

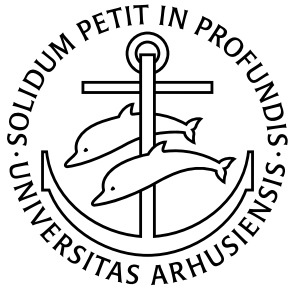


NordForsk



CDI-NANO-RAS

Mitigating off-flavour compounds geosmin and 2-methylisoborneol by applying capacitive deionization and nanotechnology in RAS



Project number

105020

Project leader

Mark Bayley, Aarhus University

Duration

01.01.2021 – 31.12.2023

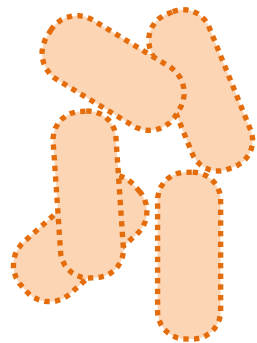


geoA

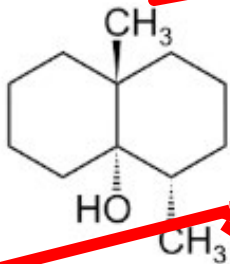
Background

(Slide Jeppe Lund Nielsen)

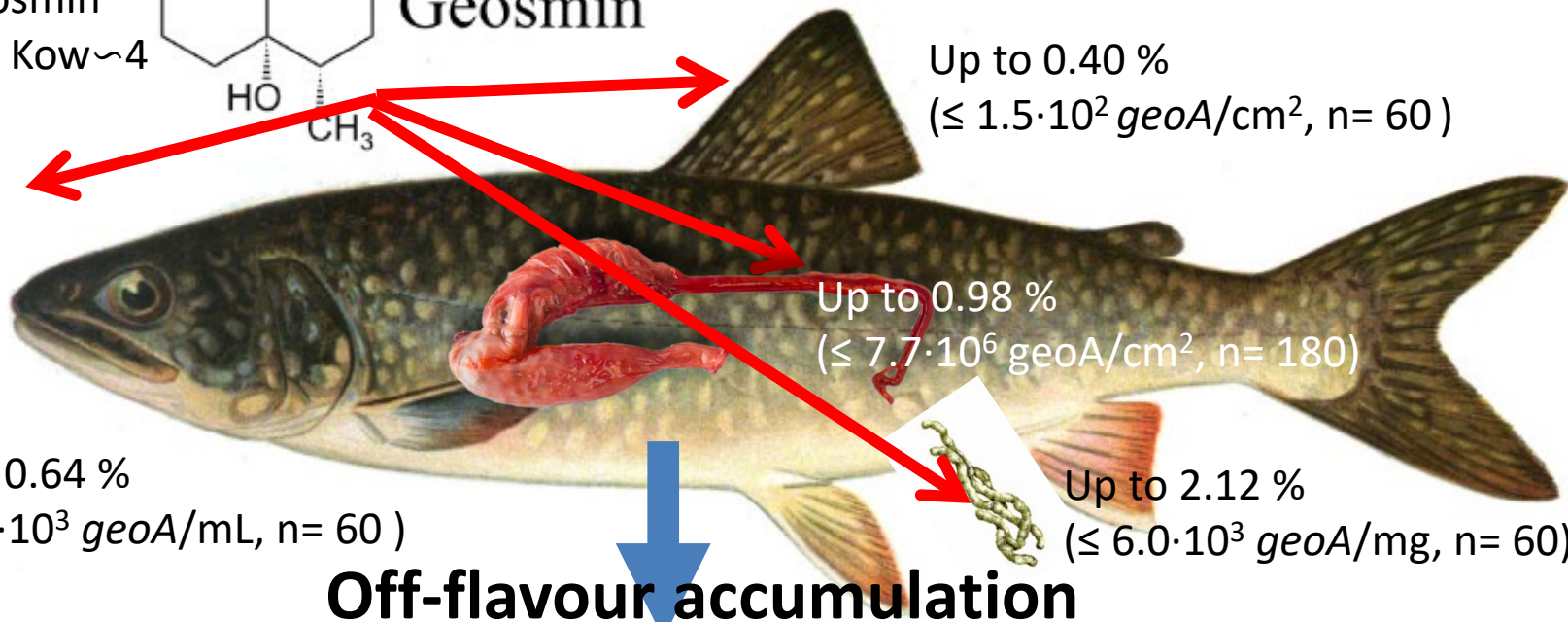
- GSM and MIB are produced in RAS by a variety of microbes
- Both sedentary and pelagic types are responsible



