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A review on the measurement of optical activity by using a Polarimeter

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Abstract
The plane polarized light passing through the solutions of some organic and inorganic compounds caused polarized light to rotate. This property is known as optical activity. The amount and direction of rotation can be determined with a Polarimeter. The present work gives the earlier, current developmental status and design considerations of existing optical activity measurements, instruments, analysis and techniques for automation. The above said areas are covered in the review. The intention of the present work is to develop the future research work in the field of polarimetry.

Keywords: Optical activity, Polarimetry

1. Introduction
Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] having chromosome number 2n=22 also Polari meters can be used to find the specific rotation of the solution or if the specific rotation is known, they can be used to find its concentration at single wave length (the Na 589 nm D line). When they are calibrated to read directly the % of cane sugar in solution, they are named as saccharimeters. In olden days Polarimeters used light sources of single wave length. Due to advances of modern technology light sources of multi wavelength are being used now; this system is called Spectro Polarimeter. In Spectropolarimeter the samples are studied over a wide range of wave length where by the dependence of the rotation on the selected wave length range is measured and is termed as Optical Rotatory Dispersion. The Spectropolarimeter is similar to a Polarimeter only inasmuch as they utilize radiation in the same wavelength range [1]. It finds extensive application in the analysis of sugar and other optically active drugs for the measurement optical rotation and direction [2]. The direction and extent of rotation (the optical rotatory power) is useful for both qualitative as well as quantitative analysis. It is great importance in the elucidation of chemical of chemical structural information of optically active components [3]. The main aim of this paper is to deliver an outline of the Polarimetry. Design and development of the experimental setup for measurement of optical activity¬ Benjamin Carroll and Ira Blei [4] have reviewed history of various Polarimeters and application of Polarimeter. They also classified Automatic Recording Polarimeter in to two types: namely instruments in which the null-point method, other one is instruments in which a ratio method is used. Explained schematic diagram of Rudolph, Cary, Bendix Ericsson, Gillham-King Spectro Polarimeter detailed in this paper. Reinbold and Pearson described the modifications made to a Perkin-Elmer 141 polarimeter which enabled the acquisition of continuous optical rotatory dispersion data over the spectral region of 650 - 240nm. The modifications basically consisted of replacing the existing light source of the Model 141 polarimeter with a double grating monochromator and a high intensity xenon light source. The instrument can be used for operation with strongly colored likewise in performing measurements in the far UV range of the spectrum.
Reinbold and Pearson [11] presented the modifications to a Perkin-Elmer model 141 Polarimeter to obtain continuous optical rotatory dispersion data over the entire spectral region which can be obtained with the original calcite polarizing and analyzing prisms and the IP 28 photomultiplier detection systems. The modifications are not extremely difficult and require only a minimum of technical services. The modification consisted essentially of adding an optical bench which contain high intensity light source.
Abramov and Gassakovaskii [12] designed a Spectropolarimeter for measuring optical activity with no modulator. He explains that when modulation is used in Spectro polarimetric measurements only the plane polarized component of the total light flux that passes through the Polarimeter polarizer is modulated. Its informative part can then be analyzed by isolating the variable component of the total photomultiplier current. Modulation is normally carried out either mechanically for example by oscillating the polarizer at a specified frequency or by

using magneto optical or electro optical modulators. The first method requires a high precision mechanical system capable of maintaining a specified modulation amplitude and frequency. The use of magneto or electro optical modulators demands a signal generator capable of providing relatively high frequencies. The use of mains current at 50 HZ always causes difficulties because of noise having the same frequency. Thus, the use of a modulator as part of a reasonably high sensitivity Spectropolarimeter has certain difficulties. The method that he suggested for measuring the angle of rotation of plane polarized light by the optically active substance is based on the same principle of detecting only the plane polarized component of the light flux, but does not require modulation.

K. Muralidhara Reddy and C. Nagaraja [16] has designed [16] A PC based Polarimeter based on Malus' law comprising of a polarizer (P) and an analyzer (A1), arranged on a common axis so that their transmission axes are parallel. Linear polarized light passes through the analyzer (A1). The transmission axis of the analyzer (A1) is parallel to this wave. When an optically active substance (ST) is placed between the polarizer (P) and analyzer (A1), the polarization plane of said linear polarized beam has an angle relative to the transmission axis of analyzer (A1). The linear polarized monochromatic light is divided into two equal parts by a beam splitter (BS1) after passing through said optically active substance (ST). One part of the light passes straightly through the analyzer (A1), which is parallel to the polarizer (P). Since the analyzer (A1) is always kept fixed, the optical rotation can be evaluated. The second part of the light reflected from the beam splitter (BS) at 90 deg is passed through a second analyzer (A2) positioned at 45 deg with respect to the polarizer (P) and the intensity is measured and analyzed.

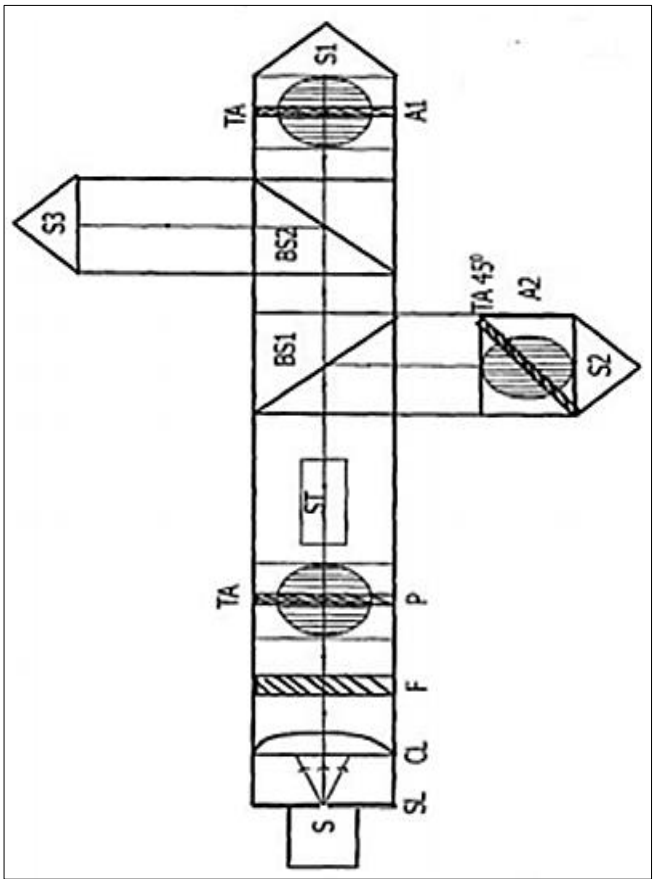

Fig 1: Optical system for polarimeter

The LUMO (liquid monitoring using novel optical sensors) presented [17] a paper on "optical rotary dispersion of sugars". In which describes the background information and theory of optical activity. Explained method, rotation of the polarization is clockwise for + and counter clockwise for -, and temperature effect on the optically active compounds. Discussed on Cotton effect of ORD Spectrum can be. Experimental setup is developed, block diagram explained with parts and specifications. The procedure developed for calculating the Optical rotation from malus law. Identified multiple sugars and measure their concentrations in sugar-water mixtures, ORD spectra for sucrose, glucose and fructose were measured in the visible wavelength region 500-700 nm. ORD spectra were measured for solutions containing two different sugar types at varying concentrations.

2. Conclusion

The present work can provide good research knowledge on Polarimeters theoretical methods and experimental method. The hardware and software implementation provides to develop new dimensions in the felid of polarimetry. Therefore, this paper provides an overview for a researcher interested in the field of polarimetry.

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