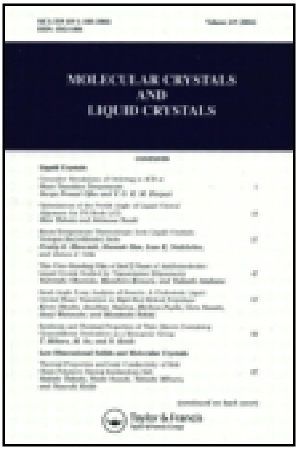

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Spectroscopic Properties of Retinoid Molecules in Langmuir-Blodgett Films

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Spectroscopic Properties of Retinoid Molecules in Langmuir-Blodgett Films

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Retinoid molecules have possibilities for novel photonic devices. In this work, we deposited retinoid LB films, and measured absorption spectra of the films. The absorption maxima of the LB films of retinal mixed with DPPC red-shifted, when the area of the retinal molecules decreased. It would be due to the dipole interaction between retinal and DPPC. The absorption spectra of the LB films of retinoic acid had four peaks. It would be caused by the monomer and three type aggregates.

Keywords: retinal; retinoic acid; DPPC; absorption; aggregation; dimer

INTRODUCTION

Bacteriorhodopsin has received large attentions for the application to the molecular electronic devices [1], molecular optical devices [2] and a molecular computer . Retinal is a chromophore contained in this protein, and interacts with photons directly. Using retinoid molecules, it may be possible to create novel devices. So the retinoid molecules have also attracted attention, and some studies of monolayers and LB films of the retinoid molecules

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were reported [4-7]. In this work, we deposited retinoid LB films, and investigated optical properties of the films by absorption spectroscopy.

MATERIAL AND METHOD

We examined LB films of all trans-retinal, retinoic acid and mixed films with stearic acid and DPPC. Chloroform was used as the spreading solvent throughout this work. Subphase were ultra pure water for the retinal films, and $CdCl_2$ solutions (0.4mM) for the retinoic acid films. Monolayers were transferred onto quartz plates (14.90mm x 63.90mm x 1.05mm) by the vertical deposition method using moving wall type LB-150MW system (Nippon Laser & Electronics Lab.) at various surface pressures.

Absorption spectra of the LB films were observed using UV-260 system (Shimadzu Corporation).

RESULTS AND DISCUSSION

In the π-A isotherm of retinal, as the surface area of the monolayer was reduced, the surface pressure increased slowly. At the area less than 43Å^2/molecule, the pressure was almost constant ($\pi \approx 18$mN/m). In the isotherm of retinal mixed with DPPC or stearic acid, the pressure increased again when the area was reduced below the constant pressure region. As the molecular ratio of DPPC increased, the width of the constant pressure

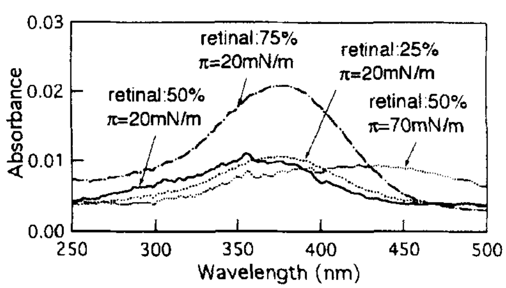

FIGURE 1 Absorption spectra of LB fims of retinal mixed with DPPC. π is the sureface pressure for deposition.

region became narrow.

The observed limiting molecular area of retinoic acid was about 3Å^2/molecule. The area was significantly smaller rather than the general cases, so the monolayer could be overlapped by itself or collapsed.

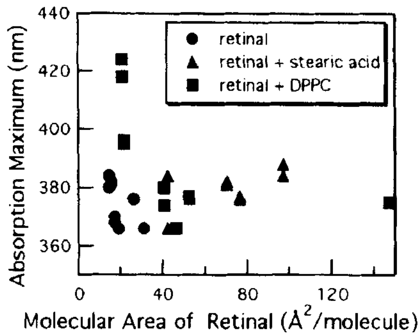

FIGURE 2 Therelationship between the molecular area of retinal and the absorption maximum of LB films of retinal mixed with DPPC.

Figure 1 shows observed absorption spectra of the LB films of retinal mixed with DPPC. When the surface pressure for deposition increased, the molecular area of retinal decreased and the spectra were red-shifted (Fig. 2). In Fig.2, the molecular area were corrected by the transfer ratios. The ratios were larger than 100%, and it could suggest overlap or collapse of the monolayers. It would be due to the decrease of the excitation energy by the interaction between dipole moments of retinal and DPPC.

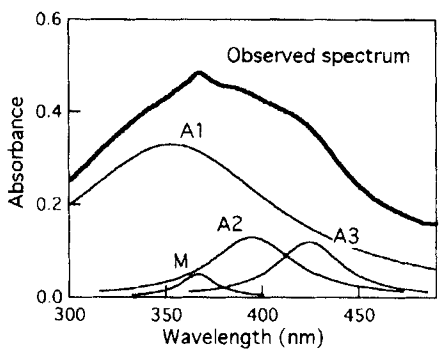

FIGURE 3 Absorption spectrum of the retinoic acid LB film. The spectrum could be resolved into four peaks, A1-3 and M, using Lorentzian function.

Figure 3 shows a observed absorption spectrum of the LB film of retinoic acid. The spectrum could be resolved into four peaks. In the absorption spectra of the LB films of retinoic acid mixed with stearic acid, as the molecular ratio of retinoic acid were reduced, the absorbance of peak at 370nm significantly increased, but the intensity of other peaks decreased. The peak of 370 nm would be due to the monomer molecules. The other three peaks would be explained by the formation to three type aggregates (dimer) of retinoic acid which had different interaction energy.

CONCLUSION

The absorption maxima of the LB films of retinal mixed with DPPC red-shifted, when he area of the retinal molecules decreased. The absorption spectra of the LB films of retinoic acid could be resolved to four peaks. It would be caused by the monomer and the formation of three type aggregates of retinoic acid which had different interaction energy.

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