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Adsorption of metal ions and bactericidal actions using mixed zeolites and graphene oxide-based membranes

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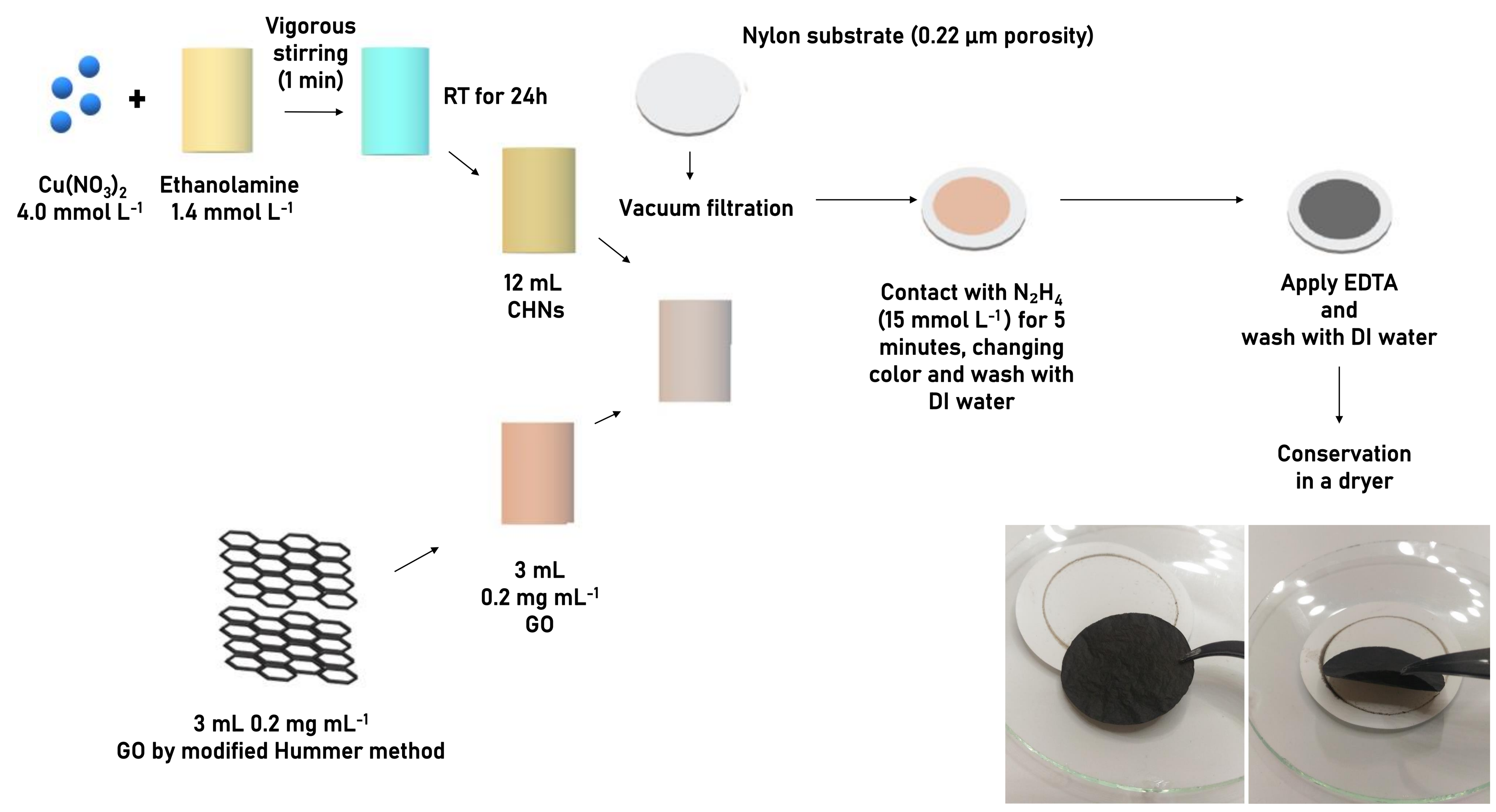
INTRODUCTION

