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## Carbonaceous templates for TiO<sub>2</sub> nanocomposites: Preparation, characterization and photocatalytic activity for hydrogen production

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The effects of carbon sphere (CS) and carbon nanotube (CNT) incorporation as carbonaceous template (CT) in the preparation of TiO<sub>2</sub> nanocomposites were compared. Three methods of alcoholic phase sol-gel, aqueous phase sol-gel, and hydrothermal were utilized to form a layer of TiO<sub>2</sub> on the CT and the effect of calcination temperature was studied. All the samples were prepared also in the absence of CT to thoroughly investigate the effect of CT incorporation. The prepared samples were characterized with SEM, TEM, XRD, BET, TGA, and FT-IR. The analysis of results revealed that the TiO<sub>2</sub> nanoparticles formed uniformly on the surface of CS, however, their formation on the CNT was not uniform. Only for the case of CS incorporation in alcoholic phase sol-gel method, CT enhanced the surface area (around 5.7 times). Moreover, the photocatalytic activity of prepared samples was compared based on the enhancement in the amount of hydrogen production by CT incorporation. The results indicated that the highest improvement was related to the incorporation of CS in the hydrothermal method followed by the calcination at 400°C that increased the photocatalytic activity 2.8 times.

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