**Antimicrobial two-dimensional covalent organic nanosheets (2D-CONs) for the fast and highly efficient capture and recovery of phosphate ions from water**

Subhasis Dey,**a Sribash Das,a** Anjali Patel,b  K. Vipin Raj, c Kumar Vanka c and Debasis Manna \*ab

a Department of Chemistry, Indian Institute of Technology Guwahati, Assam-781039, India.

b Centre for the Environment, Indian Institute of Technology Guwahati, Assam-781039, India

c Physical and Materials Chemistry Division, CSIR-National Chemical Laboratory (CSIR-NCL), Dr Homi Bhabha Road, Pashan, Pune 411008, India

E-mail: dmanna@iitg.ac.in

**Abstract**

Retrieval of depleting resources from wastewater could help resolve the mounting demands for resources in our society. Phosphate is an essential nutrient for all living things. However, the diminution of global reserves of phosphate rock could significantly affect our food security in the near future. At the same time, the removal of phosphates and pathogens is of great importance for water security and de-eutrophication. The specific pH-dependent adsorption and desorption of phosphate ions by water-insoluble adsorbents is an exciting strategy for removing and recovering phosphates from contaminated water. We developed a new two-dimensional guanidine-containing covalent organic nanosheets (2D-gCONs). This water-insoluble amorphous polymer (exfoliated) selectively sequestered phosphate ions in the presence of other competing anions and could be reused for multiple cycles. The guanidinium moieties played a pivotal role in exfoliation in aqueous medium and in the antibacterial activities against Gram-negative and Gram-positive bacteria. We hypothesize that the current study may advance the design of water-insoluble CONs to remove and recover phosphate ions from wastewater and could help alleviate the negative impact of water eutrophication. This strategy can also be tweaked to address other severe environmental challenges.

**Keywords:** 2D-gCONs**,** Phosphate retrival, Deeutrophication, Antibacterial activity.



**Figure.** General synthesis scheme of gCON. Schematic diagram demonstrating the exfoliation of gCONs in the aqueous medium in the presence of ions (A). Phosphate ion adsorption isotherm of gCONs (5 mg) at pH 7.0 under room temperature (B). Time-dependent adsorption isotherm of phosphate ions by gCONs (1-10 mg) at pH 7.0 under room temperature (C). The relative anion adsorption capacity of gCONs

**Reference:**

Dey, S., **Das, S**., Patel, A., Raj, K. V., Vanka, K., & Manna, D. (2022). Antimicrobial two-dimensional covalent organic nanosheets (2D-CONs) for the fast and highly efficient capture and recovery of phosphate ions from water. *Journal of Materials Chemistry A*, *10*(9), 4585-4593.