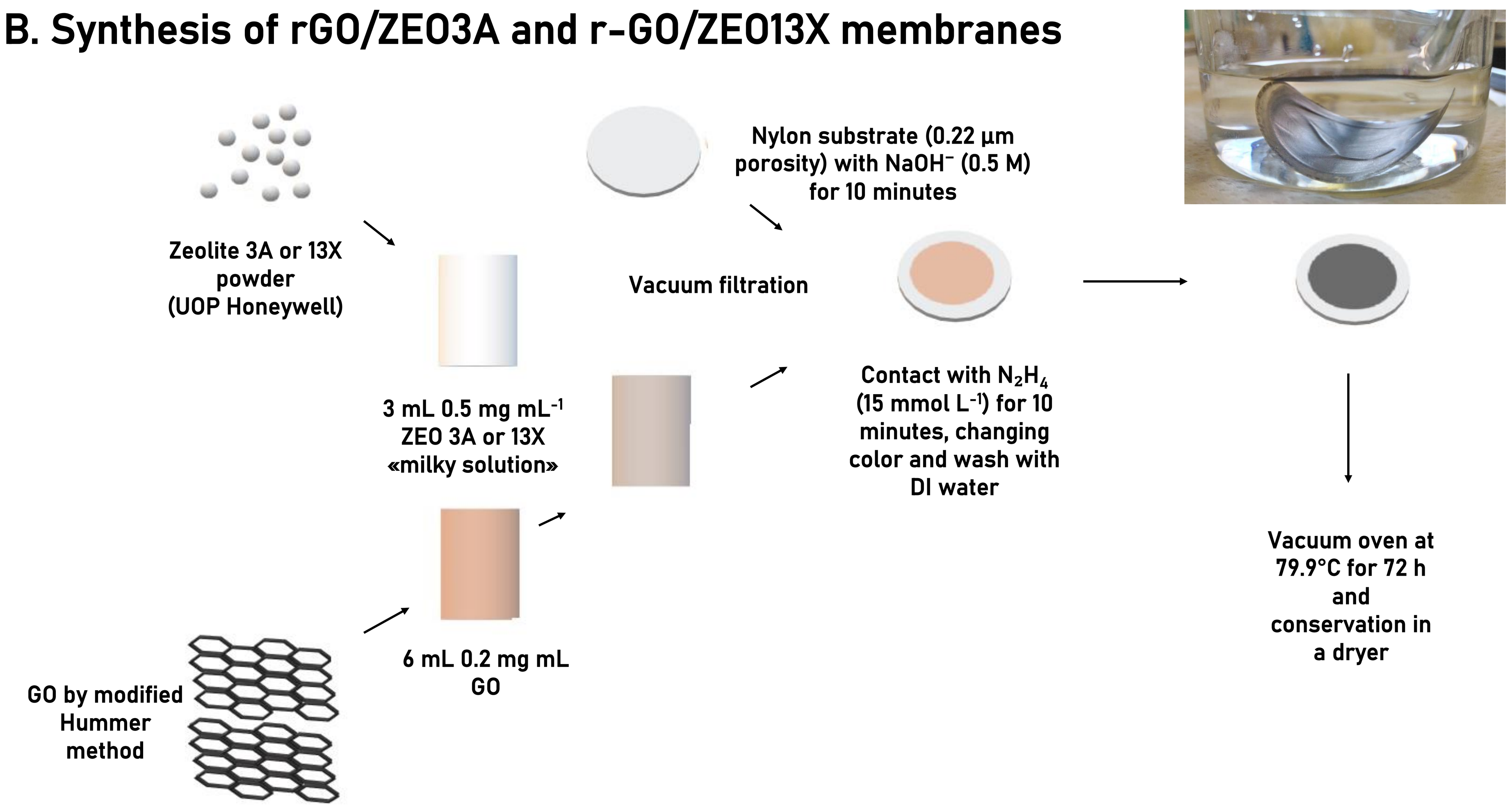
To purify water from various sources, the use of membrane filtration is an economical way to raise the emerging problem of a clean water shortage. Improvements in membrane science and technology have been important, but when it comes to the removal of small molecules, such as salt ions in sea water (desalination), waste water and industrial waste, the problem remains unresolved [1]. Zeolites, microporous materials contain nm-sized channels and cavities, which can selectively pass throughout the membrane water molecules and exclude others, can be considerate as proper candidate for preparation of graphene-based composites, due to their tuneable properties. Further, antibacterial activity of GO (graphene oxide) was tested to evaluate the potential for reducing the use of chemical treatments in water disinfection and contrasting the fouling and/or biofouling in the membranes [2]. In this work, a nano-channelled rGO (reduced graphene oxide) membrane (r-GO/CHNs) and innovative nanocomposites r-GO/ZEO3A and r-GO/ZEO13X membranes are proposed to remove metal ions from water, meeting the global need for the development of environmentally compatible, energetically efficient and rapid materials.

