A CHEMICAL SENSOR BASED ON NANODIMENSIONAL REACTION WITH CARBON NANOTUBES

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A large number of chemicals can cause biological impairment. One such chemical is aniline. It is toxic and can be absorbed by the skin. When inhaled by humans it results in damage to the tissues as the system suffers from lack of oxygen; oxygen is required in the oxidation of haemoglobin to methemyoglobin. Tests carried out on animals showed a decrease in both the red blood cell count and haemoglobin level upon exposure to aniline. The EPA has suggested regulatory guidelines for aniline where the concentration cannot exceed 50-500 mg/kg. Thus it is imperative to have a chemical sensor for determination of aniline so that preventive measures could be applied. Recently, functionalized carbon nanotube based nanodimensional reaction of primary amines has been examined. As carbon nanotubes are made up of hexagonal sites with defect centeres in pentagons and hexagons, the density of states at pentagonal sites are higher and act as electrophilic centers. With curvature modified electron density distribution, the oxidation of the amines is catalyzed to form colored azo compounds. This reaction has been studied in more detail at concentrations reaching 1 μM allowing an insight into the actual process of the conversion. In addition to studying this reaction on its own, a method has been found to accelerate the flow of the reactant solutions into the nanotubes by centrifugation. This overall process was used in the development of a chemical sensor for the presence of toxic amounts of aniline or similar compounds, with results suggesting that even sub-toxic limits of such compounds could easily be detected.