	4.5 g
Coconut milk	805.8 g

In this formula, the weight added of partially hydrolyzed Inulin is the same as the sum of the weight of Inulin and Agave syrup from the original formula. Which represents a 25% solids reduction, adding 56.6 g of Agave Inulin instead of 75.7 g and 85.68 g of free sugars instead of 114 g of Agave syrup.

*In reference to free sugars, is the same as the Agave syrup; we call it that way because is the result of a partial Inulin hydrolysis.

Ice Cream making process



Overrun Results

To calculate overrun, it took as a reference 300 mL of mixture weight, and then, the same volume of freshly made Ice Cream and overnight Ice Cream. The results are attached below, Table 1 shows freshly made Ice cream results, and Table 2 shows overnight Ice Cream results. The samples were evaluated duplicate.

Table 1. Freshly made Ice Cream overrun results.

Sample	Weight mixture 300 mL (g)	Weight of 300 mL Freshly made ice Cream (g)	Freshly made Ice cream Overrun (%)	SD
Artichoke Inulin	313	268	16.79	0.03
Artichoke Inulin	313	268.1	16.75	
Agave Inulin	310	219	41.55	0.05
Agave Inulin	310	219.12	41.47	
Partially Hydrolyzed Inulin 40%	334	242	38.02	0.08
Partially Hydrolyzed Inulin 40%	334	242.2	37.90	
Partially Hydrolyzed Inulin 40% (25% less)	315	231.01	36.36	0.16
Partially Hydrolyzed Inulin 40% (25% less)	315	231.4	36.13	

Table 2. Overnight Ice Cream overrun results

Sample	Weight mixture 300 mL (g)	Weight of 300 mL Overnight Ice Cream (g)	Overnight Ice cream Overrun (%)	SD
Artichoke Inulin	313	269	16.36	0.15
Artichoke Inulin	313	268.5	16.57	
Agave Inulin	310	219.06	41.51	0.02
Agave Inulin	310	219.1	41.49	
Partially Hydrolyzed Inulin 40%	334	243	37.45	0.20
Partially Hydrolyzed Inulin 40%	334	242.5	37.73	
Partially Hydrolyzed Inulin 40% (25% less)	315	230	36.96	0.44
Partially Hydrolyzed Inulin 40% (25% less)	315	231.06	36.33	

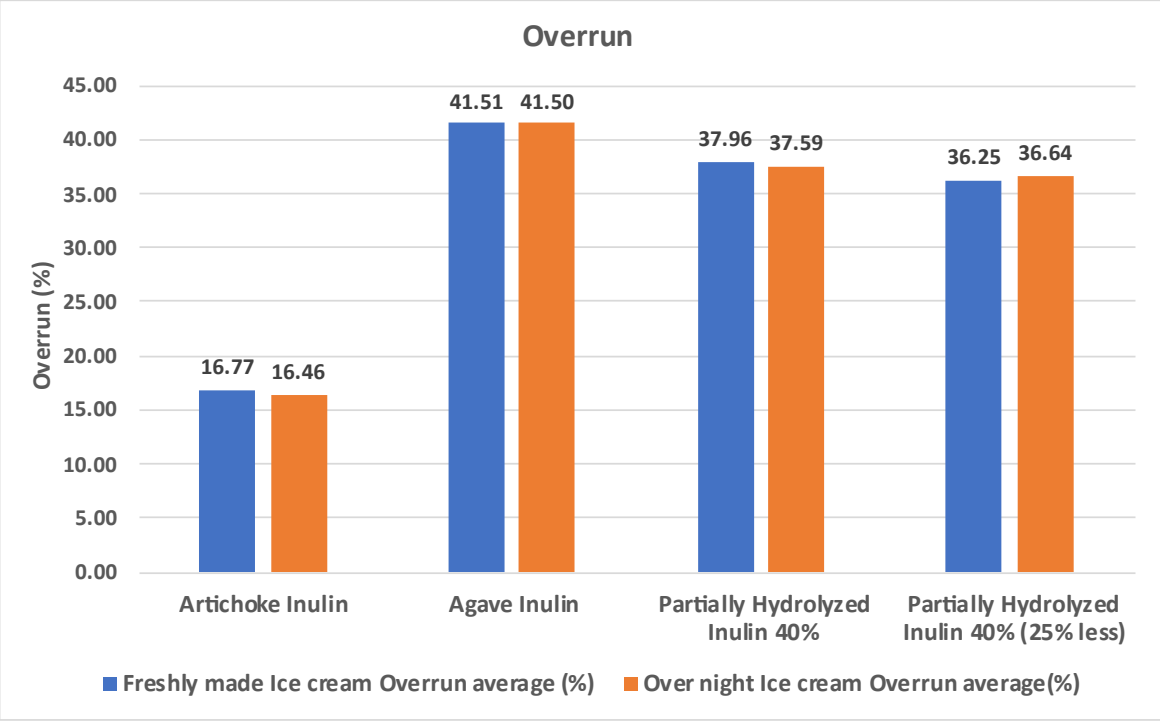


Fig. 1 Overrun averages.