MATERIALS AND METHODS

A. Synthesis r-GO/CHNs (Coper Hydroxide Nanowires) membrane



B. Synthesis of rGO/ZEO3A and r-GO/ZEO13X membranes



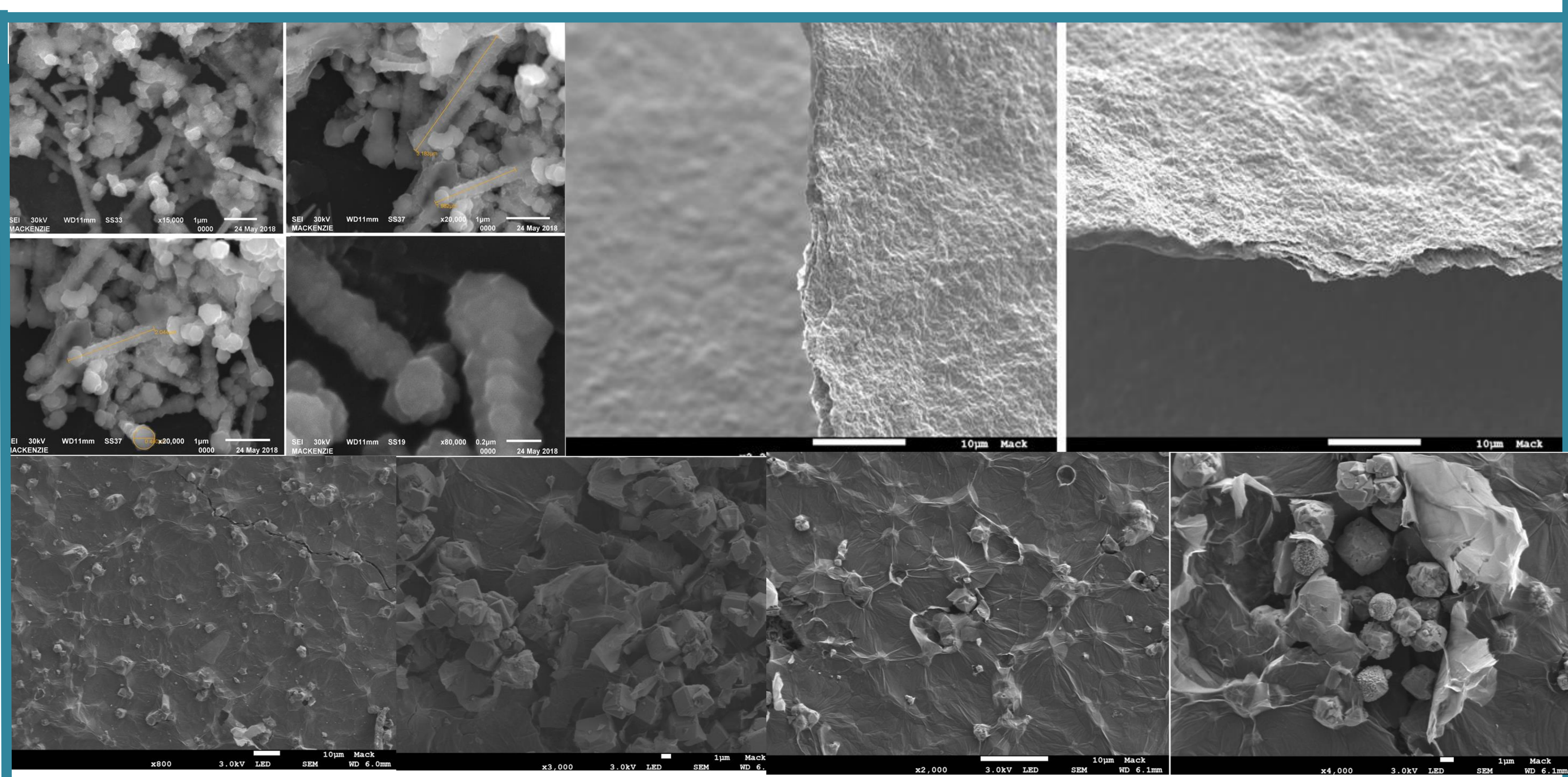


Fig.3 SEM data set.

