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## Architecting organo silica nanosheets for regenerable cost-effective organics adsorbents

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### Abstract

Organo silica nanosheets (organo-SiNSs) debut as superior adsorbents on organics removal stage. The precursor ultrathin silica nanosheets (SiNSs) provided with large surface area, uniform lamellar structure and low layer charge comes from acid leaching of vermiculite (Vt). By decoration with different cationic gemini surfactants, 1, 3-bis (hexadecyldimethylammonio)-2-hydroxypropane dichloride (BHHP) and bis-N, N, N-hexadecyldimethyl-*p*-phenylenediammonium dibromide (BHPD), organo-SiNSs could be successfully prepared and used as adsorbent for benzoic acid (BA). The surface and structure of the resultant organo-SiNSs are characterized by Fourier transform infrared spectroscopy (FT-IR), X-ray diffraction (XRD), elemental analysis (EA), thermogravimetric analysis (TG), electron microscopy (SEM and TEM) and surface areas analysis (BET). Enhanced adsorption process detected by BA yields good potential from the standpoint of particularly rapid adsorption feature within 10 minutes and cost-effective character throughout the process. The adsorption capacity of organo-SiNSs is much higher than the level of organo-clays. Intriguingly, the adsorption capacity of BHPD-SiNSs (81.72 mg g<sup>-1</sup>) higher than that of BHHP-SiNSs (58.44 mg g<sup>-1</sup>), which verifies the strength:  $\pi$ - $\pi$  interaction > hydrogen bond. Kinetics, isotherm and thermodynamics analysis on the adsorption properties are also conducted for adsorption mechanisms. The adsorption process is sustainable as the spent organo-SiNSs could regenerate by simple acid pickling methods at least for three cycles. This adsorbent organo-SiNSs lifts the veil the enormous related organo-silicate materials to serve as tunable and cost-effective adsorbents for specific organics retention.

**Keywords:** Vermiculite; Silica nanosheets; Gemini surfactant; Benzoic acid; Adsorption;  $\pi$ - $\pi$  interaction

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