PhD Open Days

Bioactive foam filters for biofouling control

PhD in Chemistry in Faculdade de Ciências, Universidade de Lisboa (CQB)

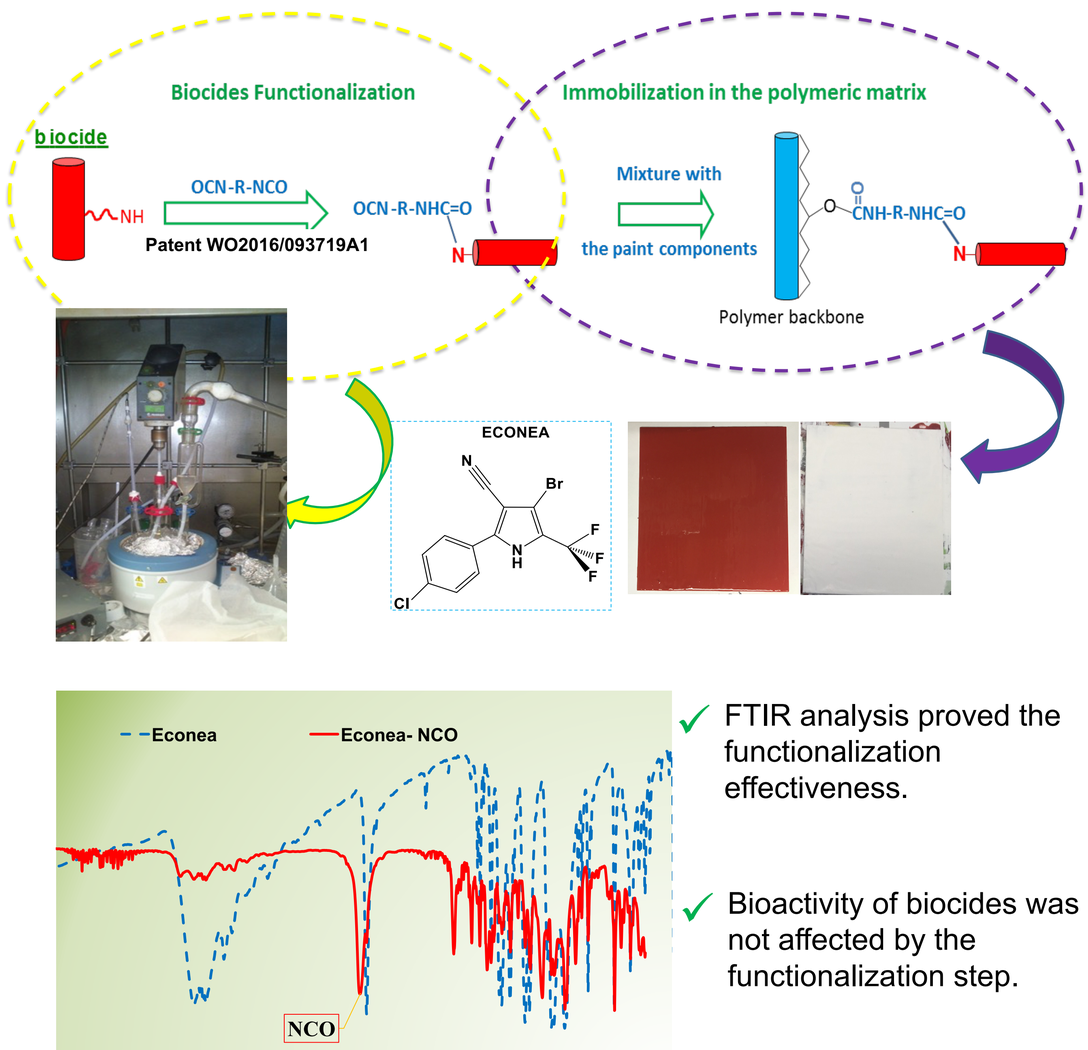
under CATSUS Programme

Olga Ferreira (olga.ferreira@tecnico.ulisboa.pt)

Introduction

Fluid contamination with persistent organic pollutants, together with microorganisms (biofouling), cause serious environmental/economic penalties and health risks on several applications (e.g. water circuits). This work aims to develop a new multifunctional non-toxic solution able to mitigate those pollutants/contaminants, through innovative approaches such as the immobilization of biocidal agents (e.g. Econea) in polymeric coatings for foams surfaces protection. The immobilization of biocidal agents in polymeric matrices was performed by using a recently patented method (WO2016/093719 A1), in which non-releasing biocidal systems were developed by providing new functional biocides able to be tethered in polymeric coatings.

Immobilization of the functionalized biocide



- ✓ FTIR analysis proved the functionalization effectiveness.
- ✓ Bioactivity of biocides was not affected by the functionalization step.

