砂糖溶液の旋光現象による透過光強度変化の予測

Prediction of changes in intensities of light beans traveling in sugared water to be caused by optical rotation phenomena

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Demonstration experiments on polarization phenomena including coloration of polarized light beams are effective for attracting audiences' interests. Compared to coloration by birefringence, coloration by optical rotation is not so often performed. One of disadvantages for the coloration by optical rotation in sugared water is difficulties in theoretical predictions of colors to be observed. In this study, an equation that can provide us with theoretically expectable values for the angle of rotation for light beams of any colors (wavelengths) transmitting in sugared water of any concentrations was successfully established. The equation successfully realized theoretical expectations of intensities as well as observable colors of light beams transmitting in sugared water that showed satisfactory matches with the measured or observed results.

偏光した光線の着色を含む偏光現象に関する演示実験は、観客の興味を引くために効果的であるが、複屈折による着色現象に比べて、旋光による着色現象はそれほど頻繁には実施されない。例えば、水溶液内を透過する光に対する旋光の作用による着色は物理的にも興味深い現象であり，高校物理や生徒・学生実験などでも興味深いテーマになり得る．しかし、砂糖溶液中における旋光による着色現象の問題点の一つは、観察される色の理論的予測の困難さである。本研究では、任意の濃度の砂糖溶液中を透過する任意の色（波長）の光線に対する旋光角度の理論的な予測値を与えることができる等式を、導出することができた。この等式は、砂糖溶液中を透過する光線の強度ならびに観察可能な色について理論的予測を実現し、これらは測定または観察結果と満足のいく一致を示した。

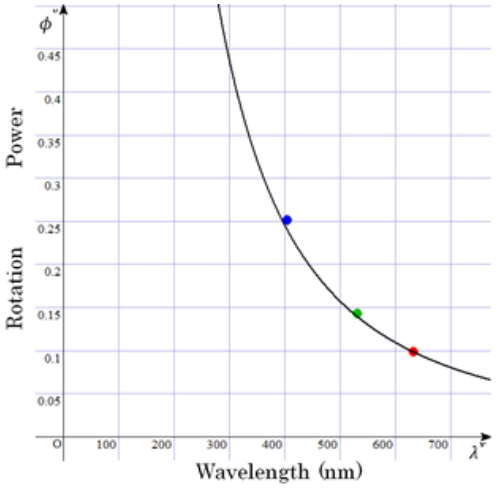

Fig.1 Predicted (solid line) and measured (plots) characteristics of the angle of rotation over wavelengths of transmitted laser beams (the angle of rotation (rad/cm) on the vertical axis and the wavelength (nm) on the horizontal axis) [1].

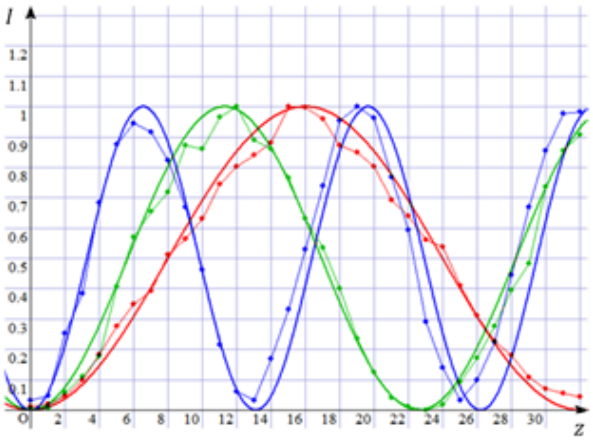

Fig.2 Predicted (solid line) and measured (plots) characteristics of the intensity changes of the transmitted laser beams in the sugared water at the concentration of 73% [1].

[1] Seika Tokumitsu and Makoto Hasegawa, 14th Intl. Conf. on Education and Training on Optics and Photonics (ETOP2017), paper no.ETP100-67, 2017-05.