The Ice Cream added with Agave Inulin had the best performance, being better than the reference 2.4 times, followed by partially hydrolyzed Inulin 40% Ice Cream being better 2.26 times, and at last, partially hydrolyzed Inulin 40% reduced 25% with 2.16 times better.

Conclusions

By adding Agave Inulin powder, it is possible to incorporate a greater amount of air into the ice cream.

Partially hydrolyzed Inulin had a good performance in terms of air incorporation.

There was no significant difference between the formulas with partially hydrolyzed inulin and partially hydrolyzed inulin reduced 25%. So, if the formula is used with the reduction of solids, it will have a good performance, so its use significantly reduces costs.

Sensory Analysis

The samples were sensory evaluated by a six-person untrained panel. The panel was provided with a descriptive questionnaire, where they only had to choose a sample to answer that question. The questions were: Which sample is the sweetest? Which sample Do you consider to be the creamiest or has the best texture? Which sample Do you consider to be the best tasting? Which sample Do you consider to be the most balanced sample in terms of flavor, sweetness and texture? The results are attached below.

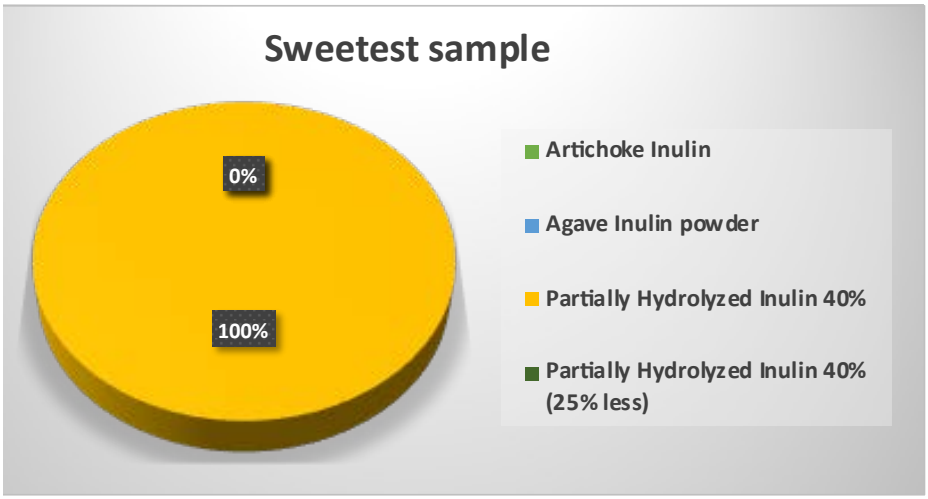


Fig. 2 Sweetest sample chosen.

Even the partially hydrolyzed inulin 40% Ice Cream was selected as the sweetest, most of the panel (83%) mentioned that should be reduced the sweetness.

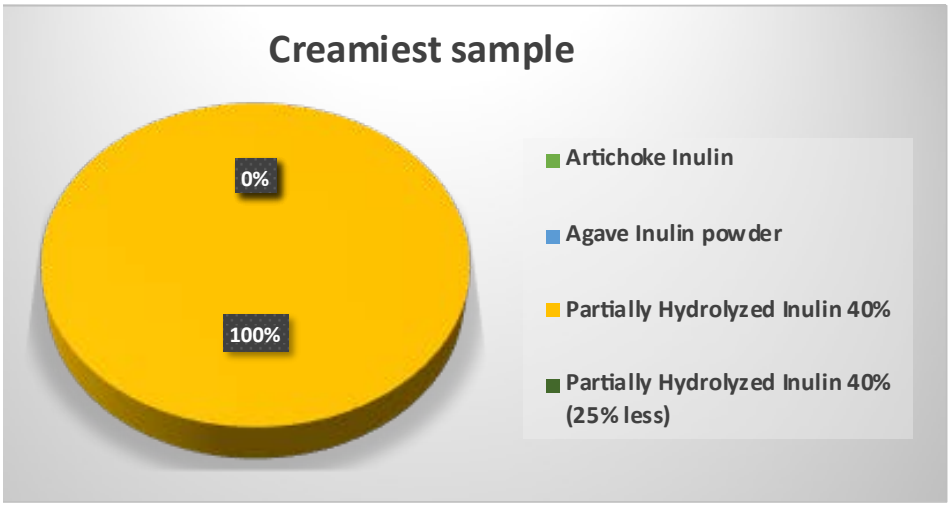


Fig. 3 Creamiest sample chosen.

Regarding texture, the panel mentioned that the Jerusalem Artichoke Inulin Ice Cream had a very light and gritty mouthfeel. They mentioned too that Agave Inulin powder Ice Cream was creamier than Jerusalem Artichoke Inulin, but less creamy than partially hydrolyzed Inulin Ice Cream and partially hydrolyzed Inulin reduced 25%.

