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Acetaminophen Adsorption Properties Using Graphene-Triazine Bilayer Composites

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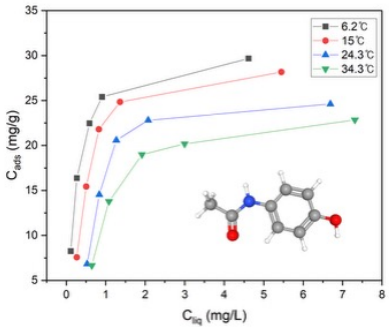
Acetaminophen (AMP), known as paracetamol, is widely used as an antipyretic, analgesic, and anti-inflammatory, being one of the most common pharmaceuticals found in different surface water environments (Gatrouni et al., 2024). It is frequently detected in aquatic environments and poses potential risks to human health, aquatic ecosystem and natural environment. Among removal technologies for AMP, adsorption is most promising method widely utilized to remove different organic and inorganic contaminants from aqueous solutions due to its simplicity, efficiency, and low cost (Arabkhani et al., 2025). In this work, the adsorption capacity of newly synthesized graphene-triazine bilayer nanocomposites was investigated for the removal of acetaminophen. The composites were synthesized via ultrasonication, chemical and hydrothermal methods: 1,3,5-triazine (TZN), trichloro triazine (TCT), and 2,4,6-tris (trifluoromethyl)-1,3,5-triazine (TTF) were embedded in graphene to form a noncovalently functionalized two-layered complex. Among the synthesized graphene-triazine nanocomposites, the TTF-functionalized composites with the hydrothermal method exhibited the highest AMP adsorption performance (28.3 mg/g) due to the strong electron-withdrawing and hydrophobic effects of the trifluoromethyl groups, which enhance π–π stacking and electrostatic interactions induced by the conjugated-π and sigma inductive effects, which results in the strong AMP adsorption onto the composite surface.

Graphical Abstract



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Biography:

Miran Seo is a Bachelor student in Environmental technology at Ghent University Global Campus with strong research interests in sustainable water treatment, environmental remediation, and green chemistry. Her academic work focuses on the adsorption and degradation of emerging contaminants, including pharmaceuticals and heavy metals, in aquatic environments. She has participated in research projects involving arsenic adsorption, photocatalytic degradation, and microalgae-based environmental technologies. She participated in several national and international conferences. By this time, she is co-author of 1 peer-reviewed publication in J. Hazard. Mat. https://doi.org/10.1016/j.jhazmat.2025.137906.