Barnacle fouling in niche areas How big is the problem?

A WHITE PAPER BY I-TECH AB, DEVELOPERS OF SELEKTOPE®

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This is I-Tech

The Technology: Selektope®

Selektope is an organic, metal-free active agent added to marine antifouling paints to prevent barnacles from settling on coated surfaces by temporarily activating the swimming behaviour of barnacle larvae.

This bio-repellent effect makes Selektope the only type of technology of its kind available to the marine paint manufacturers.

Barnacle fouling is very detrimental for ship fuel consumption, emissions and invasive aquatic species transfer. The use of antifouling paints containing Selektope significantly reduces fuel consumption, which contributes to lowering emissions. It also enables ship operators to unlock financial savings associated with lower fuel bills and lower maintenance costs associated with hull cleaning.

Depending on the formulation, Selektope can also help to reduce emissions to water by reducing biocide release by more than 90 percent compared to other antifouling paints, without negatively impacting the performance of the paint.

The Company: I-Tech AB

I-Tech is a global biotechnology company based on the west coast of Sweden.

Since 2006, I-Tech has successfully transformed the scientific invention of Selektope® into a commercially ready and available antifouling active agent which is supplied to marine coatings manufacturers for inclusion in antifouling products.

I-Tech is uniquely the first company to apply principles from biotechnology research in the paint industry to keep ship hulls free from marine fouling.

> “Barnacles can cause an increase of fuel consumption of over 40%.
> Selektope is a key alternative today and for the future.”

selektope®

i-tech

Content

I-Tech contracted independent marine coating consultants, Safinah Group to analyse underwater hull fouling condition on a sample of 249 ships which drydocked over a four-year period between 2015-2019.

249

vessels surveyed

The significant extent of barnacle fouling in niche areas based on this sampling demonstrates that the current fouling protection solutions do not give satisfying results in these areas.

572

observations

Fouling condition at drydock for 572 observations undertaken confirmed that animal fouling is present particularly at the flat bottom and sea chests.

10

billion USD

Potential fuel savings connected to fouling on the hull.

What is biofouling?

For as long as humans have traversed the world's oceans, ships' hulls have acted as magnets for marine life. The accumulation of marine organisms on submerged surfaces is called biofouling. Biofouling is a highly dynamic process and specific organisms that develop in a fouling community depend on the geographical location, water temperatures and factors such as competition and predation. Therefore, where a ship sails, or sits idle, when, and for how long, all influence which type of biofouling will accumulate and how fast.

36%

A vessel with 10% barnacle hull coverage would need a 36% shaft power increase to maintain the same speed.

20k

Each barnacle parent can release anywhere from 10,000 to 20,000 larvae, and they survive for several weeks in the water column.

Barnacle cyprid larva

Biofouling: a quick introduction

Biofouling is a complex process that often begins with the production of a biofilm. Within minutes of immersing any clean surface in water, organic and inorganic substances adhere to form what is known as a conditioning layer.

Micro-organisms such as bacteria and unicellular algae then colonise the surface to form the primary biofilm, commonly known as the 'slime' layer. If the growth of the slime layer progresses far enough, it can provide the foundation for the growth of 'macro-biofouling' organisms including seaweed, barnacles, and other hard-shelled organisms which use the biofilm like an incubator.

Macrofouling is commonly divided into two types: 'soft fouling' and 'hard fouling';

- Soft fouling comprises algae and invertebrates, such as soft corals, sponges, anemones, tunicates and hydroids.
- Hard fouling comprises hard-shelled invertebrates, most commonly barnacles, but also mussels and tubeworms. This type of biofouling is often referred to as 'animal fouling'.

Spotlight on barnacle fouling

While ship design has evolved over time, the issue of biofouling remains to be a significant Biofouling is a well known problem for the maritime sector. Natural selection amongst fouling creatures has adapted them to thrive while adhered to wet surfaces.

Take barnacles, for example. Like other stationary marine invertebrates, barnacles begin their lives as highly mobile larvae. Each barnacle parent can release anywhere from 10,000 to 20,000 larvae, and they survive for several weeks in the water column.