Geosmin
Log Kow ~4



Geosmin



Current off-flavour remediation

- Purging with reduced or no feed most common remedial strategy 4-14 days \$\$\$\$€€€€€€
- **Reduction of purge time has significant monetary and environmental benefit**



The Team:



**Capacitive deionisation
tech / Nano surfaces
Off-flavour analysis**

Joydeep Dutta
KTH



George
Triantaphyl
lidis



Fei Ye
KTH



Michael Bech AU



Kevin Stiller
Nofima

**Microbial community
analysis, visualisation,
Gene detection**



Jeppe Lund
Nielsen AAU



AALBORG UNIVERSITY
DENMARK

Rikke
Meyer AU



Torben
Kristensen
CEO SR

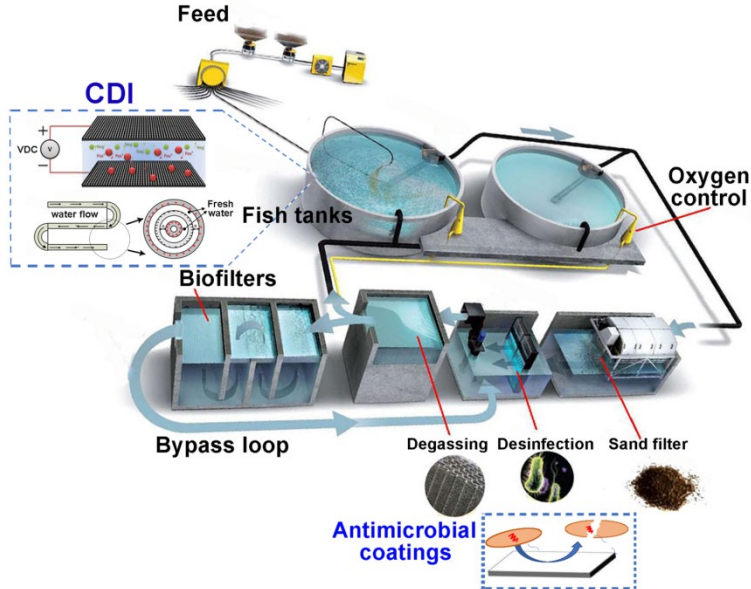
**End user testing
and optimisation**



Our strategy

We will target both waterborne and surface off-flavour producing microorganisms

- TARGET the formation of surface colonies with nano coatings
- TARGET water borne producers and chemicals with capacitive de-ionization



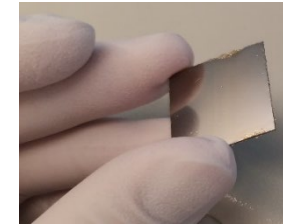
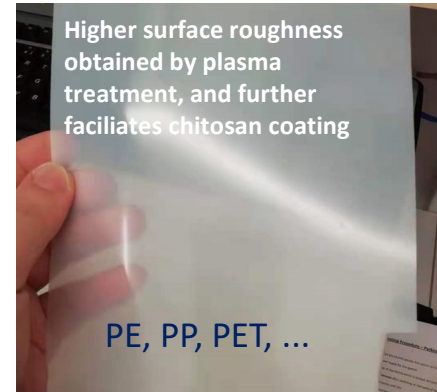
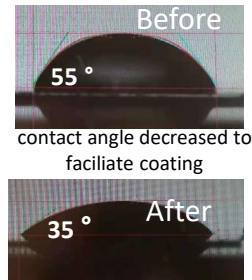


