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**Dual functional property of lycopene as a reducing agent to synthesis TiO<sub>2</sub> nanoparticles and as a ligand to form lycopene-TiO<sub>2</sub> nanoparticles complex**

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**Abstract**

Lycopene, a natural pigment present in the tomato fruit was extracted and their properties as a reducing agent for the formation of TiO<sub>2</sub> nanoparticles and as a ligand to form lycopene-TiO<sub>2</sub> nanoparticles complexes have been investigated. Titanium tetrabutoxide was used to prepare crystalline TiO<sub>2</sub> nanoparticles by using lycopene and tomato extract as a reducing agent. From the SEM micrographs and XRD graphs, it was found that the prepared TiO<sub>2</sub> nanoparticles from lycopene as a reducing agent have better properties than the TiO<sub>2</sub> nanoparticles prepared using tomato extract as reducing agent. And also lycopene acts as a ligand to attach with TiO<sub>2</sub> nanoparticles to form lycopene-TiO<sub>2</sub> nanoparticles complex, which was confirmed from the FTIR studies.

Keywords: Lycopene, TiO<sub>2</sub> nanoparticles, semiconductor, ligand, complex, FTIR.

**1. Introduction**

Nano-sized particles have gained attention among the researchers due to their unique optical, mechanical, electrical and thermal properties. Among the metal oxide semiconductor nanomaterials, titanium dioxide (TiO<sub>2</sub>) nanoparticles are extensively used as a photocatalyst in solar cells and wastewater treatment. The advantages of titanium dioxide (TiO<sub>2</sub>) nanoparticles are non-toxic, biocompatible and chemically stable [1-3]. Synthesis of titanium dioxide nanoparticles by green technologies has more advantages than chemical synthesis because of less consumption of chemicals [4]. In DSSC (Dye sensitized solar cells), natural dyes are used to coat over TiO<sub>2</sub> electrode which acts as a light harvesting element [5, 6]. Tomato extracts are used as a dye sensitizer and coated over the titanium dioxide electrode to enhance its photocatalytic property [7]. Recently, lycopene was extracted from the tomato and used as a coating material for ZrO<sub>2</sub> electrode [8]. In this research work, lycopene extracted from tomato fruit has been used as a reducing agent for the synthesis of TiO<sub>2</sub> nanoparticles and as a ligand to form lycopene-TiO<sub>2</sub> nanoparticles complex. We have synthesized the

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