Book of Abstracts
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# Crystallization of the supersaturated sucrose solutions in the presence of fructose, glucose, corn syrup and lactose

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## 1. Summary

The presence of fructose, glucose, corn syrup and lactose inhibited the sucrose crystallization. The crystallization time increased with the concentration of the additive. There is a great difference between the water activity of boiled sugar mixture solution and the same composition when crystallized. So measurement of water activity was successfully used to characterize the crystallization process. The microscope equipped with polarizing filters was used to see the structural changes in crystallization.

Keywords: crystallization, sugars, water activity, polarized microscopy

## 2. Extended Abstract

Sugar is the main ingredient of confectionery and formation of the solid crystalline phase of sugars plays an important role in many food products. To control the development of crystalline microstructure in foods, an understanding of the interactions between components and the rates of their reactions during processing and storage is required (Hartel et al., 1991).

The purpose of the present work was to investigate the crystallization of supersaturated sucrose solutions (boiling point 120$^{o}$C, $\leq$ 22% moisture, w/w) at 20°C in presence of fructose, glucose, corn syrup (DE=37.5) and lactose. The crystallization was studied using determination of water activity and measuring the crystal growth by microscopy.

Crystallization process is autocatalytic, increasing the water activity as the rate of crystallization increases. In Figure 1 it is seen that the crystallization of pure

supersaturated sucrose solution occurred within one day as the water activity increased rapidly. The addition of 20% fructose, glucose, corn syrup and lactose led to a slower crystallization.

Minimal crystallization was noticed in presence of fructose. The addition of fructose to a sucrose solution decreased the sucrose crystallization process (Roos, 1995). A small increase in water activity (from 0.337 to 0.493) within 84 days can be seen but as confirmed with polarized light microscopy the sucrose-fructose (80:20) solution did not crystallize. Such as the fructose, the corn syrup inhibits the sucrose crystallization. In Figure 1 can been seen a slight increase in water activity but no crystallization occurred in the sucrose-corn syrup solution (80:20) within 84 days. Adding 20% glucose to a supersaturated sucrose solution, the crystallization occurred within a week and the water activity increased from 0.344 to 0.750. The water activity of sucrose-lactose solution (80:20) increased slightly with storage days. The rapid increase in water activity was observed after the 28-th day when the value increased to 0.853. The water activities close to 0.85 show complete of crystallization of sucrose from supersaturated solution.

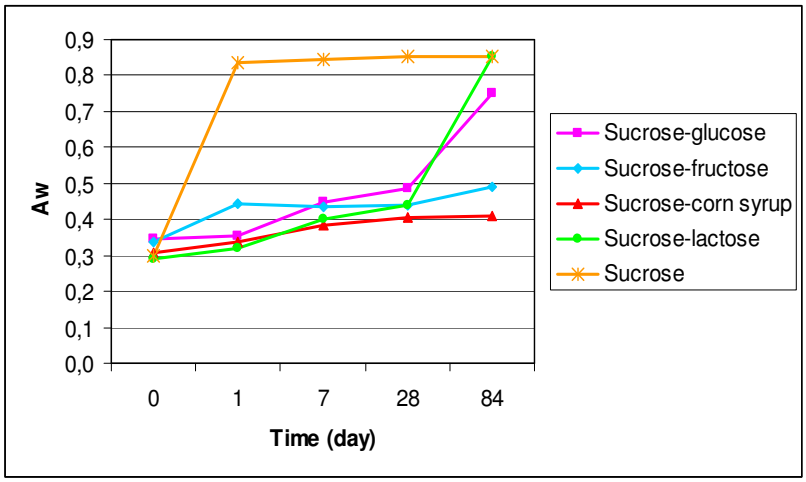


Figure 1: Water activity of sucrose-glucose(80:20), sucrose-fructose (80:20), sucrose-corn syrup (80:20), sucrose-lactose(80:20) and pure sucrose solutions within 84 days

The inhibition of crystallization rates of sucrose by addition of other sugars can be explain that monosaccharides, glucose and fructose and glucose polymers in corn syrup adsorb to the sugar crystal surface and inhibit incorporation of the sucrose molecules (Hartel, 1991).

**References**

Hartel, W. R., Shastry, V. A., (1991) *Critical Reviews in Food Science and Nutrition,* 1, 49-112

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