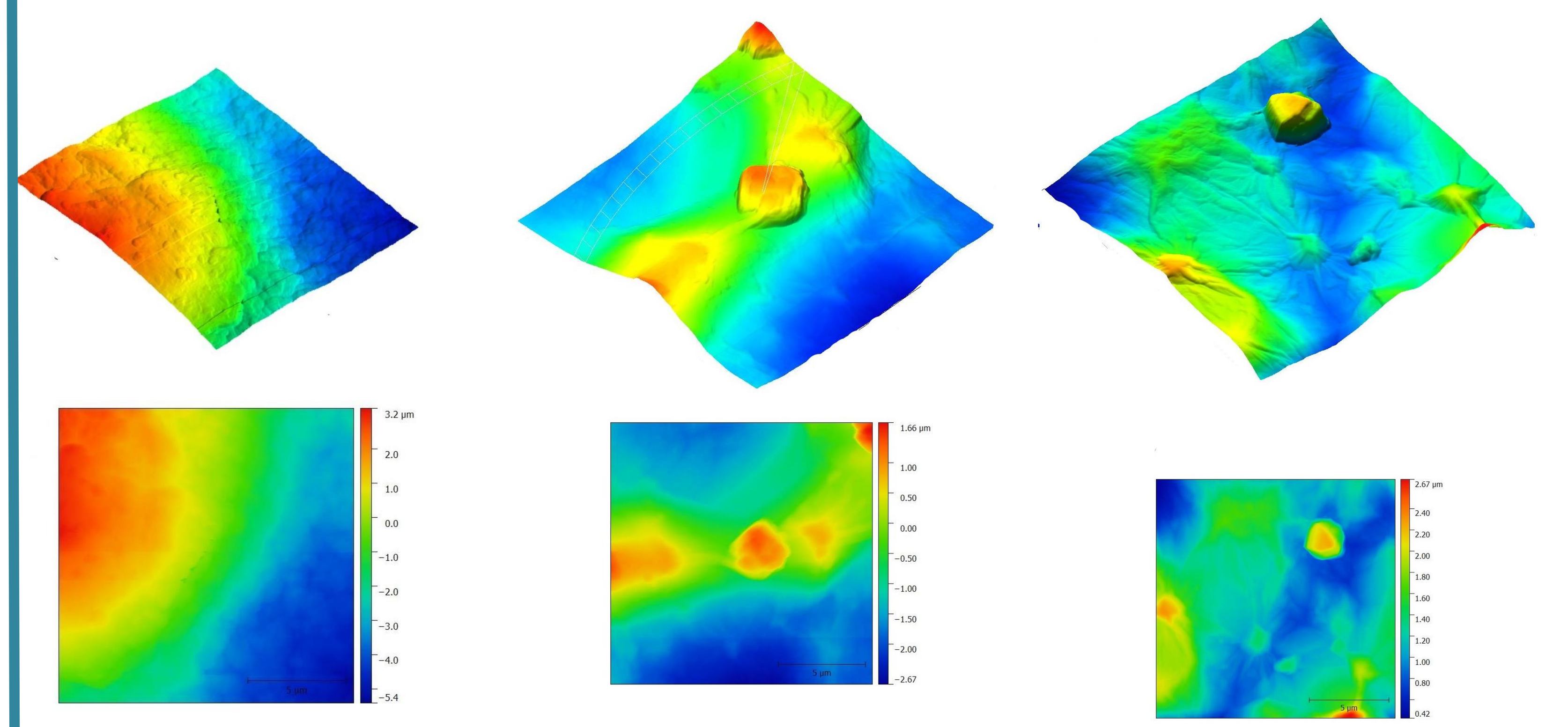


Fig.4 AFM data set.

