PROJECT: SENSOR
SYSTEM: Semi-closed system in sea and RAS
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CtrlAQUA

Antibiofouling coatings for sensors

RESEARCH QUESTION:

To overcome limitations of traditional biocide-based antifouling materials, novel antifouling strategies are explored, varying from nanocomposites based antifouling materials, fouling release materials to biomimetic microstructure materials.

DURATION: 2016-21

SALINITIES TESTED: Brackish water, salt water

HIGHLIGHTS:

- Three kinds of nonbiocidal antifouling, nanocomposites-based antifouling coating (GO/Ag), FRCs (PDMS/ZnO-GO) and biomimetic microstructure coatings (O2 plasma treated PTFE membrane) were developed.
- Project included to
  - synthesize environmentally friendly antifouling materials,
  - study the correlation between surface properties, wetting properties, and antifouling properties of the synthesized materials,
  - investigate the antifouling properties of the synthesized materials through testing against typical bacteria and algae.
- The materials demonstrated that the surface microstructure of the antifouling materials determines surface properties like surface topology, surface roughness and wetting ability, in turn influencing the antifouling property.
- The antifouling environmentally friendly materials was validated and found to be competitive candidates for practical antifouling application on sensors in salty water.

RECOMMENDATION:

- To expand lifetime and reliable sensor readings in aquaculture it is recommend using any of the developed antifouling materials for protection of sensor housings. This will also reduce time needed for maintenance of sensor systems.
- The most convenient and effective approach to combatting biofouling on sensor systems in aquaculture is nonbiocidal antifouling coatings that are nontoxic alternatives.
- Recommended is to use Polydimethylsiloxane/zinc oxide-graphene oxide (PDMS/ZnO-GO) for antifouling coatings. Alternative is to use Polytetrafluoroethylene (PTFE) coatings modified by O2 plasma treatment which alters the microstructure of the film in favour of efficient antifouling properties. Care should be taken when exposing the PTFE film as to long exposure time can cause destruction and a broken membrane resulting in significantly decrease the hydrophobic and antifouling properties.

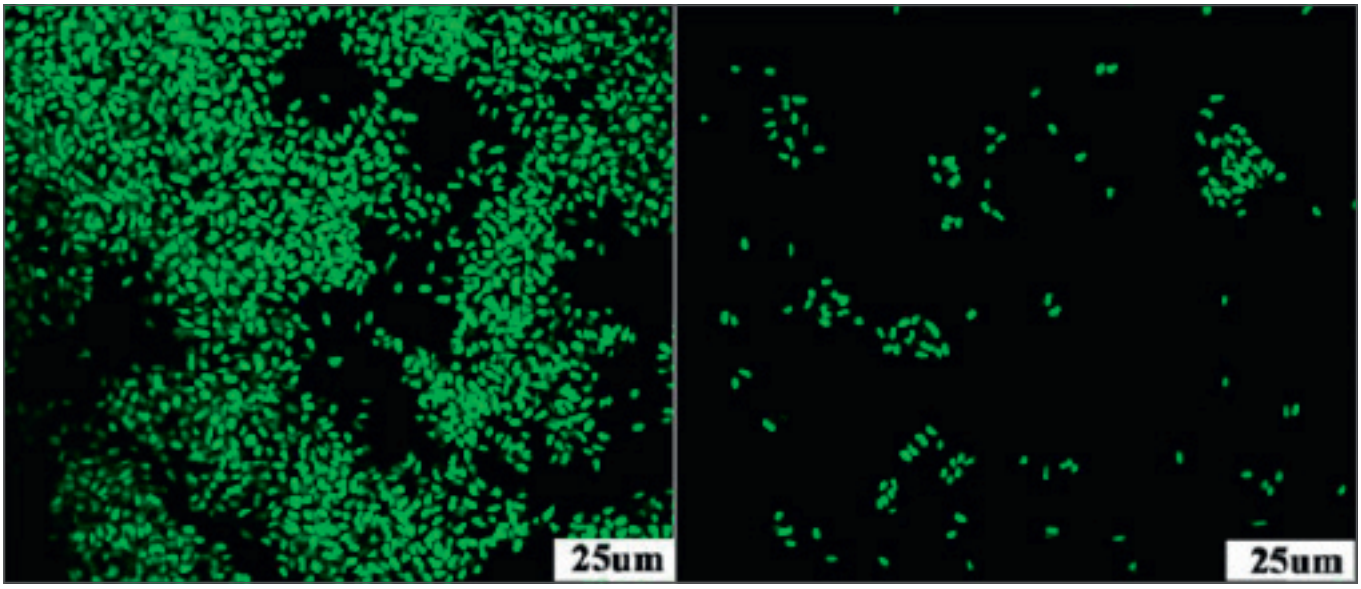
The factsheet is ready for implementation, but with the note that the testing has not been done for all industrial relevant conditions.

READ MORE:

TZhang, Xiaoxue; Årstøl, Erland; Nymark, Marianne; Fages-Lartaud, Maxime René; Mikkelsen, Øyvind (2022).

The Development of Polydimethysiloxane/ ZnO–GO Antifouling Coatings. Journal of Cluster Science volume 33, 2407–2417 https://doi.org/10.1007/s10876-021-02165-7

Zhang Xiaxoue, Mikkelsen Øyvind (2022). Graphene Oxide/Silver Nanocomposites as Antifouling Coating on Sensor Housing Materials. Journal of Cluster Science volume 33, 627–635 https://doi.org/10.1007/s10876-020-01953-x"



Effect of modifying polydimethylsiloxane with zinc oxide / graphene oxide to achieve antifouling properties. Biofilm coverage was reduced to 2,4% of the surface using modified coating (image to right).