Title:	Investigations on dye adsorption and photocatalytic Cr-(VI) reduction by SnS 2 nanosheets prepared via hydrothermal method
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Abstract:	In recent years, metal chalcogenide photocatalysts with high performance for water treatment and pollutant degradation under visible-light have attracted considerable interest in solving energy and environmental issues. Metal chalcogenide semiconductors have found applications in various fields of science as well such as solar cells, sensors, polarizers, and thermoelectric cooling materials. In this thesis, we have synthesized tin sulfide (SnS 2) nanosheets, a metal chalcogenide with the crystalline structure CdI 2 comprised of triple plane layers of S-Sn-S by strong ion-covalent bonds coupled with weak Van der Waals forces, using conventional hydrothermal method. The prepared catalyst was characterized by PXRD, TEM, HRTEM, DRS, and BET which inferred they were nanometer in size with a bandgap in the visible range. The as-synthesized SnS 2 nanosheets were used for adsorption of organic dyes- RhB, methylene blue, and methyl orange. It is observed that the catalyst has more adsorption capacity for RhB than that of methylene blue. We also found the effect of different pH on adsorption and it has been observed that the adsorption process is much more facilitated in the basic medium in case of methylene blue; however, in the case of RhB, the adsorption process is not regular at pH>10. The prepared SnS 2 catalyst has shown 90% adsorption of methylene blue up to 5 cycles. Both the adsorption process followed pseudo-second-order kinetics and Langmuir adsorption isotherm implying adsorption due to chemisorption and monolayer adsorption. The prepared SnS 2 NSs did not show any adsorption of methyl orange which indicates that the adsorbent has (-)ve surface charge and it capable of adsorbing cationic dyes. Photocatalytic reduction of Cr-(VI) is also carried out using the as-synthesized SnS 2 nanosheets. It has been observed that the catalyst is capable of 95% removal of Cr-(VI) in 26 minutes in the presence of ammonium oxalate, a hole scavenger, in Xenon lamp. The reaction follows pseudo-first-order kinetics with a rate constant of 0.1 min -1 . This study suggests that as-prepared SnS 2 nanosheets can be considered as a promising catalyst for wastewater purification and pollutant degradation.
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