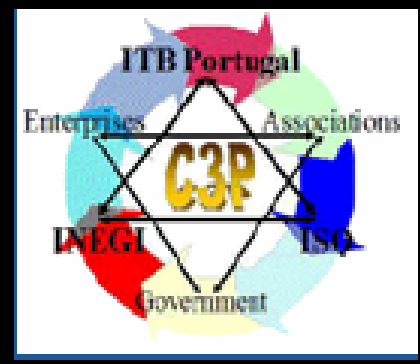
Uma Rede de Tecnologia e Qualidade

# A brief state of the art in EU of ecopaints for ship hull uses

E. Dias Lopes, N. Duarte, ISQ




C3P and NASA Technical Workshop 2005

September 8 – 9, 2005

# MAIN SOURCES OF POLUTION IN SHIP COATING

- **VOC & HAP emissions** to atmosphere (coating operations and preparation of paints)
- **Emissions of particles and heavy metals** during the dry-abrasive blasting process in surface preparation for repaint
- **Polution of water** (coating, removal of coating, removal of primers during construction and cleaning of painting equipment)
- **Marine polution** among the life cycle of paints containing toxic antifoulings (TBT)

## Why anti-fouling hull paint?

- **Hull surface finishing afects hydrodynamics behaviour.**
- **Growth of marine organisms in hull reduces the efficiency and increases fuel consumption and exhaust emissions.**
- **Elimination of marine fouling an objective of paint coating.**

The most common schemes contain organic tin (TBT) and a hazardous effect on human life and marine environment.

In the 1970s, the chemical industry and ship owners thought that TBT-impregnated antifouling paints was the best decision.

TBT leached from the paint into sea water it damaged barnacles, seaweed and any other marine life attached to the hull.

# C3P and NASA Technical Workshop 2005

In late 1970s and early 1980s TBT began to be linked with mortality and deformities in shellfish in the bays and harbours where concentrations of TBT had begun to climb.

There are now records of sexual changes and sterility in 72 species of marine snails, reduced resistance to infection in bottom dwelling fish, and traces of TBT in whales, dolphins and seals.

Antifoulant coatings commonly contain high levels of inorganic copper and zinc, typically cuprous oxide and zinc oxide.

Application of the coating using airless paint spraying equipment reduces the painting efficiency, due to overspray.

# Fouling-control coating options:

- ✓ **textured surfaces (rough),**
- ✓ **foul release coatings (smooth)**
- ✓ **coatings incorporating active agents (biocides)**

## The antifouling main problem is:

- Marine water is strongly affected by release of toxic substances by a longtime of hazardous consequences.

- International legislation is forcing new solutions (IMO, EU, Local)

## EU Commission:

✓Application of TBT antifouling to all ships flying EU flags countries was forbidden from 1/7/2003.
✓If a TBT antifouling was applied before 1/7/2003, TBT-free products must be applied to EU ships flying EU at the next drydocking; existing TBT products need not be sealed off or removed until 1/7/2008.
✓A TBT free certificate (for vessels >400 GT) or self certificate (for vessels >24m in length and <400GT) is required at the next docking for the antifouling system applied on all ships flying EU flags. Certificates by Classification Societies.

## EU Commission:

✓If a ship is change flag from a non-EU country to a EU country of the and TBT antifouling were applied to the hull after 1/7/2003, the TBT product must be either sealed off or removed from the hull before coming under EU flag.

## One solution can be:

**Building a better understanding of biological processes may lead us towards more effective fouling management solutions.**