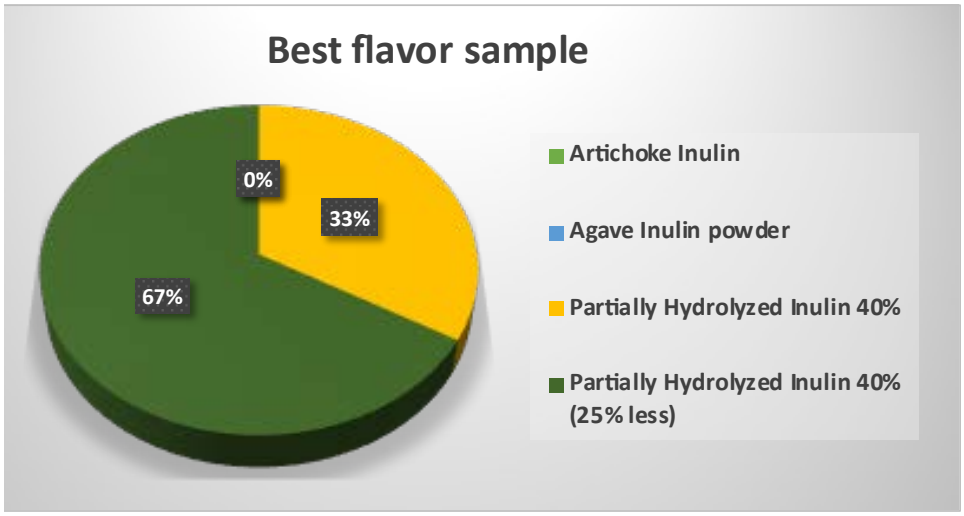


Fig.4 Best flavor sample chosen.

The majority of panel mentioned that partially hydrolyzed Inulin 40% reduced 25% had the best flavor because it was sweet, and it was possible to perceive the different flavors.

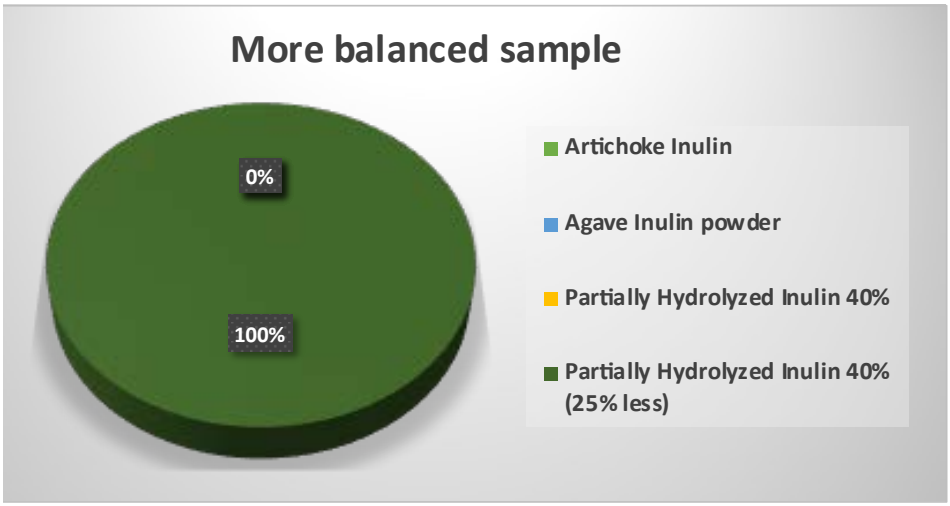


Fig. 5 More balanced sample chosen.

The ice cream formulated by adding partially hydrolyzed Inulin 40% reduced 25% was the most sensorially accepted by the untrained panel, since the balance between flavor, texture and sweetness is perceived.

Although color was not taken as a part of sensory evaluation, the panel mentioned a slight change in color between the samples, being the whitest the Jerusalem Artichoke Inulin Ice Cream, followed by creamier color of Agave Inulin powder Ice Cream and partially hydrolyzed Inulin 40% reduced 25% and at the end, the partially hydrolyzed Inulin Ice Cream with a yellowish color.

Fig. 6 Jerusalem Artichoke Inulin Ice Cream.

Fig. 7 Agave Inulin powder Ice Cream.

Fig. 8 Partially hydrolyzed Inulin Ice Cream.

Fig. 9 Partially hydrolyzed Inulin reduced 25% Ice Cream

Conclusions

Using partially hydrolyzed Inulin for the production of Ice Cream is a viable option, since it has very good overrun performance, remains stable, improves texture, even reducing its content in the formulation, which also impacts costs.

By adding Agave Inulin powder or partially hydrolyzed Inulin the texture improves, regarding the Jerusalem Artichoke Inulin.

Improvement area

To modify some process parameters to obtain a partially hydrolyzed Inulin with a lighter color, so that it does not impact on the color of Ice Cream base.