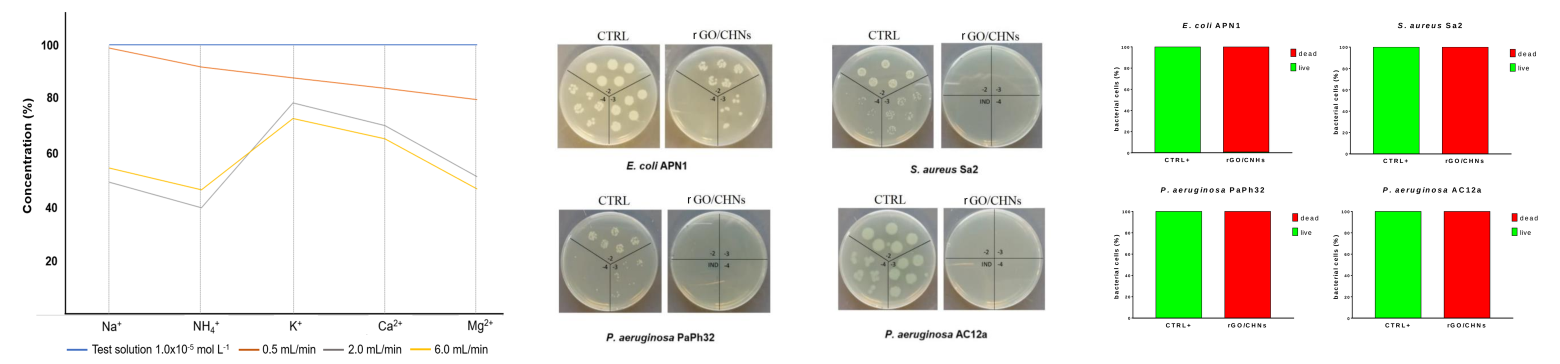


Fig.5 Adsorption rate of cations i(left) and killing kinetics (right) of the membrane r-GO/CHNs at 4h.

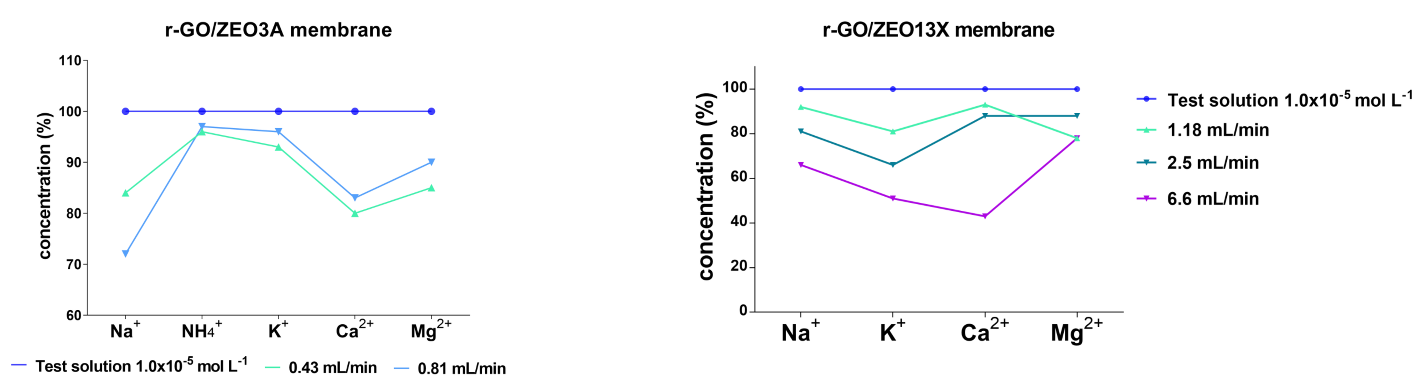


Fig.6Adsorption rate of cations in the membranes r-GO/ZEO3A (left) and r-GO/13X (right).

RESULTS

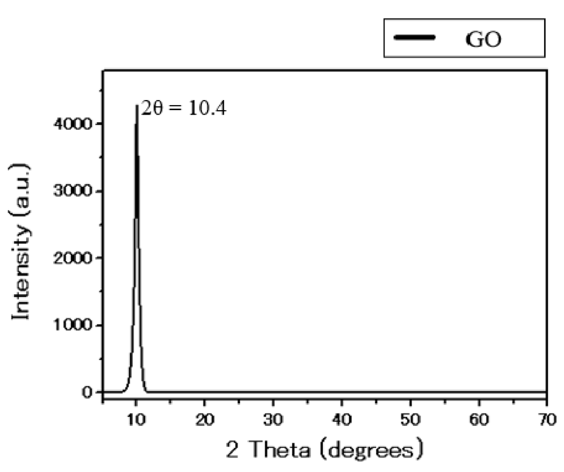


Fig.1 XRD pattern of GO.