# Advantages of natural antifoulants for coating:

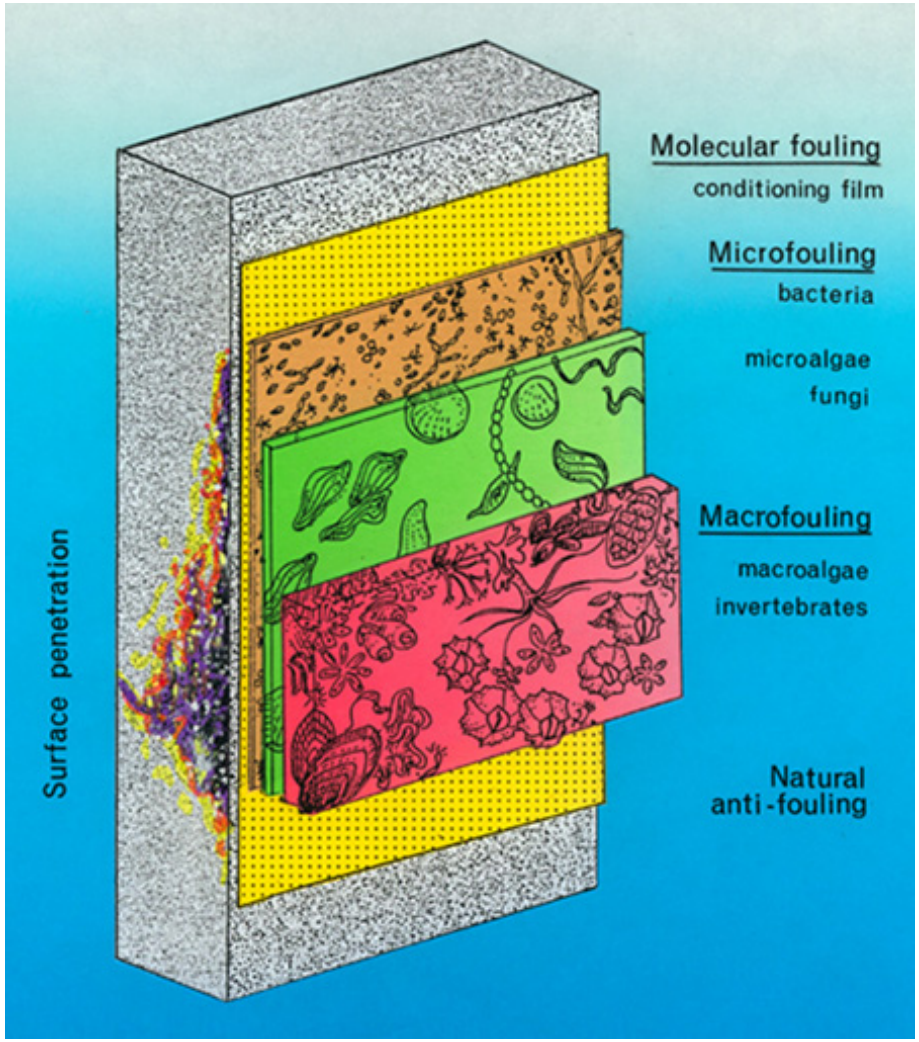
- ✓ Natural characteristics developed for millions of years for their efficacy,
- ✓ Will not be broad spectrum biocides
- ✓ Rather function in specific ways producing organism to avoid autotoxicity,
- ✓ Biodegradables.

They are part of a more general class of compounds – marine natural products or secondary metabolites - which while often biologically active may not function in nature as inhibitors of colonisation (growth of fouling).

- **The organisms involved in the fouling process all uses a biological mechanism (a form of glue) to settle at e.g. a ship hull.**
- **The barnacle larvae secrete a protein to settle as cypris larvae on a surface before the metamorphosis into the adult stage.**
- **The secreted protein (the glue) can by hydrolysed by enzymes.**

Source: BioLocus Ltd., Danmark

## C3P and NASA Technical Workshop 2005




# Fouling - Biological Process

Source: NERC News, April 1995

# The elimination of biological glue by enzymes stops the hull fouling!!!???

# MAIN RESULTS

**Marine painted panels containing enzymes were immersed into seawater for six month.**

**In the panels inspection only very few barnacles could be detected on the enzyme containing panels compared to the control panels without enzymes.**

# But... from China with eco-innovation...

**China Marine Research Institute of the State Oceanic Bureau developed a toxicant free ship paint.**

**The toxicant is the compound made of natural pepper extracts and organic clay which will not kill the adhesive marine living creatures but drive them away from the ship.**

**Experimented in 7 ships running over the South China Sea, the East Sea, the Yellow Sea and the North Pacific Ocean.**

Source: China Science and Technology Newsletter, Oct 2002

# Existing ecological alternatives have been tested:

- **non-toxic, non-stick coatings** to prevent settling (smooth silicone, teflon or hydroviscosic coatings)
- **self-polishing, anti-fouling paints without biocides**
- **fibre-flock coatings**
- **hard, non-abrasive coatings** in combination with special cleaning procedures (e.g. hydro jetting, rotating bristles).

WWF

# German coast ship trials testing biocide-free anti-fouling (conclusions):

- ✓ The performance of the biocide-free anti-fouling coatings suggest some promising alternatives to organotins for coastal vessels.
- ✓ Results may depend on the ships' operating conditions.

# German coast ship trials testing biocide-free anti-fouling systems (conclusions):

- ✓ The fibre-flock paints performed well even on a slow moving vessel with long harbour periods.
- ✓ Additionally for brackish water, hydroviscosic paints and Teflon-based non-stick coatings combined with cleaning, seem to be viable alternatives.

# German coast ship trials testing biocide-free anti-fouling systems (conclusions):

- ✓ The use of anti-corrosive paint only, on fast moving vessels, may be appropriate under certain conditions, which makes the application of antifouling systems unnecessary.

# German coast ship trials testing biocide-free anti-fouling project (partners):

**Ship owners:** AG Ems, AG Norden-Frisia, Wyker Dampfschiffs- Reederei, Insel und Halligreederei Kurt Paulsen, HADAG, Manfred Friedhoff, Coastal guard Lower-Saxony, Coastal Research station of Lower-Saxony

**Paint manufactures:** CHUGOKU Germany, Colloid, Hempel Germany, Akzo Nobel (International Farbenwerke – Akzonobel.), Relius Coatings, SIGMA Coatings, SealCoat, Tenax Marine Paints



The Free Antifouling Paints are a
Technical & Commercial Challenge!
Are Shipowners, Paint Industry and
Research Institutions able
to accept it?

Uma Rede de Tecnologia e Qualidade

Eduardo Dias Lopes edlopes@isq.pt

Norberto Duarte njpereira@isq.pt

ISQ - R&D Division

www.isq.pt