In order to complete the transition to adult life, the 'cyprid' form of barnacle, larvae must attach to a hard substrate. Therefore, these tiny, shell-less swimmers are on a mission to find their ideal habitat. The perfect, submerged, static surfaces presented by ship hulls are very attractive real estate.

The cyprid barnacle larvae explore the hull surface, walking around using a pair of attachment organs called 'antennules'. Once they find a suitable place to call their forever home, they attach themselves head-first by releasing a glue-like substance; only then can they develop into the sturdy, calcareous-shelled adult barnacle we all recognise.

The strength of this glue-like substance is such that mechanical forces are required to remove barnacle fouling from ship hulls, much to the detriment of the paint on the hull.

For barnacles, attracting more barnacles to mate with is important. Therefore, while exploring a surface, they leave behind blobs of temporary adhesive 'footprints'. The temporary adhesive operates as a signaling molecule to induce the settlement of additional barnacle larvae. Therefore, once a ship hull has some barnacle fouling, the problem will only get worse.

Why is barnacle fouling so bad?

For the barnacle glued to the hull, life is great; it now has its home established in a place where the constant flow of water will bring food directly to its door and it can start to consider starting a family. However, for the ship operator barnacle fouling presents a significant financial and operational burden.

Hard fouling significantly increases the amount of frictional resistance (hydrodynamic drag) across a ship's hull when it moves through the water. Increased frictional resistance requires the ship to burn more fuel to maintain a set speed through the water. Alternatively, if a ship is required to conduct a voyage on fixed shaft power, or a fixed fuel consumption volume, speed losses will result.

A 2007-published study by Michael. P. Schultz proclaims that a vessel with 10% barnacle coverage would need a 36% shaft power increase to maintain the same speed. Although this particular study was based on a naval frigate, the statistics are relatable to cargo ships alike. Therefore, barnacles are creatures that you do not want to colonise the hull of your ship when profit margins are tight.

Barnacle coverage (%)	Additional shaft power to sustain speed at 15 kts (%)	Additional shaft power to sustain speed at 30 kts (%)
10	36	23
17	44	27
39	54	33
48	57	35
57	54	33
63	55	34
70	53	33
79	52	32
Light**	31	20
Medium**	47	30
Heavy**	76	47

*Adapted from Schultz et al (2011) ** values from Schultz et al (2011)

Spotlight on niche areas

The hulls of vessels are complex surfaces, having many different "niche areas" wherein the effectiveness of biofouling management strategies such as the use of antifouling coatings and hull grooming methods, is limited compared to the flat surfaces of the hull.

In order to quantify just how significant the issue of barnacle infestation in ship niche areas is across the global shipping fleet, we contracted independent marine coating consultants, Safinah Group to analyze underwater hull fouling condition on a sample of 249 ships which drydocked over a four-year period between 2015-2019.

The range of antifouling coating technologies included in the research were ships that were making use of both biocidal antifouling coating (low, medium and high grade) and foul release coatings

The sample included all major ship types covering a range of trading activity. The 249 vessels examined were split by type.

"small amounts of hard fouling on the propeller can have a huge impact on the performance of a vessel. "

"While a vessel might have a pristine underwater hull, our research suggests that there is a good chance it is highly colonised with hard fouling in the niche areas."

62%

62% of vessels had barnacle fouling coverage on the hull of up to 1000m^2 on the underwater hull area

44%

On 44% of vessels surveyed, >10% of the underwater hull surface was significantly covered with hard fouling.

*Out of the 249 vessels inspected during drydock, the fouling condition of 198 could be accurately assessed.

WHAT ARE NICHE AREAS?

Niche areas on a ship includes sea chests and gratings, bilge keels, seawater inlet gratings, lateral thruster tunnels, bow thrusters and gratings, propeller shafts, propellers, rudders and dry dock support strips. Fouling in niche areas creates ideal spots for hitch-hikers such as crabs, mussles and other marine species, causing the risk of transferring invasive species. Fouling, on for example propellers, could also significally lower the performance.

Sea chests and gratings

Sea chests are primarily used for ballasting, cooling, and fire prevention purposes. They are typically deep penetrations into the hull designed to optimize flow into seawater intake pipes.

