

CATALYZED OXIDATION OF ANILINE BY HYDROGEN PEROXIDE IN THE PRESENCE OF CARBON NANOTUBES: A POSSIBLE CASE OF A NANO DIMENSION REACTION

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The oxidation of aniline by hydrogen peroxide is accelerated by the presence of multiwalled carbon nanotubes. The diffusional growth of the product coming out of the carbon nanotubes is dramatic. A strong red-colored product is formed with time. The reaction was monitored by UV-VIS absorption spectrophotometry and GC/MS. A well-defined absorption maximum appears at 347 nm with another overlapping absorption peak at 420 nm, each of which grows with time. As the amount of carbon nanotubes present in the medium increases, the optical density increases. When there are no carbon nanotubes present, a sharp absorption maximum at 327 nm has been observed. GC/MS data show that, initially, nitrosobenzene is formed with a mass number of 107, which is further oxidized to nitrobenzene. Table 1 shows the mass spectral data of nitrosobenzene.

Table 1: Mass spectral data of nitrosobenzene product with and without the presence of carbon nanotubes.

Ratio of aniline/peroxide	% Area of nitroso-benzene ¹	% Area of nitroso-benzene
1.0 ^a	1.53	1.19
0.5 ^a	1.76	1.4
0.25 ^a	2.33	1.73
1.0 ^b	2.52	0.5
1.0 ^c	4.33	1.58

a: 1 mM aniline and 1 mM hydrogen peroxide, b: 2mM aniline and 2mM hydrogen peroxide, c: 5mM aniline and 5mM hydrogen peroxide. 1: Experiments with 100 mg multiwalled carbon nanotubes.

At the carbon nanotubes, the coupling of nitrosobenzene with aniline could result in the formation of an azo compound. The coupling is

less efficient without the carbon nanotubes. The reaction generally results in the formation of nitrobenzene; hence, in the two situations the colors are drastically different. One postulate is that the nano dimensional reaction occurs within the carbon nanotubes^{1,2}. Results obtained with fluorescence spectrometry will also be presented.

1. J.M. Nugent, K.S.V. Santhanam, A. Rubio and P.M. Ajayan, Nano Lett., 1, 87 (2001)

2. C. Downs, J. Nugent, P.M. Ajayan, D.J. Duquette and K.S.V. Santhanam, Adv. Mater., 11, 1028 (1999)