TWIST SENSE DETERMINATION ON MICELLAR CHOLESTERIC LYOTROPIC MESOPHASES

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ABSTRACT - Cholesteric lyotropic mesophase twist sense was determined by two methods, both using a polarizing microscope under monochromatic orthoscopic illumination.

In this note, we report by the first time twist sense determinations on micellar cholesteric lyomesophases. Type II twisted mesophases [1] prepared from decylammonium chloride (DAC) and sodium decyl - sulphate (SDS) have been investigated. Cholesteric properties have been induced in DAC samples by adding small amounts of cholesterol. For the SDS mesophases, a new inductor has been used , the diacetone- L - sorbose (2,3,4,6 - di- O - isopropylidene - α - L-sorbofuranose, DAS) easily prepared by reacting sorbose with acetone.[2] The mesophase compositions were (% molar fraction):

(A) DAC 5.07 ; ammonium chloride 1.93 ; water 92.80 and cholesterol 0.20.

(B) SDS 4.37 ; sodium sulphate 1.05 ; decanol 1.08; water 93.39 and DAS 0.11.

Twist sense has been determined independently by two methods. The first one is based on a modification of the wedge method,[3-5] originally applied to thermotropic cholesteric mesophases. The cholesteric phase is oriented in planar alignment, in a cell of variable thickness. With a polarizing microscope, under monochromatic plane polarized light, extinction zones can be seen. If on rotating the analyzer clockwise,[3,4] the extinction zone displaces towards the large thickness region, the helical array is right-handed. We have adapted the method by using micro culture slides. These slides are easily available for biological studies and have one polished spherical well 18 mm in diameter and approximately 0.5 mm. deep. The lyomesophase was poured into the well and the cover slip was sealed with paraffin. The planar alignment was achieved by a magnetic field (1.41 T) applied perpendicularly to the slide plane. Under such conditions the extinction zones are circles and the same procedure described above is applicable. The second method is essentially an optical rotatory dispersion method. It is based on the theory developed by de Vries [6] to explain the rotatory power and other optical properties of cholesteric liquid crystals . Recently [7,8] the method was used for cholesteric sense determination of polypeptide lyotropic mesophases, from ORD and CD data. The optical rotatory power is measured with a polarizing microscope for several wavelengths (λ). The different wavelengths were obtained by means of a continuous interference-filter monochromator (Zeiss, model 47 43 10), attached to the light source properly diaphragmed. Samples in flat capillar cells, 0.3 mm thick, were previously oriented in planar alignment by a magnetic field. The plot of the rotatory power (ϕ) against $1/\lambda^2$ (de Vries plot) is

a straight line. If the wavelength of the associated cholesteric pitch[8] band is in the infrared region, the slope is positive for a left-handed cholesteric mesophase or negative for right-handed systems. A left-handed cholesteric twist for the DAC / cholesterol mesophase was determined by the wedge method and confirmed by the de Vries plot (see Fig. I.a). The opposite handness was obtained for the SDS/DAS mesophase (see Fig. I.b).

Both methods, which involve observations with a polarizing microscope, are simple and require small samples amounts. Either of them can be applied since they give the same handness. The first method demands a single monochromatic filter, as just one wavelength is involved. The second needs an adjustable monochromator, and the slope of the ϕ x $1/\lambda^2$ plot depends on the pitch length and the birrefringence values.[6] Therefore, if the pitch is known, the birrefringence value can be determined.

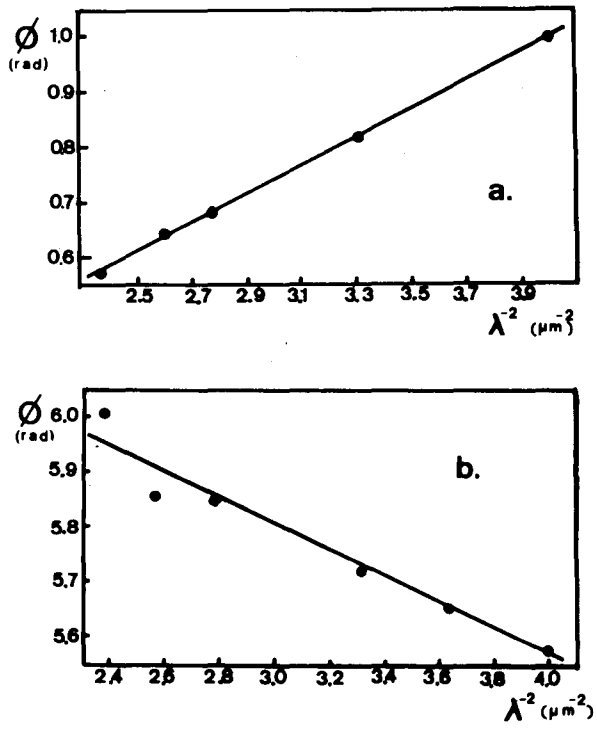

FIGURE I - De Vries plot for cholesteric type II lyomesophases, at room temperature:
a) DAC/cholesterol ; b) SDS/DAS.

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