The size of sea chests varies depending on flow requirements, and larger ships normally have multiple upper and lower sea chests. Sea chests have slotted, perforated, or flush-mounted gratings to prevent large debris from entering the system, and the open area of the gratings are sized to allow for proper suction from the pumps.

Rudders

Rudders are typically stern-mounted and centered about the outflow jet, behind the propeller. The ship's rudder provides maneuverability function.

Propellers

Ship propellers are located as fixed appendages at the stern of a ship and are responsible for the ship's propulsion.

Dry dock block marks

When a ship is placed into a dry dock, it is supported using blocks placed along the hull of the ship. The ship is floated onto the blocks and after the water is drained from the dry dock, the area in contact between the ship's hull and support blocks is inaccessible, so coatings are often not applied to these areas.

Bilge keels

Bilge keels provide hydrodynamic stability to protect the vessel against roll. They are typically paired symmetrically about the keel line at the turn of the bilge and run approximately half the length of the ship.

Lateral thruster propellers, tunnels, and gratings

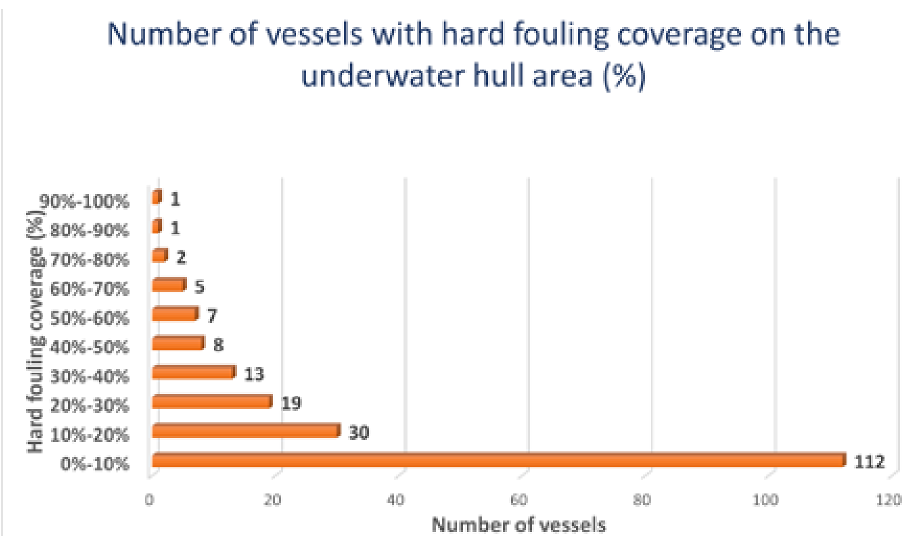
Lateral thrusters provide thrust to a ship for increased side-to-side maneuverability, especially at low speeds where the effectiveness of a conventional rudder is greatly reduced, for example, during docking.

HARD FOULING WAS FOUND ON NEARLY EVERY VESSEL SURVEYED.

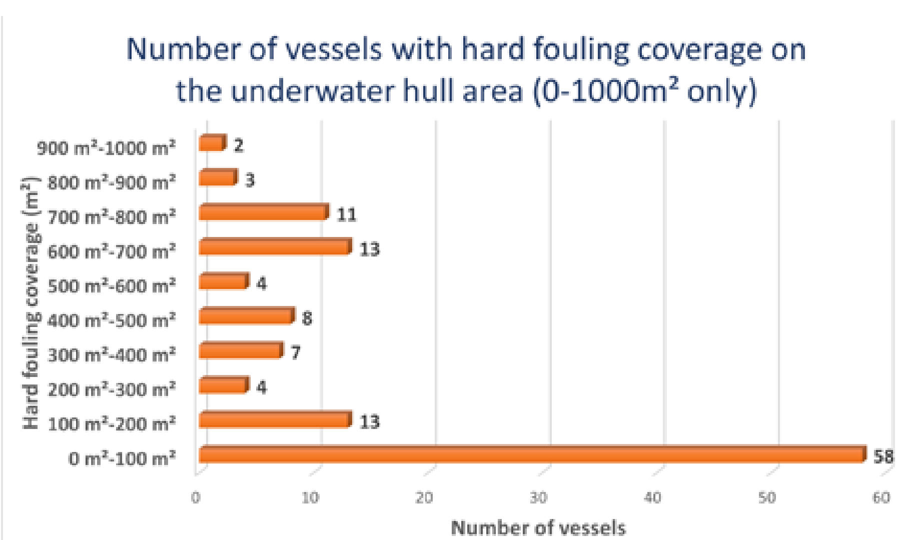
It was found that nearly every vessel surveyed, had some degree of underwater hull hard fouling.

