

## Data and info sheet on Cysbio and antifouling in paint

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### CysBio

- Company established in February of 2019 based on research from Novo Nordisk Foundation Center for Biosustainability (DTU Biosustain)
- Founders: Henrik Meyer (CEO), Alex Toftgaard Nielsen (CSO), Hemanshu Mundhada (Research Director) and Christian Bille Jendresen (Research Director)

### Fermentation technology

- Microorganisms convert renewable sources of carbon, such as glucose, to the wanted biochemicals.
- The microorganisms can be upscaled industrially in large fermentation tanks, and by simple fermentation (principally similar to beer brewing) the carbon sources are converted to the wanted product, which is then extracted from the fermentation broth and concentrated into the final product.
- Eelgrass acid:
  - Is naturally found as a product made by eelgrass in the ocean, where it's excreted from the plant's leaves. The plant thereby prevents formation of biofilm, which would otherwise grow on the leaves and reduce the photosynthesis. As an ingredient in coating material (such as in paint), eelgrass acid can prevent bacteria, fungi, and bigger organisms from attaching to the surface.
  - Over time, it may replace less sustainable materials, such as copper and other biocides, which are used today in ships' hull coating and other similar uses.
  - Eelgrass acid can be produced chemically or by extraction from the eelgrass plant, but it's a costly process. By producing the acid through fermentation, it makes a commercially viable price possible.

### Biofilm

- Bacterium that attaches to surfaces
  - Ships: microorganisms attach to the hull, leading to slime, algal growth, and barnacles.
- Biofilm increases the ship's water resistance: lowers the ship's speed, increases fuel consumption.
  - Economy: Example: A ship sailed without antifouling from San Francisco, US to Yokohama, Japan. Transport costs rose by 77 percent due to biofilm.
  - Environment: increased fuel consumption = increased CO<sub>2</sub> emissions + risk of spreading invasive species from one ecosystem to another.

### Paint for ships

- More than a billion litres of ship's paint are used annually
  - Market value is estimated to about \$2,5 billion
  - Annual growth at five percent

### **Antifouling paint**

- Bottom coating used to prevent fouling.
- Biocides are necessary in hull coating as it prevents biofilm.
  - More than 90 percent of big ships are coated with antifouling paint containing copper and similar materials

### **Regulations against antifouling paint containing copper**

- Sweden: ban on copper in the Bay of Bothnia and freshwater lakes
- California: The sale of ship's paint with high concentrations of copper for recreational vessels is banned
- Washington state: banned in 2026
- The Netherlands: sale of ship's paint with high concentrations of copper for recreational vessels is banned