



## Effective decoloration of cationic dyes by silica gel prepared from Tunisian sands and TiO<sub>2</sub>/silica gel composites: dual adsorption and photocatalytic processes

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### ABSTRACT

Silica gels synthesized from Tunisian sands employed as alternative low-cost adsorbents, and silica gel/TiO<sub>2</sub> composites for combined absorption/photocatalytic decoloration of methylene blue (MB) dye solutions, were studied. The silica gel is characterized by a high specific surface area of up to 194 m<sup>2</sup>/g and is likely to increase in aqueous solution, according to the solid/liquid ratio which modulates the degree of hydration. This was determined at various synthesis pH values. For this silica gel, the maximum adsorption capacity (up to 91%, 125 mg/g) was obtained in acidic medium (pH 3). The adsorption mechanism fitted better using the Langmuir model, and the adsorption kinetics of the dye on these materials was well described by the second-order model. Silica gel/TiO<sub>2</sub> demonstrated an effective degradation of MB the first stage (30 min without UV-light exposure) and under UV. The kinetics of discoloration of MB followed a pseudo-first-order rate law. We can remark that 5 h of UV irradiation was enough to achieve 99% discoloration of the MB. The findings demonstrated the applicability of this silica gel/TiO<sub>2</sub> catalyst for the photocatalytic oxidation of MB.

**Keywords:** Silica gel; Titania; Cationic dye; Adsorption; Photocatalysis

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