Since anything more than 10% coverage is deemed to be an 'unacceptable' level of coverage by experts, when considering the impact it will have on vessel performance, this is a significant problem for ship operators.

On many vessels, fouling levels were even worse; approximately 15% of vessels had between 10-20% of hard fouling coverage on the hull, 10% of vessels had 20-30% of hard fouling coverage and the remaining 10% of vessels had between 40-80% of coverage. 1% of vessels had hard fouling coverage of between 80-100%.



On 44% of vessels surveyed, over 10% of the underwater hull surface was significantly covered with hard fouling. On many vessels, fouling levels were even worse; approximately 15% of vessels had between 10-20% of hard fouling coverage on the hull, 10% of vessels had 20-30% of hard fouling coverage and the remaining 10% of vessels had be-



When taking a closer look at those vessels suffering with 0-1000m^2 hard fouling coverage, it was found that 53% of those vessels had hard fouling coverage of at least 100m^2 or more.

DOES VESSEL ACTIVITY IMPACT BARNACLE FOULING?

For the pruposes of this research, vessels were grouped by relative vessel activity and typical industry assumptions.

As expected the frequency of animal fouling occuring, increases on the lower activity vessels and for all vessels fouling coverage is generally higher on the flat bottom and sea chest areas.
In relatively lower activity vessels, hard fouling in the seachest was higher (97%) than the hard fouling present in the sea chest of realitely higher acitity vessels (91%).

Relatively lower activity	Relatively higher activity
Chemical / Product Tanker	Car Carrier
Crude Oil Tanker (up to 80k DWT)	Crude Oil Tanker (up to >80k DWT)
LPG	Container
Oil Product Tanker	Cruise Ship
	Ferry
	LNG

Observations across all ship types revealed that the frequency of hard fouling was relatively higher on the lower activity vessels.

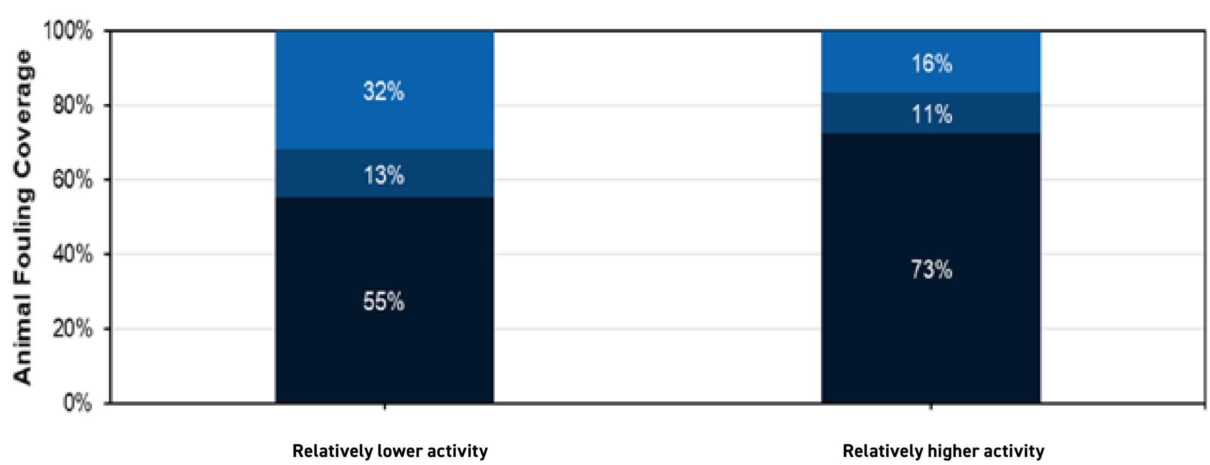
In fact, 45% of lower activity vessels surveyed suffered from hard fouling coverage of > 10% compared to just 27% of higher activity vessels.