Antifouling coatings –

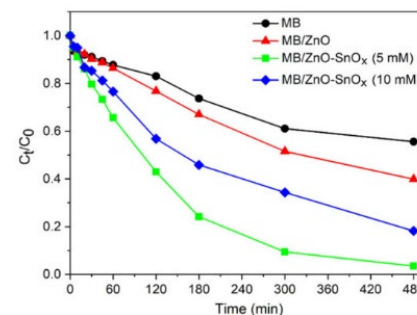
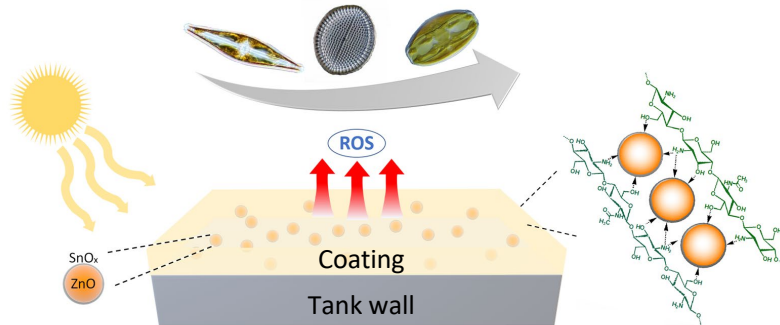
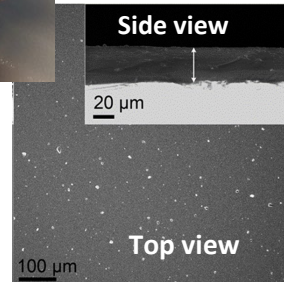
- Surface activation by corona discharge

Preliminary Results

- Biopolymer nanocomposite coating on plastic/ metal/ glass surface



Chitosan-ZnO spray coated on metal



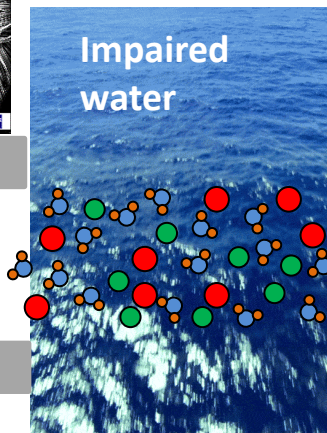
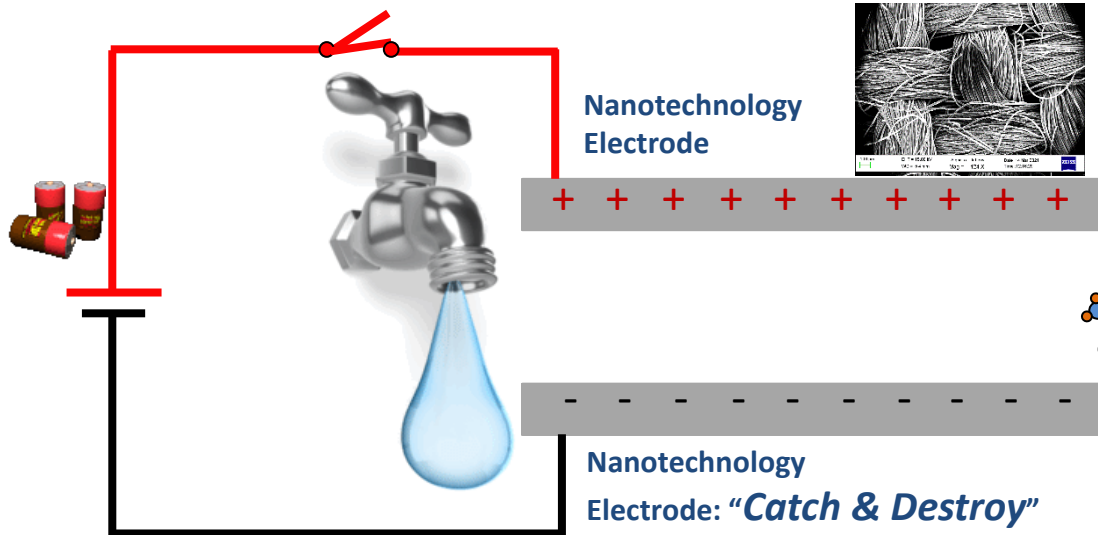
Photodegradation of model dye molecule (methylene blue) showing the activity a planned