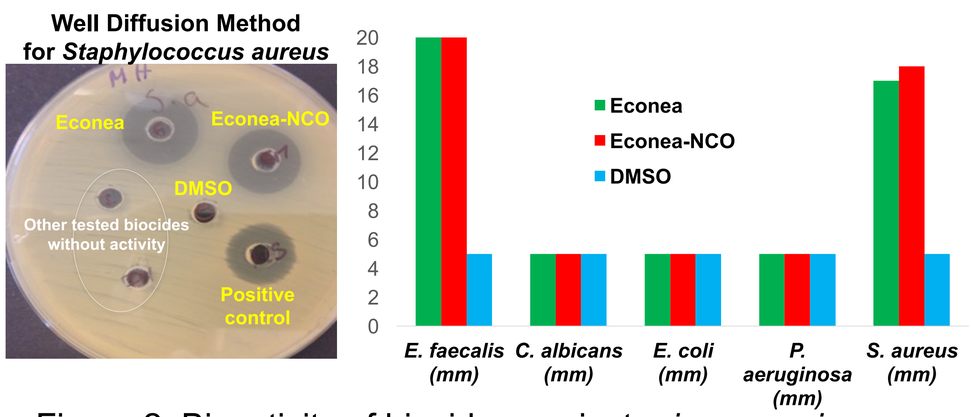


Figure 2: Bioactivity of biocides against *microorganisms*

Bioactivity assessment for the coatings

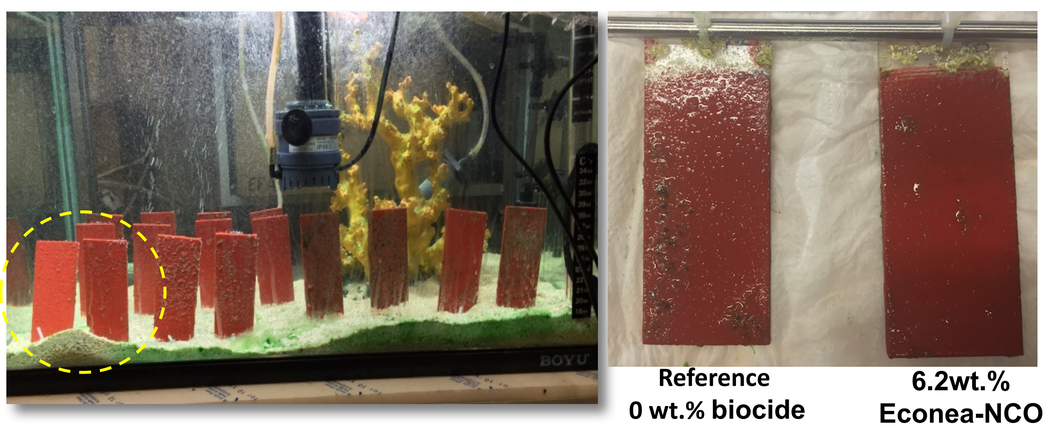
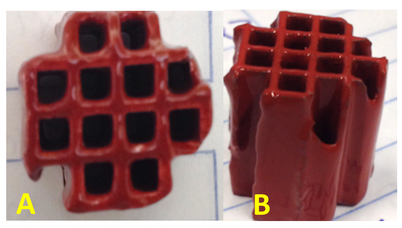


Figure 3: Polyurethane coatings on acrylic substrates (6x3 cm)
After 8 months in an aquarium with artificial sea water

- ✓ After 8 months the bioactivity of Econea-NCO coating with 6.2wt.% biocide improved when compared with its reference counterpart.

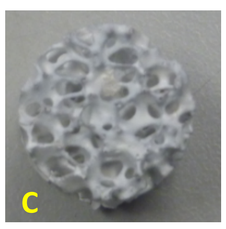
Ceramic cellular structures coated with bioactive paints

Biocidal polyurethane (A, C) and silicone (B) based coatings.



Cordierite Monoliths (200 cpsi)

The original paint properties were not significantly affected.



Alumina Foam (30 ppi)

Conclusions

- ✓ Commercial biocides were successfully immobilized in polymeric coatings.
- ✓ Econea biocide and its functional counterpart showed similar bioactivity against *E. faecalis* and *S. aureus* microorganisms.
- ✓ Antifouling effects, at simulated conditions, of polymeric coatings containing immobilized Econea, have shown promising results.
- ✓ The ceramic cellular structures coated with the immobilized biocide developed films that evidenced uniform polymeric layers. Adhesion tests are on-going.
- ✓ This innovative strategy is still in a early stage of development, thus improvements are possible.

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Dr. E. R. Silva (Supervisor, FCUL; Invited Professor, IST)

Prof. Dr. João Gomes (Co- Supervisor, ISEL/IST)

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phdopendays.tecnico.ulisboa.pt