45% of lower activity vessels had hard fouling coverage of > 10%

vs

27% of higher activity vessels had hard fouling coverage of > 10%

Hard fouling coverage by relative vessel activity



SUMMARY PREPARED BY SAFINAH GROUP:

Based on the sample of 249 vessels it has been observed that animal fouling is clearly a problem. Approximately 30% of all vessels with animal fouling have barnacle coverage that is 20% of the total underwater hull area. Barnacle fouling as expected is more predominant on the flat bottom and sea chests when compared to the other main underwater area; the vertical sides.

HARD FOULING IN NICHE AREAS.

VESSEL 1

Vessel type:
LPG

In service period:
5 years

Niche area coating:
Biocidal antifouling, type unknown.

Sea chest

Sea chest

Sea chest

VESSEL 2

Vessel type:
Chemical / Product Tanker

In service period:
3 years

Niche area coating:
Biocidal antifouling, type unknown

Sea chest

Sea chest

Sea chest

VESSEL 3

Vessel type:
Cruise

In service period:
Unknown

Niche area coating
FRC on bow thrusters

Bow thruster

Bow thruster

Bow thruster

NICHE AREAS - BIOFOULING HOT SPOTS

WHY ARE NICHE AREAS HOT SPOTS FOR BIOFOULING?

Niches areas are typically cavities or protrusions and some with grate coverings at the entrance. They provide a favorable environment for biofouling organisms accumulation for a number of reasons:

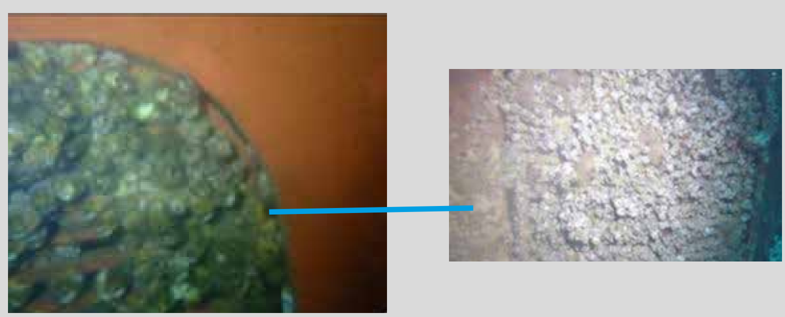
Restricted water flow:
This limits the action of biocidal antifouling coatings that require a flow of water to remove the top coating layer, which continuously exposes fresh biocid-active agents at the surface of the hull surface. Without the flow of water, a thick "leach layer" of depleted biocides forms, preventing the proper action of the antifouling coating. Therefore, The efficacy of biocidal coatings can significantly decrease in low-flow water flow areas. The same applies for fouling release coatings where the shear forces of the water flow will release the fouling.

In-water cleaning difficulty and high safety risks:
Access to niche areas for cleaning can be tricky and dangerous. For example, a diver cannot enter thruster tunnels due to gratings and they endanger divers if they are inadvertently activated. Gratings are also proven very difficult to clean.

Susceptibility to improper covering during coating application:
Often the niche areas, which are technically more difficult to coat, do not receive proper attention in surface preparation and coating coverage. Antifouling coating systems applied to niche areas are also at risk of failing since the application of coatings to grating, angular edges or appendages, where access to apply the coating is limited, can lead to coating failure due to cracking, and a reduced dry film thickness of the coating system.

Damage to coatings due to turbulence:
Cavities, protrusions and appendages in niche areas can affect hydrodynamic flow around the ship, causing heavy turbulence around niche areas that can degrade the antifouling coating in place, faster than in other smooth hull areas.

This image of a seawater inlet grating shows an example of how the coating itself seems to work, as the area around the inlet is free of fouling, but from the edges of the inlet grating, heavy fouling is discovered.



Heavy barnacle fouling on seawater inlet gratings

WHY IS BIOFOULING IN NICHE AREAS SO BAD?

Although hard fouling in the niche areas does not induce as much hydrodynamic drag which induces excessive fuel consumption and carbon emissions as biofouling on the main hull surface area, niche area fouling can significantly impact the operational and environmental performance of vessels in other ways.