- Photocatalytic generation of reactive oxygen species (ROS) for antiviral/antifouling



Capacitive Deionization

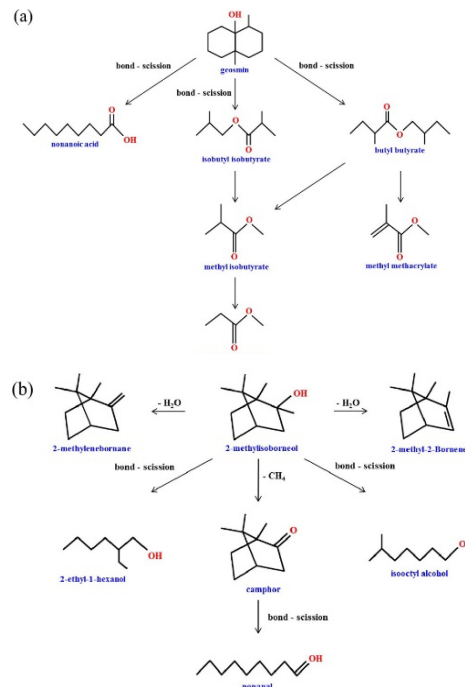
Adsorption process



- Anions/ Nucleophiles
- Cation/ Electrophiles

- ☐ Electrosorption process
- ☐ Higher surface area → Higher ion/molecule adsorption

Degradation pathway of GSM & MIB

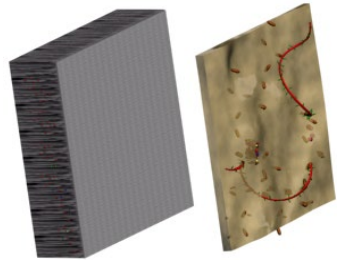
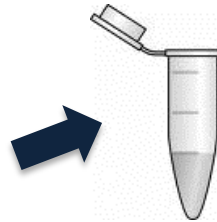
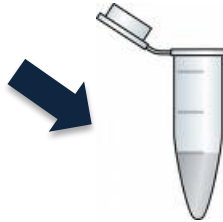
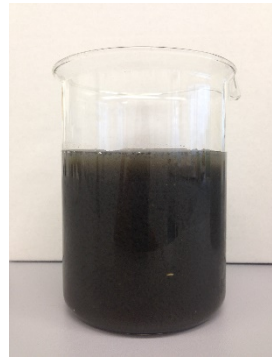




Microbial Identification

4. Microbial community

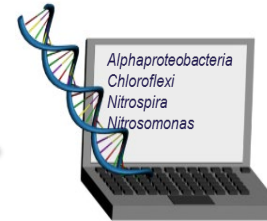
Samples from biofilter in RAS



Membranes



DNA extraction
and amplification



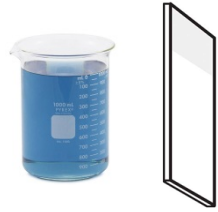
Bioinformatik

Species 1	11.3	12.9	13.8	16.3	24.4	25.5	28.9
Species 2	1.9	2.7	2.1	4.3	4.3	5.5	5.7
Species 3	0	13	9.5	3	0.1	0	0
Species 4	0.4	0.8	3.8	7.8	1.5	0.4	0.3
Species 5	4.9	1.2	2	1.7	0.1	0	0.5
	T1	T2	T3	T4	T5	T6	T7