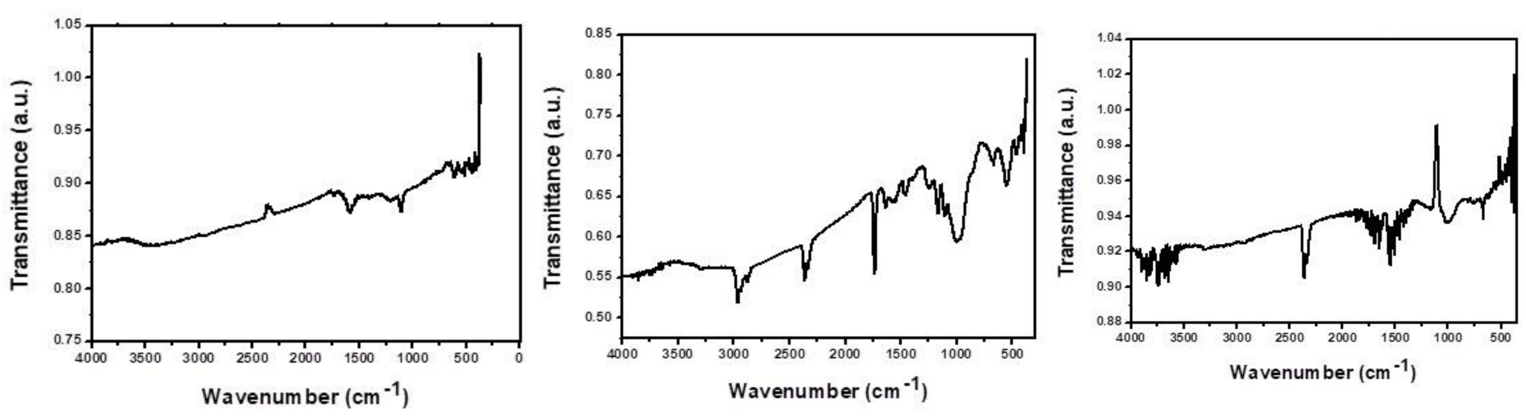


Fig.2 FT-IR spectra of r-GO/CHNs (a), r-GO/ZEO3A (b) and r-GO/ZEO13X.

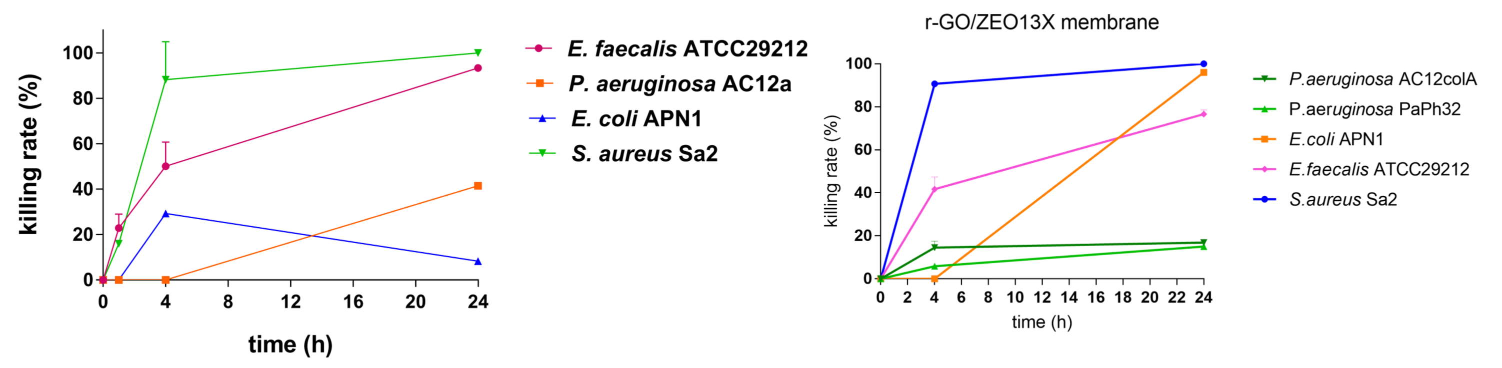


Fig.7 Killing kinetics of the membranes r-GO/ZEO3A (left) and r-GO/13X (right) at 1, 4 and 24 hours.

CONCLUSIONS

The synthesis of the material covers a green economy principle together with its characteristics to be an ultrathin, ultralight membrane supported by an industrial and economical sustainable production. The adsorption tests are satisfactory compared with other rejection results of metal ions for graphene membranes. The antibacterial properties preclude the formation of fouling, increase the performance, the life time of the material, making it suitable for biomedical applications too.

REFERENCES

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2. S. Szunerits and R. Boukherroub, Journal of Materials Chemistry B, 4(43), (2016), 6892-6912.

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