Biofouling in niche areas can:

- Be a vector of invasive aquatic species transfer.
- Create increased maintenance costs.
- Lead to machinery and propulsion failure.
- Increase fuel and emissions (fouling on dry dock block areas on the flat bottom)
- Safety risk, when pumps will not get enough water

NICHE AREAS - BIOFOULING HOT SPOTS

FOULED NICHE AREAS - A VECTOR OF INVASIVE AQUATIC SPECIES TRANSFER.

A multitude of species, carried either in vessels' ballast water or on vessels' hulls, are capable of surviving transit to new environments where they may become invasive by multiplying and out-competing native species.

Several organisations, working towards sustainable marine environments, has recognized the potential for invasive aquatic species transferred through biofouling to cause harm to biodiversity and marine ecosystems.

According to the International Maritime Organization (IMO), several studies have determined that vessel biofouling has been a comparable, if not more significant, factor than untreated ballast water for introduction of IAS. In some parts of the world, evidence suggests that 70-80% of IAS introductions have occurred through biofouling. Although it is difficult to quantify the global economic impact of IAS, useful examples include the impact of the zebra and quagga mussels' introduction in the United States, which alone are estimated to cause USD 1 billion a year in damages and associated control costs.

Growing regulatory focus on the transportation of invasive aquatic species (IAS) by the international shipping fleet creates commercial risks for the global shipping fleet. Ship hulls, along with ballast water have been identified by the IMO as being a vector for invasive aquatic species transfer between different ecosystems worldwide, posing a great threat to biodiversity.

REGULATIONS TO REDUCE THE TRANSFER OF INVASIVE SPECIES.

Although no international regulations exist, yet, the lack of an international regulatory framework addressing the prevention of the transfer of IAS through biofouling has prompted several local governments to act and develop unilateral regulations.

Californian port authorities believe that bio-fouled hulls can be responsible for up to 60% of the established aquatic species now being seen along the west coast of America. Consequently, local regulations can place strict quality controls on hull condition, which can dictate whether a ship is allowed to enter the port or not according to how much of a threat to local biodiversity it poses.

In 2017, a 33,752 dwt Korean-owned bulk carrier DL Marigold was ordered to leave New Zealand waters after its heavily fouled hull was judged to be a threat to bio-security. Under new biosecurity rules that entered into force in May 2018, all international vessels arriving into New Zealand must have a clean hull.

These type of regulations can create a huge financial burden for ship operators since the costs associated with turning the ship around and sailing it back to a location where hull cleaning can be undertaken is very high and very inconvenient.

MACHINERY AND PROPULSION FAILURE.

Reduction of heat exchange capability of the heat exchangers. When box coolers are fouled heat exchange is reduced and either the temperature is not lowered sufficient or more energy will be needed to obtain the target.
If the water inlets are clogged heat exchange can also be reduced, in the worst case this can lead to failure.

Propellers are highly sensitive towards hard fouling, only small amounts of barnacle fouling can have a huge impact on the performance of a vessel.

NICHE AREAS - BIOFOULING HOT SPOTS

IS BARNACLE FOULING PREVALENT IN NICHE AREAS?

When comparing the following locations – boottop, vertical sides and flat bottom – animal fouling was present on the majority of observations for all locations. However, animal fouling was particularly prevalent on the flat bottom area.

Fouling condition at drydock for 572 observations undertaken, split into the areas vertical sides, flat bottom, bootop and seachest (niche area), confirmed that whilst animal fouling is present on the majority of the observations for all locations, this is particularly the case for the flat bottom and Seachest.

This is expected since these areas receive little or no UV light which is not required for animal fouling, unlike weed fouling.

The combinations of fouling types observed across the different areas confirms that, animal fouling only (approximately 74% of observations) dominates in sea chests.

HOW SIGNIFICANT ARE THESE FINDINGS FOR THE INDUSTRY?

The significant extent of barnacle fouling in niche areas based on this sampling demonstrates that the current fouling protection solutions do not give satisfying results in these areas. They are a vector for invasive species and so far the risk of increased maintenance cost has just been accepted by the industry.