Visual and Correlative analysis of microbial off flavour producers

Samples from
Aquaculture



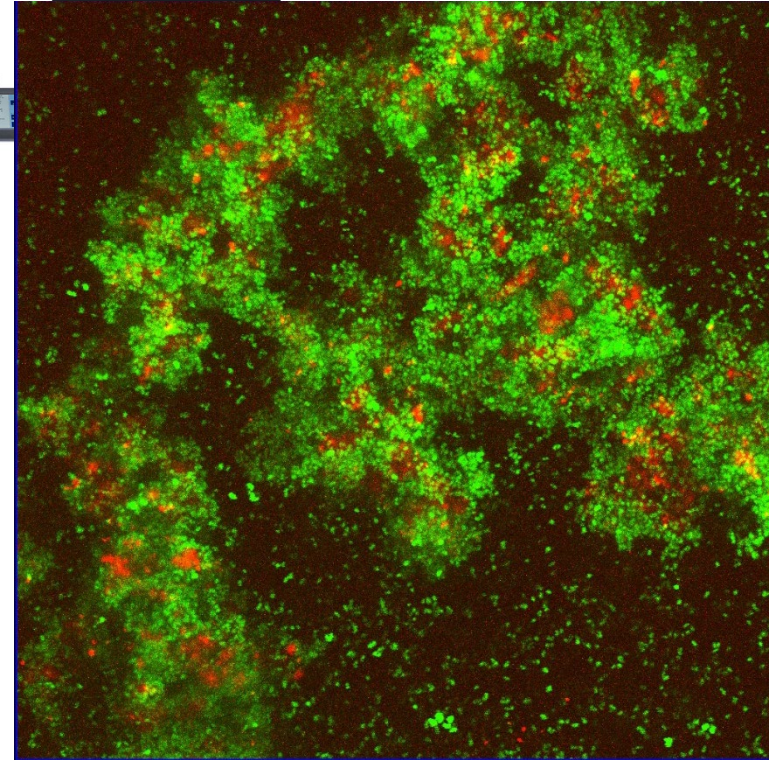
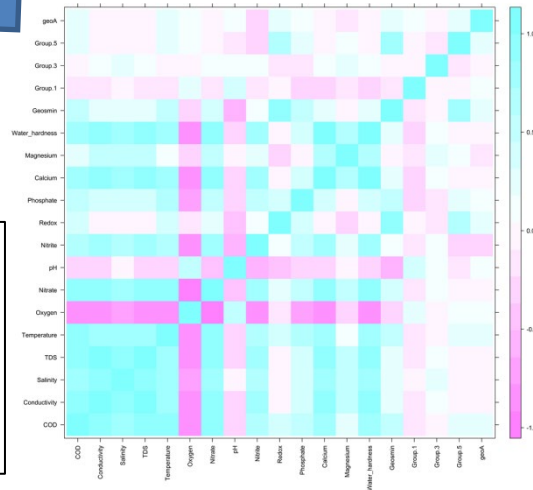
3D Visualisation Confocal laser scanning microscopy



All geosmin producers

Specific geosmin
producers

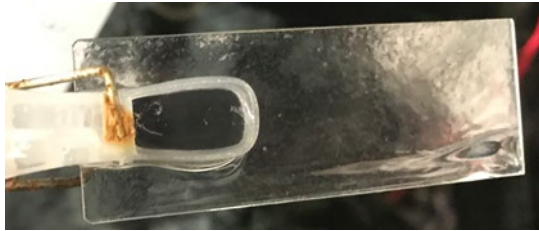
Positive
correlation
Negative
correlation



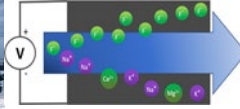
Nano Coating and CDI Testing in growth tanks



Testing at the recirculation aquaculture system (RAS) at NOFIMA



Slide for collection of biofilm



Test of CDI



Test RAS facility at Aarhus University



Sashimi Royal 1000 tons RAS farm



Water treatment at Sashimi Royal

Project objectives

- Optimization and Captive deionization (CDI) for removal of off flavour chemicals or waterborn microorganisms
- Optimization of chitosan nano coatings for reduction of off flavour producing surface colonies
- Evaluation of CDI and Nanocoatings in both test facilities & commercial scale RAS farm
- Reduce purge time to reduce loss of weight
- Optimise RAS to reduce geosmin and MIB producers
- Report our results!

Contact information

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