

EMISSION SPECTRA OF XYLENES
BY CONTROLLED ELECTRON IMPACT

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The emission spectra of o-, m- and p-xylenes were observed by exciting them with controlled electron beam of 200 - 300 V. A characteristic band of the aromatic hydrocarbon was observed in the 270 - 320 nm region. However, the intensity and the vibrational structure of the band of p-xylene were different from those of o- and m-xylenes.

The emission spectra of simple molecules under electron impact excitation were investigated by many researchers. However, little has been done on large organic molecules as aromatics. The emission spectra of toluene and anisole were reported and a characteristic band was observed in the 250 - 320 nm region.¹⁾ Those of xylenes are communicated in this letter.

In the emission spectra under electron impact excitation, the photoemission from small fragments of large molecules was observed more easily than that from large parents themselves. This is probably because the latter has more freedoms of motion and non-radiative processes become more predominant. The aromatic molecule is one of exceptional molecules of which excited large parent species give intense photoemission.

Typical emission spectra of xylenes under electron impact excitation in the 250 - 450 nm region are shown in Fig. 1. The spectrum of m-xylene is similar to that of o-xylene. A characteristic band was observed in the 270 - 320 nm region with the different intensity and the different vibrational structure for each xylene. The band observed in the present study corresponds well to the band of fluorescence spectrum in both location and structure.²⁾ Thus, it is assigned to the transition from the lowest excited singlet state to the ground state as in the cases of toluene and anisole.¹⁾ In these spectra there are some additional features, which could be assigned to the fragment species. The sharp lines at 434, 410, 397 and 389 nm are assigned to the hydrogen Balmer series and the bands at around 431 and 389 nm to CH radical.

The difference in the appearance of the spectra of p- and o-xylenes is noteworthy. The former has more vibrational structure and the latter is more diffuse. This phenomenon is also observed in the fluorescence.²⁾ The relative intensity of aromatic band over hydrogen Balmer series shows a remarkable difference in two spectra. The fluorescence yield of p-xylene was reported to be larger than that of o- and m-xylenes.³⁾ It can be concluded that the molecule

with higher symmetry has a sharper and stronger band than the one with less symmetry in the emission spectrum by electron impact just as in the fluorescence. This is probably because the former has less vibrational modes to interact with the electronic level.

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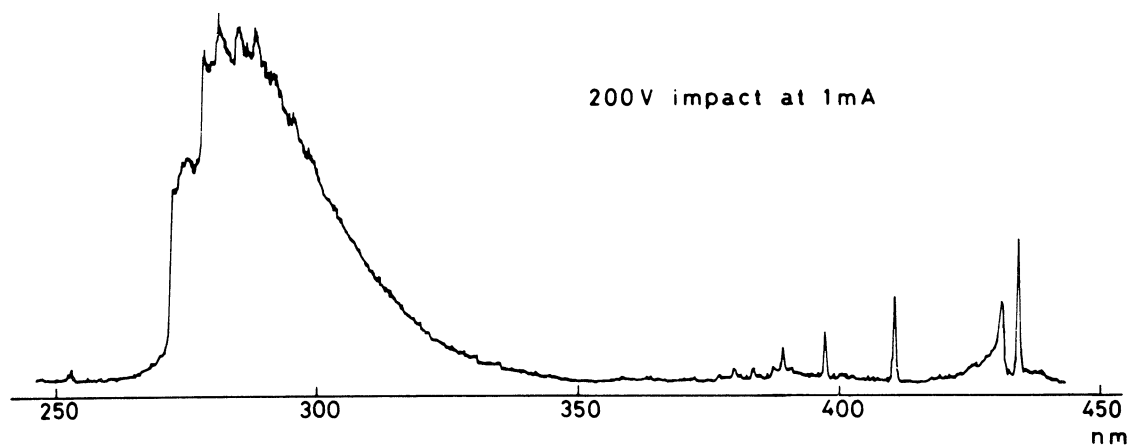
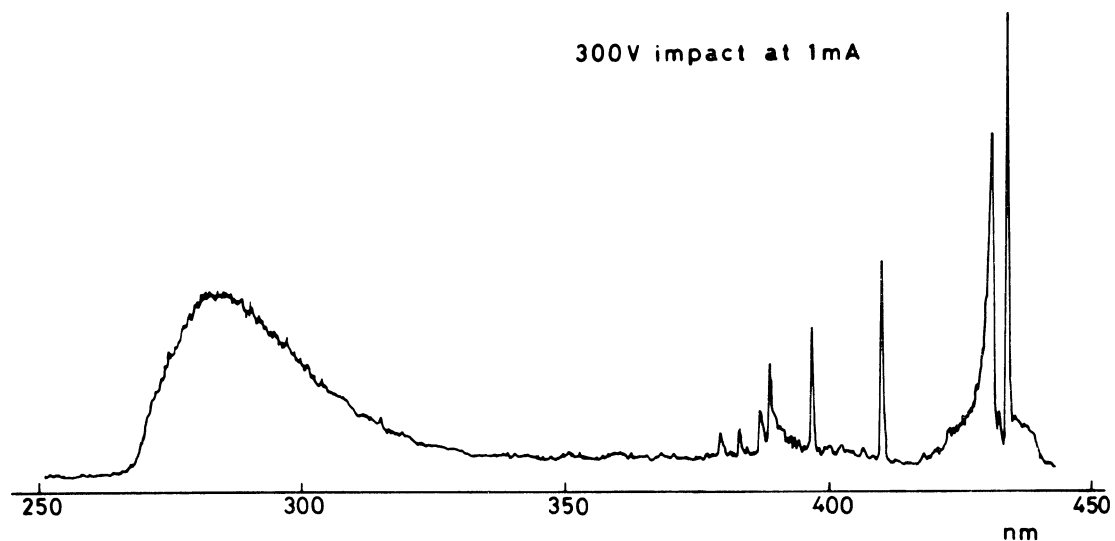


Fig. 1.

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