Collective character of previtamin D *cis-trans* isomerization in nematic and cholesteric liquid crystals

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Photomodulation of structure and optical properties of liquid crystals (LCs) induced by photochemical reactions of doped photosensitive molecules is of great current interest. Here we discuss the opposite effect of the influence of the ordered nematic and cholesteric LC media on the photoisomerization of chiral steroid 7-dehydrocholesterol (7-DHC, provitamin D_3) molecule.

It is known that the short-wavelength UV irradiation ($\lambda = 253.7$nm) of 7-DHC results in the formation of previtamin D (Pre) by hexadiene ring opening. Previtamin D is also a photosensitive molecule and under UV irradiation it undergoes a number of photoconversions with the most efficient *cis-trans* isomerization into tachysterol (T). The accumulation of *trans*-isomer is accompanied by significant increase of the sample optical density in the 250÷310 nm spectral region [1].

Kinetics of 7-DHC photoisomerization in mesophase and isotropic phase of LCs was studied using UV absorption spectroscopy. At room temperature it was found that the efficiency of *cis-trans* isomerization increased significantly with raising of the 7-DHC concentration from 0.04 wt.-% to 3 wt.-% in both nematic and cholesteric LCs.

Besides, the remarkable reduction of the *cis-trans* isomerization efficiency was established with the temperature rising up to the isotropic phase transition. Finally, in isotropic phase no dependence on the 7-DHC concentration was found.

As was shown by numerical calculations [2], the concentration dependence of *cis-trans* isomerization cannot be explained merely by the increase of individual quantum yield because the optical density increase corresponded to the quantum yield $\varphi > 1$.

We believe that the previtamin D *cis-trans* isomerization acquire the collective character in the mesophase with the decrease of distance between neighboring previtamin D molecules, i.e. with the concentration rise of dopant 7-DHC molecules.

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References

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