The Power of Sugar

What Is Sugar?

Sugar is made up of three molecules - oxygen, carbon and hydrogen.

It is found in plants, vegetables, fruits and grains. Also found in animal products like milk and cheese.

What Does Sugar Do?

The most common and obvious answer to this questions is that sugar SWEETENS. This is true and correct, but sugar has so many other powerful properties!

Here are 6 other roles that sugar plays in desserts:

- **Hydroscopic** - Sugar attracts and absorbs water molecules.
  Example: Cookies can remain soft and moist on the counter or store shelf because of the sugar/moisture retention. Or if you've ever added sugar to your strawberries, you've noticed that the sugar start to release strawberry "juice" creating a syrup.

- **Aerate & Stabilize** - The tiny sharp edges of little sugar crystals, when agitated fast enough, act as little shovels creating multiple air pockets.
  Example: Creaming butter and sugar or making meringue - fluffy stuff!

- **Depresses Freezing Poin**t - Sugar again bonds with water meaning it lowers the freezing point in ice cream. Sugar gives us scoopability.
  Example: Sorbet with no sugar will be hard and icy.
  Sorbet with too much sugar will be melty and soupy.

- **Fuel** - Sugar activates yeast
  Example: We see this in the making of breads and alcoholic beverages

- **Preserves** - Sugar preserves products
  Ex: Jams and Preserves

- **Caramelize** - Sugar has a chemical reaction when heat is applied, it changes in color, flavor and structure, changing from a solid to a liquid.

Applying Sugar to Ice Cream

Sweetness Power

Below is a chart that covers the sweetness power of different sugars. These are all in comparison to regular table sugar, which is 100% sweet.

It is important to understand the sweetness power of sugar as you are applying sugar to ice cream. Sugar as we learned bonds with water, so the more sugar you have in your ice cream base the more of the free water molecules it can trap, giving you a "scoopable" ice cream. But not enough sugar and your ice cream will be hard and icy (*unscoopable*). Understanding the sweetness of different sugars will allow you to make a more educated decision on what sugars to choose.

Anti Freezing Capability

Below is a chart that covers the anti freezing capabilities of different sugars. These are all in comparison to regular table sugar, which is 100% anti freeze.

To recap, when we talk about anti freezing capability and depressing the freezing point, we are referring to the same concept. They refer to the strength of a sugar in relation to how much it will allow your base or syrup to freeze or not freeze.

At the same temperature, let's say 0 Celsius, a syrup made with sugars that have a lower anti freeze power will freeze firmer. A syrup made with sugars that have a higher anti freeze power will be softer. The more anti freeze capability, the more scoop able your ice cream can be.

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Sweetness Power

Sugar	100
Dextrose	70
Maltodextrin	20
Fructose	170
Glucose	50
Inverted Sugar	125
Honey	130

Anti Freezing Capability

Sugar	100
Dextrose	190
Maltoextrin	30
Fructose	190
Glucose	80
Inverted Sugar	190
Honey	190

What The Heck Does This Mean?

Let's say you have two scoops of ice cream on a cone. Same recipe, one is made with trimoline and one is made with glucose.

Using the graphs above, we know that trimoline is sweeter than sugar and has a higher anti freeze capability.

Glucose on the other hand is less sweet than sugar and has a lower anti freeze capability.

So what can we conclude?
For one the ice cream with trimoline is sweeter and two, it is softer in texture because of the higher anti freeze.
The ice cream with glucose is less sweet and is more firm/frozen because of the lower anti freeze.

How Do We Apply This Knowledge To A Recipe?

Let's make a comparison between a scoop of vanilla ice cream and a scoop of pistachio ice cream.

Inside a ice cream display case that is set to 12 Celsius, the vanilla ice cream is going to scoop well and the pistachio ice cream is going to be harder to scoop. Why? Because we know that pistachio ice cream is more dense since it has a higher fat content.

How can our knowledge of different sugars help us make a better recipe so that our pistachio ice cream has the same texture/consistency as our vanilla ice cream in the same display case set at 12 Celsius?

By adjusting the types of sugars in the recipe! Yes!

So instead of just adding more sugar to the pistachio ice cream (which will make your ice cream softer), we want to switch the type of sugar we use. We want to maintain the same sweetness perception but increase the anti freeze capability.

Dextrose would be a great choice here. If for example, you decided to add 50 extra grams of sugar to your pistachio ice cream to achieve a better consistency, you could instead add 25g of dextrose. Since dextrose is only 70% as sweet as sugar (25x70% = 17.5g) it will only taste like you added 17.5g of sugar (not 25g). BUT dextrose has twice the anti freeze capability than sugar, meaning it has more power to bond with water giving you a softer, more scoopable ice cream.

Fun Fact:

Did you know that sugar increases the boiling point of water?

Water boils at 100C, but the introduction of sugar increases the boiling point.

If you took one cup of water, and you added two cups of sugar, the syrup would not longer boil at 100C. You would have to take the temperature higher.

If you took the same cup of water and added three cups of sugar, you would have to take the temperature even higher than the previous example.

This is why we need candy thermometers.

Stages of Sugar

Soft Ball	110-115C	Fudge, Pate de Fruit, Jams
Firm Ball	116-120C	Soft Caramels, Meringues
Hard Ball	121-130C	Nougat, Marshmallows
Soft Crack	132-145C	Taffy
Hard Crack	146-155C	Toffee, Lollipops

Sugar in Fruit

When it comes to making sorbets, knowing the amount of sugar in the fruit you are using is vital and will affect the texture of your sorbet significantly.

It isn't good enough to have one sorbet base recipe for ALL fruits. If you've ever eaten a cherry compared to a cranberry, you know there's a big difference.

Below is a chart outlining the sugar content of commonly used fruits - a useful reference to have when developing sorbet recipes.

Fruit	Avrg. Sugar %	Fruit	Avrg. Sugar %
Apple	14	Litchi	16
Apricot	10	Nectarine	10
Avocado	1	Mandarin	12
Banana	18	Mango	13
Blackberry	8	Melon	8
Black Currant	10	Orange	10
Blueberry	8	Papaya	8
Carrot	10	Passion Fruit	12
Cherry	15	Peach	9
Coconut	93	Pear	12
Cranberry	4	Persimmon	14
Fig	15	Pineapple	13
Grape	17	Plum	10
Grapefruit	7	Pomagranate	15
Guava	8	Raisin	18
Honeydew	10	Raspberry	9
Kiwi	12	Red Currant	6
Lemon	2	Strawberry	7
Lime	1	Watermelon	9

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