Optical activity

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Optical activity (optical rotation) is the turning of the plane of linearly polarized light as the light travels through certain materials. It occurs in solutions of chiral molecules. It is being developed as a method to measure blood sugar concentration in diabetic people.

Introduction

Optical isomers, or enantiomers, have the same sequence of atoms and bonds but are different in their 3D shape. Two enantiomers are nonsuperimposible mirror images of one another (=chiral). Optical isomers also have no axis of symmetry. Optical isomers have basically the same properties but there are a few exceptions (uses in biological mechanisms and optical activity).

Rotation of light

An enantiomer that rotates plane-polarized light in the positive direction, or clockwise, is called dextrorotary ((+) or d-), the enantiomer that rotates the light in the negative direction ist called levorotary ((-) or l-). When both d- and l- isomers are present in equal amounts, the mixture is called a racemic mixture.

Measuring Optical Activity

Optical activity is measured by a polarimeter and is dependant on several factors: • concentration of the sample • temperature • length of the sample tube or cell and • wavelength of the light passing through the sample. Rotation is given in +/- degrees, depending on whether the sample has d- (positive) or l- (negative) enantiomers. The standard measurement for rotation for a specific chemical compound is called the specific rotation, defined as an angle measurement at a path length of 1 decimeter and a concentration of 1g/ml. The specific rotation of a pure substance is an intrinsic property of the substance. In solution, the formula for specific rotation is:

$\alpha (T,\lambda) = \alpha / l*c$

where α is the measured angle of rotation of a substance, l is the path length in decimeters, c is the concentration in g/ml, and α (T,λ) is the specific rotation in degrees cm3 dm^{-1} g^{-1}) at a given temperatute T in Celsius and wavelength in nanometers.

References 1. http://en.wikipedia.org/wiki/Optical_rotation 2. http://de.wikipedia.org/wiki/Optische_Aktivität 3. http://chemwiki.ucdavis.edu/Organic_Chemistry/Chirality/Optical_Activity 4. http://rudolphresearch.com/polarimeters-and-polarimetry/#.UqTqazmABSV 5. http://www.mhhe.com/physsci/chemistry/carey/student/olc/ch07optical_activity.html