What is honey made of? The optical rotation of natural sugars

Honey has the property of rotating the plane of polarization of polarized light. Sugars, which are the major components of honey, are chiral compounds and like almost all naturally occurring carbohydrates the sugars present in honey are the D molecules. Each sugar, at a given concentration, affects the rotation by an amount that is characteristic of the sugar. The optical rotation of a mixture will depend on the relative proportions of the sugars present. Honey analysts used optical rotation as a method of sugar analysis for many years.

Bees gather nectar from flowers and concentrate it to make a supersaturated solution of glucose, fructose and sucrose. The bees add an enzyme, invertase, and this converts most of the sucrose (a disaccharide) in the nectar to glucose and fructose. The resulting mixture has, at hive temperature, a very high solubility in water. This has two advantages for the bees. The low water content (18%) of honey means that it is resistant to spoilage through fermentation and honey also represents a very dense store of energy, taking up a minimum of space in the hive.

- Measure the optical rotation of honey. Honey is a supersaturated solution of mostly D-glucose and D-fructose, with a small amount of sucrose. Find out how each of these substances is likely to rotate the plane of polarisation of polarized light. Are they dextrorotatory or laevorotatory? Which of the sugars is present in the highest concentration?

It is suggested that a solution is made by transferring 26 g of honey to a 100 cm^3 volumetric flask which is then diluted to volume with water.

Health & Safety

In planning this activity, you should consider health and safety. Check your plans with your teacher before implementing them.

Credits

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