Barnacle fouling can only occur when a vessel either has low speed or lays up several days in coastal waters. However, since this data analysis was carried out before the COVID-19 pandemic we anticipate that the extent of barnacle fouling coverage not only on the hull but also in niche areas will have increased significantly for the huge proportion of vessels that have laid idle.

Antifouling coatings - a key solution

When looking at the future trading potential, ship operators need to ensure that their ship is protected whether it be in constant active service, idle for long periods of time, or fluctuating between the two. Antifouling coatings will remain to be a key solution for the prevention of biofouling in niche areas.

90%

90 percent of the market is so-called traditional antifouling products that use approved biocides in various combinations.

80%

80 percent of the marine paint market demand is met by 6 of the largest suppliers in the world.

3bn

The global antifouling paint industry has annual sales of approximately USD 3 billion.

Use of niche area-optimised antifouling coatings

Historically, efforts to prevent biofouling on niche areas have been much less than that for the overall flat surface of the hull, since the primary goal of hull cleaning is to reduce hydrodynamic drag and, in turn, fuel consumption (e.g., Schultz et al. 2011).

However, given the high risk to maintenance costs and IAS transfer, barnacle fouling in niche areas needs to be higher on the agenda. Antifouling coatings will remain to be a key solution for the prevention of biofouling in niche areas. However, certain changes need to be made to enhance their effectiveness.

The fouling control solution used for the hull might not be the ideal choice for niche areas. Fouling control solutions should be used which work under the different hydrodynamic conditions in the niche areas. This can be higher polishing paints which were designed to work at lower speed and for longer idling. Additionally the biocide package can be optimized for the type of fouling found in these areas to have a similar effect.

This includes:

The use of antifouling coatings with a higher polishing rate in niche areas for better performance in low-water flow conditions.

Greater time for surface preparation and attention paid to the coating of niche areas with antifouling systems when a ship in under construction or in dry dock.

Improvements in niche area design, from a ship design perspective, to remove angled edges and hard-to-coat gratings.

Greater attention/time spent during niche area coating

The best antifouling coatings will not give satisfying results if the application is not done properly. Often niche areas do not get the attention they deserve. The surface preparation should be done with the same level of quality as the rest of the hull and also the application quality should be done on the same level as the rest as the hull including film thickness measuring.

Improvements in niche area design

Most gradings in nowadays design are square bars and on the edges there is normally significantly less paint film thickness retained. The lower thickness of an antifouling results in lower protection and fouling starts from the edges then overgrowing the other parts. A different design of the gradings can help to reduce this problem.

Yesterday's solution will not work for tomorrow's problems.

This has catalysed great developments in the marine coating sector to ensure that technologies that can offer superior antifouling protection are incorporated into marine coatings. It is for this reason that our barnacle-repeling ingredient technology Selektope® is being increasingly added to marine coatings by global paint manufacturers to deliver superior protection against hard fouling, allowing them to offer static performance guarantees that are significantly longer than 30 days.

As such, our antifouling coating ingredient technology Selektope® has witnessed significant uptake in the years since the first commercial Selektope®- containing antifouling coating was launched in 2015.

I-TECH´S LARGEST CUSTOMERS

CMP CHUGOKU · JOTUN · HEMPEL

Philip Chaabane, CEO, I-Tech AB concludes:

"The insight into the barnacle fouling problem across the global fleet, based on the inspections carried out by the Safinah Group, make for alarming reading.

Based on this sampling, it is extremely likely that a large proportion of vessels are in fact operating with high degrees of hard fouling. Given the increase in idle vessels that we have seen during the pandemic, we can reliably assume that the extent of fouling across the shipping industry will have spiked significantly."

"This entire period needs to serve as a lesson for our industry, coating specifications need to be taking into account the possibility that ships could at any time be forced into extensive idle periods. As such, we are encouraging ship owners, operators and managers to consider the technology mix within antifouling coatings to ensure that they protect their vessel from hard fouling during any unanticipated long idling periods."

"A beneficial strategy is to take a proactive approach on prevention of hard fouling. To achieve this, owners need to be looking closely at the antifouling technology mix within their marine coatings and analysing the idle period guarantees their additives have. They will strongly need to consider which antifouling additives enable idle period guarantee that are longer than 30-days, such as Selektope®."

