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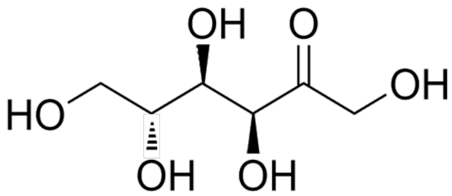
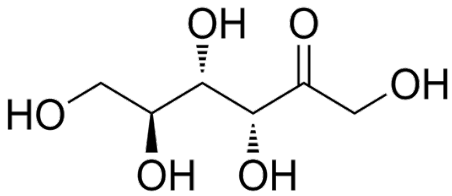
To bee or not to bee: the chemistry of honey

Chirality infosheeet

In the case of simple sugars, the addition of D/L, +/−, or *R*/*S* can be found in structure explanations. In the case of fructose, for example, this looks like this:

	
D-Fructose	L-Fructose
(−)-Fructose	(+)-Fructose
(3*S*,4*R*,5*R*)-Fructose	(3*R*,4*S*,5*S*)-Fructose

Upon taking a closer look at the two structures of fructose, it can be seen that certain OH groups point in different directions. The symbol means that the groups or atoms point to the front; the symbol means that the corresponding groups or atoms point to the back.

Such representations are used in cases where two (or more) possibilities exist. Such substances are called enantiomers (a special kind of isomers). They represent two different substances with different properties. The atoms are linked in the same way, but they differ in their three-dimensional structures.

To be able to form different three-dimensional structures with the same arrangement of atoms, a so-called chiral centre is necessary. The difference between whether a certain group points to the front or to the back seems minimal at first glance, but the various enantiomers often show enormous differences in their biological effects.

Enantiomers have very similar chemical properties and are therefore difficult to separate using chemical methods. To distinguish them, one can use the fact that enantiomers turn the plane of oscillation of linearly polarized light in different directions (optical activity).

Polarimeter

In a polarimeter, the light from a light source first passes through the polarizer.

Since light can be understood as electromagnetic waves that oscillate in all directions, the polarizer only allows light of a very specific orientation to pass through. After the polarizer, therefore, the light waves are oriented in one direction.

A chemical substance (with a chiral centre) in solution is now able to rotate these light waves, which, in turn, can be observed by an analyzer. The analyzer must be turned so far that the light waves become visible again, that is, as far as the optically active substance has turned the waves before. Now the angle can be determined.

The designation +/– in the name of a compound indicates the direction in which the light is rotated: + indicates compounds are rotating light clockwise; – indicates compounds are rotating light anticlockwise.