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Polarimetry in the Field of Pharmaceutical Analysis

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Opinion Article

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ABOUT THE STUDY

Polarimetry is the measurement and interpretation of the polarization of transverse waves, particularly electromagnetic waves such as radio waves. Polarimetry is typically used to characterize electromagnetic waves that have passed through or been reflected, refracted or diffracted by a material. An ordinary ray of light is thought to vibrate in all planes at right angles to its propagation direction, according to the wave theory of light. When this ordinary ray of light is passed through a nicol prism, the emergent ray has only one plane of vibration. The basic scientific instrument used to make these measurements is a polarimeter, though this term is rarely used to describe a polarimetry process performed by a computer, such as in polarimetric synthetic aperture radar. Polarimetry can be used to measure a material's optical properties such as linear birefringence, circular birefringence as an optical property, linear dichroism, circular dichroism and scattering. There have been many designs of polarimeters, some archaic and some still in use, to measure these various properties.

The most sensitive use interferometers, while more traditional polarimeters use a combination of polarizing filters, wave plates and other devices to investigate the physical properties of sources such as active galactic nuclei and blazars, exoplanets, interstellar gas and dust, supernovae, gamma-ray bursts and stellar rotation stellar magnetic fields, debris discs, binary star reflection and cosmic microwave background radiation observations of astronomical polarimetry are performed as imaging polarimetry, where polarization is measured as a function of position in imaging data, spectropolarimetry, where polarization is measured as a function of light wavelength or broad-band aperture polarimetry.

Optically active samples, such as chiral molecule solutions, frequently exhibit circular birefringence. Circular birefringence causes plane polarized light to rotate as it passes through the sample. Vibrations occur in all planes perpendicular to the propagation direction in ordinary light. When light passes through a nicol prism, its vibrations

are cut off in all directions except the direction of the prism's axis. Because its vibration is only in one direction, the light that emerges from the prism is said to be plane polarized. If two nicol prisms are placed with their polarization planes parallel, light rays emerging from the first prism will enter the second prism. As a result, no light loss is observed.

However, if the second prism is rotated by 90° angle, the light that emerges from the first prism is blocked by the second prism and no light emerges. The first prism is commonly referred to as the polarizer while the second prism is referred to as the analyzer. To measure this rotation, a simple polarimeter consists of a long tube with flat glass ends into which the sample is placed. A nicol prism or other polarizer is located at each end of the tube. Light is shone through the tube and the prism at the other end which is attached to an eyepiece is rotated to reach the region of complete brightness, half-dark, half-bright or complete darkness. A scale is then used to read the angle of rotation. The same phenomenon is observed after a 180° angle. The sample's specific rotation can then be calculated. Temperature can influence light rotation which should be considered in the calculations. Polarimetry of thin films and surfaces is often referred to as ellipsometry. Polarimetry is used in a variety of remote sensing applications including planetary science, astronomy and weather radar. Polarimetry can also be used in wave computational analysis. Radars, for example, frequently use wave polarization in post-processing to improve target characterization. Polarimetry can be used in this case to estimate the fine texture of a material assist in resolving the orientation of small structures in the target and when circularly-polarized. The number of bounces of the received signal is resolved using antennas.