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Ms. Winny George

Characterization of Quartz Plates using a Homogeneity Set-Up.

ABSTRACT - Masterthesis

Sugar is something we need in our day to day life, be it for taste, health or flavour. Many of our daily consuming products either have sugar in the granule form or have sugar concentration in them. The amount of sugar present in the liquid commodities is an important aspect that anyone who is health conscious would be interested in. Many chemical and sugar industries use polarimetric measurements to gain precise information about the sugar concentration in alcoholic beverages, fruit juices etc. Not only sugar, other substances can be detected or measured-with polarimeters.

The explanation of 'optical activity' becomes an important aspect when discussing polarimeters. The light which is mainly the electromagnetic in nature oscillate normal to the direction of propagation. Some materials allow the propagation of light in a single direction (in a single plane) and it is called polarized light. Some organic substances can rotate the plane polarized light in accordance to the optical axis of the solution of the organic substance (clockwise or counter clockwise) or the organic substance itself. The organic substances that have this property are said to be optically active in nature. The rotation is directly proportional to the amount of molecules that interact with the light that is passed through it. As a result, the degree of rotation is dependent on the nature of the molecules interacting, the path length and its concentration. This optical rotation is measured using a polarimeter.

Now to calibrate these polarimeters in general, quartz control plates are used as calibration standards to check polarimetric instruments. The ICUMSA (International Commission for Uniform Methods of Sugar Analysis) and the OIML (International Organization of Legal Metrology) give the specifications on how the quartz plates should be (geometry, material properties, etc.). OIML indicates a visual test for homogeneity wherein defects like scratches, crystalline defects, twinning and other hazy defects may be seen though it is subjective. A small defect in the quartz plate can cause changes in the optical rotation and hence the angles may vary. This change can cause a problem in the calibration of the quartz plate later.

In this thesis, the quartz plates are proofed for optical homogeneity with a camera based polarimetric set-up. Camera pictures are analyzed with the help of MATLAB for a quantitative analysis of the quartz control plates under test.