

COMMUNICATIONS

LETTERS

Fluorescence Spectra of Poly(L-lysine)/Sulfated Poly(vinyl alcohol)/Acridine Orange Complexes

Chong-Su Cho

Department of Chemical Engineering, College of Engineering, Chonnam National University, Kwangju 500, Korea

(Received February 3, 1981)

In a previous paper,¹ we studied the interaction between poly(L-lysine) (PLL) and partially sulfated poly(vinyl alcohol) S: PVS-25, PVS-30, PVS-46 and PVS-95 (The number indicates the degree of sulfation in mol%) as a model for the polypeptide/polysaccharide complex in biological connective tissue. It was found that PLL takes a random coil conformation in the PLL-PVS-25 complex, a random coil conformation including a small amount of α -helix in the PLL-PVS-30 complex, and the α -helix in the PLL-PVS-46 and PLL-PVS-95 complexes over a wide range of pH, from 2 to 12.

Furthermore, a study was also made on the PLL-PVS-Acridine orange complexes to elucidate the structure of the PLL-PVS complexes.² The PLL-PVS-25 acridine orange complex did not give the acridine orange-induced circular dichroism(CD), indicating a random arrangement of the acridine orange molecules bound to the VS groups in the PLL-PVS-25 complex. The PLL-PVS-30 acridine orange complex gave a small acridine orange-induced Cotton effect. The PLL-PVS-46-acridine orange and PLL-PVS-95-acridine orange complexes gave well defined induced CD spectra with small troughs at 435 and 510 nm and a large peak at 465 nm, indicating a right-handed superhelix of the acridine orange molecules around the right-handed α -helix of PLL chain, where the PVS chain is intercalated. It is probable, however, that the PVS chain segments are arranged in both right- and left-handed superhelices around the PLL helix.

In this paper, we wish to report some supplementary evidence for the structure of the PLL-PVS/AO complexes by means of fluorescence spectra,

Figure 1 shows the fluorescence spectra of the PVS/AO complexes according to the charge density of PVS. We observe that fluorescence intensity of AO become weak by forming the complex with PVS and the emission maximum wavelength of the AO only is 535 nm which appears in the monomer type(green fluorescence) but the maxima of the PVS-AO complexes are two, one being monomer type, the other being aggregated type which appears at about 600

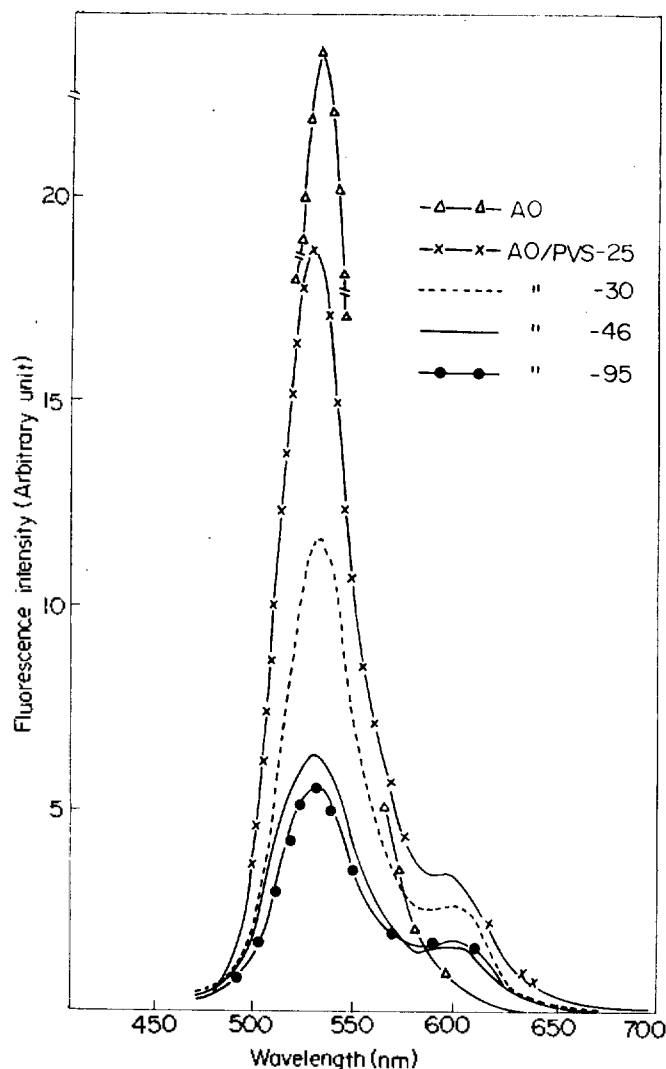


Figure 1. Fluorescence spectra of the PVS/AO complexes according to the charge density of PVS with excitation wavelength at 280 nm.

