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One and two dimentional models of dye adsorption for application in dye sensitized solar cells

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Abstract content
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The dye sensitized solar cells are currently the subject of intense research in the field of renewable energy as a low-cost photovoltaic device. The light adsorption occurs in dye molecules adsorbed on a highly porous structure of TiO2 porous film. The progress in the efficiency and stability of these solar cells is very low, due to many fundamental aspects of their operation that are still unknown. One process, for which there is limited information, is the time taken to upload the dye on the TiO2 nanoporous film which acts as a semiconductor. Dye molecule is adsorbed onto a TiO2 working electrode by dipping it into the dye solution for periods of several hours to several days. However, such long dipping times are not economic for industrial production of DSSCs. The factors controlling this process are not yet fully understood. We have developed a 1D and 2D models based on the Langmuir isotherms to study and understand the diffusion and adsorption of the dye molecules in TiO2 nanotube films. Our modelling results show that the adsorption of dye into the TiO2 nanotubes is controlled by the diffusion coefficient, the adsorption-desorption ratio and the initial dye concentration.

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