

- Title:** Structural characterization of N-doped anatase-rutile mixed phase TiO<sub>2</sub> nanorods assembled microspheres synthesized by simple sol-gel method
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- Abstract:** Abstract: In this study, N-doped anatase–rutile mixed phase TiO<sub>2</sub> nanorods assembled microspheres were synthesized via a direct and simple sol–gel method. The physical analysis via X-ray diffraction indicated that the prepared sample had a mixed phase of anatase and rutile TiO<sub>2</sub>. The morphology of the structure was observed with field emission scanning electron microscopy, transmission electron microscopy and atomic force microscopy, which showed that the formation of TiO<sub>2</sub> microspheres was constructed by TiO<sub>2</sub> nanorods or rice like structure nanorods. Besides, Fourier transform infrared analysis revealed that the presence of N<sub>2</sub>O<sub>2</sub><sup>2-</sup> and NO<sup>-</sup> species in the spectra while XPS study indicated the incorporation of nitrogen as dopant in TiO<sub>2</sub> at binding energies of 396.8, 397.5, 398.7, and 399.8 eV. Furthermore, the optical properties determined by UV–Vis spectroscopy concluded that the prepared sample exhibited excellent optical responses to UV and visible region as well as being a potential material for degradation of hazardous water pollutants. The photocatalytic activity of the prepared TiO<sub>2</sub> exhibits excellent photodegradation of methylene blue under UV and visible light irradiation.