Power up the antifouling coating

Selektope® is an organic, non-metal active agent that is unique compared to traditional biocides, Selektope® has been developed and commercialised by I-Tech for use in paint systems. Its powerful, repellent effect on barnacles keeps the ship hull and niche areas clean from hard fouling.

2g/l

2 grams of Selektope® is used per one litre of paint, comparable to 500–700 grams of copper oxide used per litre of paint for barnacle prevention.

Along with only seven other substances, Selektope® is approved according to very comprehensive EU biocidal legislation, the EU-BPR.

THE SCIENCE BEHIND SELEKTOPE®

Selektope® is an organic, non-metal active agent that is unique compared to traditional biocides currently used in many marine paints. When leached into the water from the antifouling coating, functioning like any other biocide, Selektope® activates the swimming behavior of barnacle larvae through natural receptor stimulation. This induces the barnacle larvae's swimming behavior that they use when seeking a hard substrate on which to attach. This constant swimming mode prevents them from being able to settle, forces them to find another hard surface on which to glue themselves and build their volcano-shaped shell.

The effect of Selektope® is temporary, the barnacle larvae are only affected while they are in close proximity to the coated surface and the exposure to Selektope® ultimately leaves them unharmed. When used in antifouling paints, Selektope® can protect all ship types when they are idle or operating at low speeds for extended periods of time, even in extreme barnacle fouling risk areas. As such, antifouling coatings with Selektope® confer relative peace of mind to ship owners and operators that their ship hulls will remain barnacle free.

Selektope® is currently used in Biocidal Antifouling Coatings of the self-polishing co-polymer type (SPC). Biocidal antifouling coatings are the most widely used technology for fouling control and account for approximately 90% of the fouling control technology market There are no special requirements for the application of a Selektope containing coating, it can be applied using standard procedures and equipment.

Out of the top six marine coatings manufacturers, three have commercialized products containing Selektope® in the past five years: Chugoku Marine Paints, Hempel and Jotun. The technology is also being used in many outfitting coating products in addition to 60-month antifouling systems. To-date, hundreds of ships are benefitting from the anti-barnacle insurance that Selektope® delivers when present in the antifouling coating on the hull.

The return of investment for premium antifouling coating technology is favorable given that the fuel penalties from biofouling are so high if a ship operates or is at anchor in biofouling hotspots. For the cargo-carrying industry looking to weather future shifts in their sailing patterns, being proactive on antifouling paints could mean the difference between profit and loss.

Protecting the niche areas with Selektope® - proven efficiency

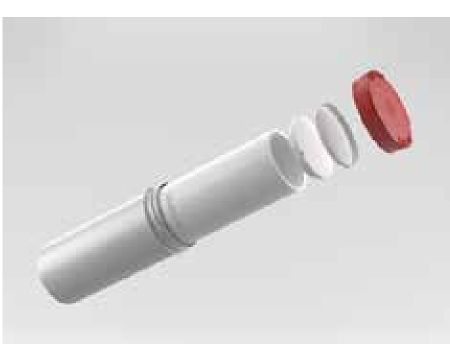
Grating coated with high grade AF of SPC Cu2O type for coastal LPG carrier (1200DWT) - 15 months

Grating coated with high grade AF of SPC Cu2O + **Selektope®** for coastal LPG carrier (1200DWT) - 16 months

Selektope® in paint

In a coating system, Selektope® binds to pigment and other particles and is therefore continuously released in the same way as other active substances and components. This contributes to long-term performance as long as the paint remains on the hull. The paint formulation, which mainly comprises binding agents, biocides, pigment and filler material, is applied to the hull using a traditional spraying method.
The compatibility between Selektope® and the paint matrix in the marine coatings industry ensures a slow and steady release, securing the antifouling effect over time.

Selektope® is based on a molecular structure comprising phenyl and imidazole groups. When a barnacle larvae comes into contact with Selektope®, they become hyperactive and performs about 100 kicks per minute. The effect is reversible, and the larvae quickly return to their normal state when not exposed to Selektope®. In this way, the larvae simply cannot attach to a surface painted with Selektope® and, at the same time, the larvae are not damaged in any way.



The smart container is self disolving during paint production. Ensuring smooth and safe handling of the product.