The Absorption Spectra of Quinolino-quinolines

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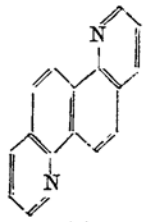
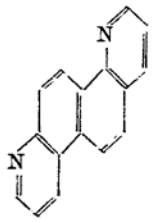
The recent advances in chemical physics have enabled us to interpret the electronic states and spectra of rather complicated molecules, although the theoretical treatments are more or less crude ones, which may be inevitable at the present stage of our knowledge. In this respect, the most well studied are aromatic hydrocarbons, while no pertinent investigations have hitherto been made with hetero-molecules, which is mainly due to the lack of spectroscopic data on these substances. The present report is concerned with the study of spectroscopic properties of quinolino-quinoline compounds, with a view to contributing fundamental data for theoretical elucidation of electronic states of heterocyclic compounds.

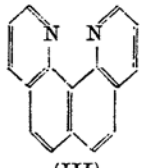
The compounds investigated were the following four types of quinolino-quinolines;



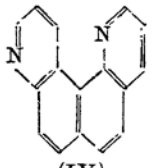
(I)



(II)



(III)



(IV)

Among these, the componds (I) and (II) correspond to the hydrocarbon chrysene, and (III) and (IV) to 3, 4-benzo-phenanthrene. The solvent used was ethanol and the measurement of absorption was made within the range of 2500 Å. to 4000 Å. by using the quartz-spectrograph QM-60 combined with the photo-multiplier-tube 1P28.

It was found that the four compounds studied have the property in common of showing three main absorption bands, among which the band at the shortest wave-length is most intensive, while the other two have almost the same intensity. These three bands may be regarded as corresponding to the three bands of chrysene and 3, 4-benzo-phenanthrene, respectively. The characteristic features of the absorption bands shown by quinolino-quinolines lie in the fact that, in the case of the compounds (I) and (II), the second band is split into two, while in the case of compounds (III) and (IV) the splitting occurs in the band at the longest wave-length. The absorption maxima observed are listed in Table 1, in which also the data for chrysene and 3, 4-benzo-phenanthrene reported by Klevens and Platt[1] are given for comparison.

Table 1 (λ in Å. unit)

Compounds	First band	Second band	Third band
Chrysene	2690	3310	3640
I	2640	2940, 3080	3490
II	2650	2930, 3060	3490
III	2640	3100	3460, 3610
IV	2690	3050	3460, 3660
3, 4-benzo-phenanthrene	2810	3300	3740

As may be seen from the table, the absorption spectra shown by the compounds (I) and (II) are very similar to each other, resembling on the whole the spectrum shown by chrysene, while those of compounds (III) and (IV) are similar to each other, both resembling the spectrum of 3, 4-benzo-phenanthrene. It is, however, to be noticed that when compared with bands shown by the corresponding hydrocarbons, the bands shown by quinolino-quinolines are always shifted more or less to the side of shorter wave-lengths. At any rate, it may be concluded that the replacement by nitrogen of the carbon in a benzene ring entails far less change in the spectroscopic properties of aromatic compounds than does the change in the mode of combination of benzene nuclei.

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(1) H. B. Klenvens and J. R. Platt, *J. Chem. Phys.*, **17**, 470 (1949).

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