Overview and Status of LEAF project
“Low Emission Antifouling”

- Some backgrounds. “The concept”
- LEAF: from Newcastle to Singapore an ICMCF case
- Project status after the ...“first half”
Intoxication by local concentration of biocide at the solid-water interface. AF efficacy depend on biocide release-rate.

Release-Rate:
Sustained biocide release-rate needed, long time efficacy.

Erosion:
Controlled erosion needed, to maintain the release to the minimum level of efficacy.

- Very challenging tuning of erosion for maintaining release rate
- Designed for emitting and disperse biocide into the environment
- High loading of biocide needed
Intoxication only if barnacles can penetrate the coating. Efficacy and release-rate are independent.

- Easy to achieve long life time.
- Designed for retain the biocide into the environment.
- Low loading of biocide in the paint.

No release of biocide needed.

No controlled erosion needed.
The LEAF consortium is born during the networking activities in Newcastle conference 2010.

- Discovery of the efficacy of Macrocyclic Lactones
- Hypothesis of post penetration mechanism

Poster presentation 16th ICMCF (2012) Seattle
- Correlation penetration/efficacy
- Independency efficacy/release-rate


Project’s Work Packages:

- Optimization of biocide package
- Development and formulation of antifouling coating system
- Testing of antifouling coating system (lab and field)
- Technology demonstration and validation
- Sustainability assessment
- Dissemination and preparation for future exploitation
Optimization of biocide package

Status:

Algal and soft fouling:
- New Bioassay based on biochemistry has been introduced (will be presented by Prof. Claire Hellio Tuesday 8 July 5:15pm)
- Toxicity evaluation of 5 biocides on coral symbionts (Poster Presented by Rozenn Trepos Portsmouth University)

Barnacles:
- Novel bioassay design for pre and post settlement studies on coated panels started @ University of Gothenburg, Sweden (Poster presented by Dr. Christian Pansch ICMCFsg0193a0001)
Development, and Characterisation of AF coating

Status:
• Erosion resistance → Improved; still potential for further improvement 2014
• Hardness → Improved; still potential for further improvement 2014
• Distribution: Very Good Homogeneity
• Undergoing studies for alt. solutions

(You can read more in the Poster presented By Simone Garofoli ICMCFsg0233a0002)
Biocide Release Rate Measurements by ICP-MS and LC-MS/MS Extraction by ISO-15181-1

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<th>Day no.</th>
<th>Ivermectin release μg/cm²/day</th>
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<tr>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>3</td>
<td>0.72</td>
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<tr>
<td>10</td>
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<td>45</td>
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</table>

Ivermectin RR as from ISO

Zn²⁺ RR as from ISO

**Status:**
Very Low main biocide emission 8-6ng/cm²/day at steady state
- No Zn²⁺ burst
- Very Low Zn²⁺ release rate at steady state

Learn more from Mattias Berglin Oral3 today after lunch “Non covalent affinity between biocides and matrix components. Friend or foe”
Field Test of antifouling coating

**Status:**
LEAF- Beta Version
Efficacy test in field:
0 months → 4 months → 9 months
Very good only some green algal presents
(Mediterranean Sea)
For Brazilian field test results see IEAPM
Ricardo Coutinho’s Poster.
Upscale Development of antifouling coating @Boero’s facilities

Status:
• 90 L produced (cost 25% less than classical Cu-AF)
• Distributed to 7 boat owners in different 5 countries

Next steps:
• In 2015, ca.300L will be produced. Test Boats will be selected from the database present from the LEAF webpage [WWW.LEAF-ANTIFOULING.EU](http://WWW.LEAF-ANTIFOULING.EU) today (Aug-2014) already 37 boats owners have submitted the registration form for participating at the Final test 2015.
Boat Test: Technology demonstration and validation

### Boat Type

- Motor Boat (p [9])
- Fishing Boat [1]
- Other [2]
- Sailboat (pleasure) 21  64%
- Motor Boat (pleasure) 9  27%
- Fishing Boat (professional) 1  3%
- Other 2  6%

### Boat Length

- 7.68
- 23
- 8.28
- 7
- 6
- 5
- 9
- 8
- 5.20
- 16
- 13
- 14
- 10.7
- 11
- 12
- 20
- 10
- 11.5
- 12.7
- 9.4
- 5.11
- 4.2

### Boat Width

- 33
- 2.18
- 1.7
- 3.87
- 3
- 2
- 1
- 4
- 3.25
- 2.67
- 3.50
- 2.5
- 2.6
- 4.1
- 2.1
- 3.4
- 3.5
- 2.2
Sustainability assessment and industrial upscalability

Status:
- Preliminary LCA analysis shows 50% reduction of CO2 footprint compared to common AF Cu paint.
- 25% Lower production Costs
- An ecotox, emission scenario and human exposure dossier is under preparation by external experts.

All the results and comments regards LEAF formulation at 2013. The LEAF Formulation will be furthermore improved during the 2014 and the Final prototype will be ready in 2015.
Summary

• New AF paint based on the LEAF concept is under development by an international team effort financed by the European Union LEAF (2012-2015)

Results so far:
• Very Good AF efficacy demonstrated in field.
• Low biocide emission registered in lab by ISO standard methods.
• The proposed innovation has passed Industrial feasibility and upscalability control.

Next steps:
• Second generation LEAF paint with even further enhanced lifetime
• Preparation of document and dossier for exploitation (external dossier on human and environmental exposure)
• Final Demonstration Activity 2015 (Larger Boat Test distributed globally)
• Final Conference late 2015 (venue Sweden, TBD).
Thank you all, and especially thanks to LEAFs peoples