nm(red fluorescence)³. We can also find that AO molecules are aggregated by forming complex with PVS. In these results, it might be regarded that the fluorescence of AO is greatly quenched because of the aggregation of AO by forming complex with PVS.⁴

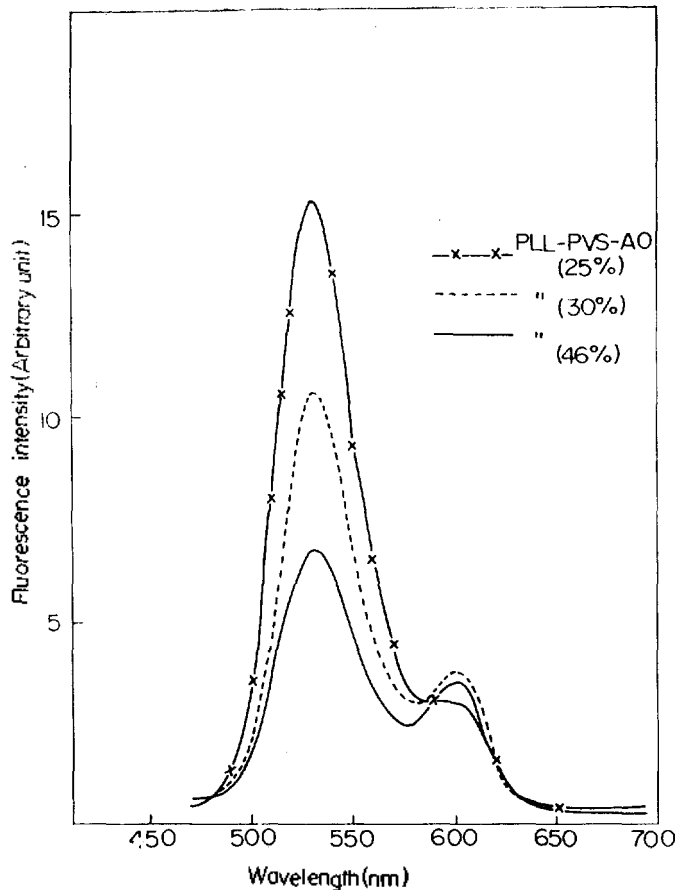


Figure 2. Fluorescence spectra of the PLL/PVS/AO complexes according to the charge density of PVS with excitation wavelength at 280 nm.

Furthermore, it is found that the fluorescence intensity depends on the PVS charge density, which shows that fluorescence intensity decreases with increasing PVS charge density. These results may indicate that chain flexibility decreases with increasing the PVS charge density⁵ and the

aggregation of the AO molecules is promoted around the PVS charge density.

Figure 2 shows the fluorescence spectra of the PLL/PVS/AO complexes as a function of the PVS charge density. In the case of PLL/PVS-25/AO complex which takes random coil, its fluorescence intensity becomes weaker than that of PVA-25/AO system. This result indicates that the chain flexibility of PLL/PVS-25/AO decreases by the AO binding to the PLL/PVS-25, therefore AO molecules being aggregated.

In case of PLL/PVS-30/AO and PLL-PVS-46/AO complexes which take partial helix conformation, the fluorescence intensities of those complexes are stronger than that of PVS-30/AO and PVS-46/AO. These results can be explained by that the compact conformation of partial helix of PLL/PVS-30/AO and PLL/PVS-46/AO increases the fluorescence intensities more than extended coil conformation of PVS-30/AO and PVS-46/AO complexes.⁵⁻⁷

Acknowledgement. This investigation was supported by the grant from the Korea Science and Engineering Foundation.

References

- (1) C. S. Cho, T. Komoto, A. Nakagami and T. Kawai, *Makromol. Chem.*, **180**, 1951 (1979).
- (2) C. S. Cho, T. Komoto and T. Kawai, *Makromol. Chem.*, **181**, 193 (1980).
- (3) V. Zanker, *Z. Physik. Chem.*, **199**, 225 (1952).
- (4) B. Simionescu and G. J. Smets, *Makro. Chem., Suppl.*, **1**, 249 (1975).
- (5) G. Muller and J. C. Fenyo, *J. Polym. Sci. Polym. Chem. Ed.*, **16**, 327 (1978).
- (6) L. Stryer, *Science*, **162**, 526 (1968).
- (7) v. Vitagliano, L. Costantino and R. Sartoria, *J. Phys. Chem.*, **80**, 959 (1976).