Use of Secondary Metabolites from Marine Sponges as a New Antifouling Technology

Jennifer Chitty
Universitat Autònoma de Barcelona, Bellaterra 2013

What is Biofouling?

Biofouling is the name given to the **accumulation of microorganisms, algae and animals on wetted surfaces** such as ships' hulls and bioreactor membranes.
An initial **organic biofilm** is created, which is later colonized by bacteria and eventually macrofoulers like algae and barnacles.

In order to prevent biofouling Governments and industries spend over **US$ 5.7 billions/year** in antifouling (AF) coatings that are toxic to the environment. Its use is increasingly restringing and some components are even **banned**.

The Promise of Biological Anti-foulings

While conventional AFs consisted on **Copper**, **Mercury**, **Arsenic** and **TBT**-related biocides, Biotechnology is offering a new solution. A new technology pretends to use what already occurs in natural marine sponges: this is called **Biomimetism**.

Marine sponges have **secondary metabolites** that avoid fouling over them and could be used in AF coatings to cover ships' hulls. Some sponge metabolites that currently have huge potential are:

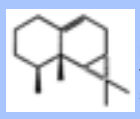


Fig 1. Most basic terpenoid structure

- **Terpenoids**: Inhibit larval settlement and barnacle metamorphosis. 14 terpenoids are currently being studied.
- **Brominated alkaloids**: they are cytotoxic and inhibit larval settlement and cause cyprid's death. Bastadin and hemibastadin are the most famous compounds.
- **Alkaloid bis-1-oxaquinolizidine**: specially rich in *H. exigua*, it inhibits both micro and macrofoulers at the same time. It is cytotoxic, antifungal and even antitumoral.

The use of other compounds like nano silver and nano copper to interrupt **Quorum Sensing** has also been a possible solution for fouling problems.

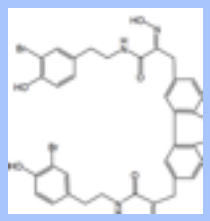
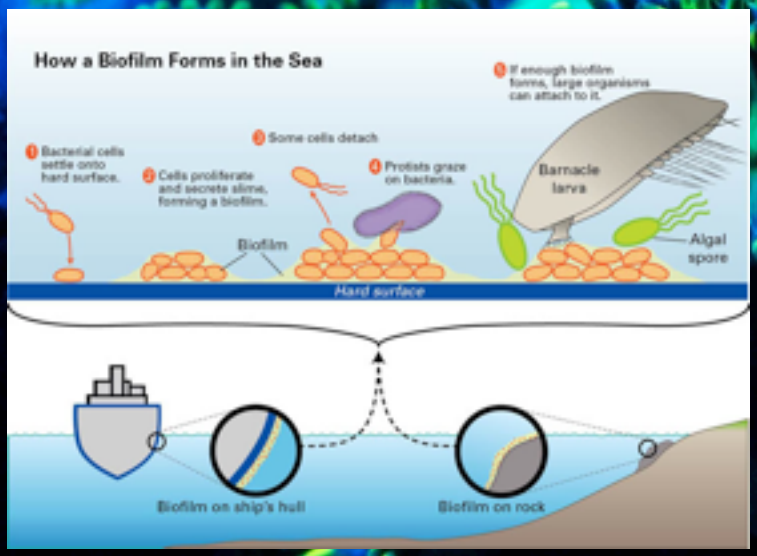


Fig 2. Hemibastadin structure



Conclusions

Soon environmental and economical issues will push the shipping industry to discontinue conventional AF and adopt new technologies.
The use of secondary metabolites seems like a promising solution, but the following are making it difficult to produce and commercialize in the near future:

- **high production costs**
- uncertain production methods
- **government bureaucracy**
- further research is still needed

Other technologies like the development of nanopatterns and the use of **nanotechnology** over ship's surfaces and the use of **photocatalytic materials** are also a possible solution.

References

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contact: jennamazeika@gmail.com