Environmentally friendly graphene-based membranes for water filtration

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Antibiotic contaminations present a serious threat to human and animal health security. Antibiotics removal from aqueous environments mostly relies on either adsorption or catalysis oxidation processes, which are rather inefficient[1]. Towards sustainable management of water and sanitation on a global scale, new classes of membrane materials and systems are required. Owing to atomic thickness, large surface area, and mechanical strength, graphene-based materials appear as a suitable choice. So far, graphene oxide membranes were proposed for water purification, efficiently blocking solutes with hydrated radii larger than 4.5 Å. These materials are however not ideal since they tend to swell and weaken when operating in water over a few days[2,3]. Liquid phase exfoliation (LPE) methods allow the large-scale production of atomic thick graphene flakes at low cost[4], but hazardous and toxic solvents (*i.e.*, NMP, DMF, and DMSO) are commonly used, hindering sustainable upscaling. Here we describe the preparation of LPE graphene by high-shear mixing in environmentally friendly, non-toxic solvent Cyrene[5,6]. The graphene dispersions have a 1 mg/mL concentration and high stability (over 9 months). Membranes were fabricated via vacuum-filtration on PVDF supports and tested in terms of mechanical strength, bacterial adhesion, and antibiotics (ampicillin and tetracycline) filtering. The membranes remain structurally stable over 90 days, without any noticeable swelling. When exposed to common bacterial pathogens (*Escherichia coli* and *Enterococcus)* in freshwater, they showed a very scarce level of bacterial adhesion, indicating a promising resistance to biofilm formation. Overall, the membranes showed more than 90% rejection of both antibiotics.

References

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Figures

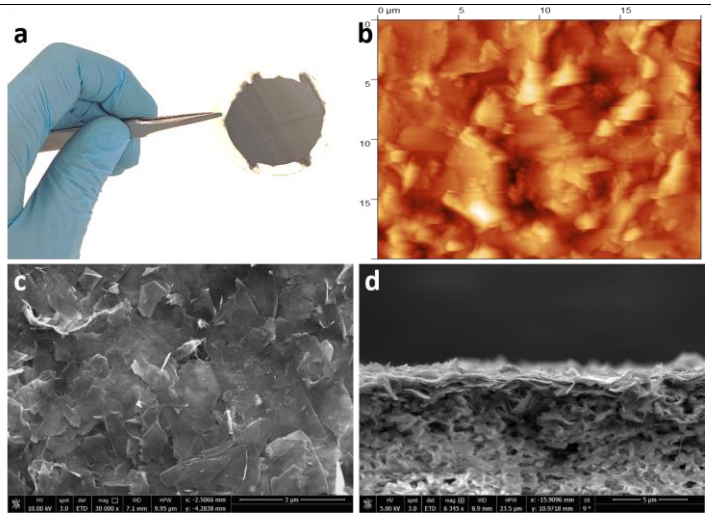

Figure 1: (a) Graphene-based membrane on PVDF. (b) AFM image of the top surface. SEM images of (c) top surface and (c) cross-section of the membrane.