

The name “Aquaterras” was chosen for this unique Biocide Free antifouling paint system.

The origin of AQUATERRAS came from the following roots ; “AQUA” meaning water.

Our planet is a planet of water “TERRAS” comes from the Japanese expression ‘terasu’ which means to “illuminate” or to “shine”

The development of Aquaterras was driven by Nippon Paint Holdings’ Corporate policies and philosophies for Environmental Protection and Sustainability.

Background

Nippon Paint has a long history of detailed research and development into antifouling paints that have reduced shipping’ s marine environmental impact and in reducing air pollution.

In 1990, Nippon Paint developed the world’s first TBT-free true self-polishing copolymer (SPC) antifouling “**ECOLOFLEX**” series. Ecoloflex products have since been applied to many thousands of ships and continue to reduce shipping’ s costs and environmental impact today.

2008 Nippon Paint introduced ‘**LF-Sea**’ the world’ s first low friction fuel-saving antifouling paint using patented hydrogel “water trapping” technology incorporated in an SPC antifouling.

2013 this technology was further enhanced by Nippon Paint’ s development and launch of an ultra-efficient fuel-saving antifouling paint “**A-LF-Sea**” – the advanced version of LF-Sea.

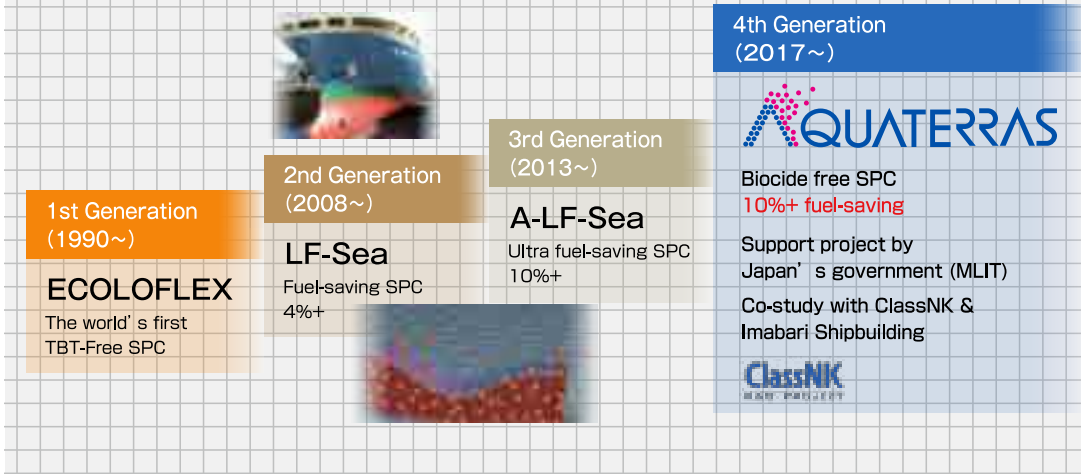
These products have been proven by experience on thousands of vessels to have contributed to the lowering of air pollution and greenhouse gas emissions from the efficiency of their low-friction surfaces the reduction of the ship’s fuel consumption.

After years of further research by teams of technicians, Nippon Paint is now able to announce a significant leading step in technical innovation with the launch of the world’ s first self-polishing antifouling paint that is completely **biocide-free**.

AQUATERRAS will further contribute to shipping’ s reduction of both its marine and atmospheric environmental impacts.



Timeline of Antifouling Development



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Point 1 **Biocide Free**

Point 2 **Fuel Saving 10%**

Point 3 **Easy Application**

AQUATERRAS - Product Outline

AQUATERRAS is a biocide-free antifouling paint based on patented anti-fouling technology. AQUATERRAS differs from any other SPC antifouling paint in that no biocides have been incorporated in Aquaterras' s formulation.

AQUATERRAS' s reduction of frictional resistance and the efficiency of its prevention of fouling on ships has been made possible by the combination of its unique hydrophilic & hydrophobic micro domain structures as well as the development of a special hydrolysis (SPC) reaction.

Through Nippon Paint' s research and the development of its stable polishing mechanism, Aquaterras provides both excellent long-term antifouling performance and fuel-saving.

| Features | Benefits |
|--|--|
| Biocide-free | <ul style="list-style-type: none"> Reduction of marine environmental burden Smooth film Health & safety |
| New hydrolytic antifouling technology (Patented pending) | <ul style="list-style-type: none"> Excellent antifouling performance Long-term stable polishing Flat & smooth and ultra low friction Approx. 10%+ fuel-saving effect |
| Good workability | <ul style="list-style-type: none"> Easy application (No special application apparatus) |

Line-up

| Suitable ship | Product |
|-------------------------------------|-----------------|
| Ocean-going ship (High speed) | AQUATERRAS 1000 |
| Ocean-going ship (Mid to low speed) | AQUATERRAS 2000 |
| Coastal ship | AQUATERRAS 6000 |
| New Building during outfitting | AQUATERRAS 8000 |

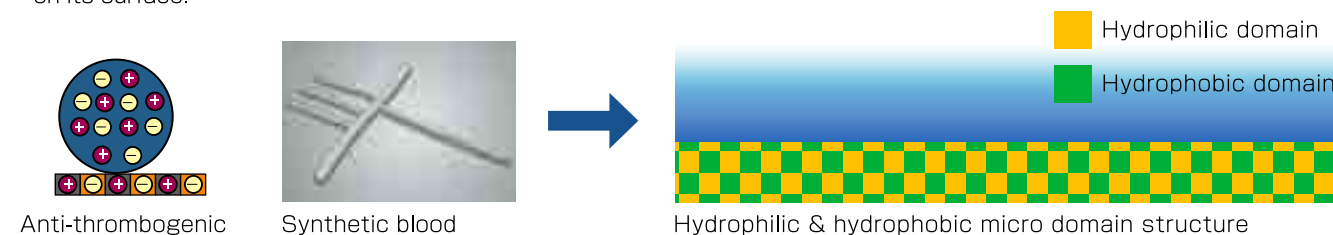
Certification

AQUATERRAS series complies with IMO-AFS2001 ,as tin-free anti-fouling system. Certification from Classification Societies is available. This product is a biocide free anti-fouling paint with no chemically active ingredients.

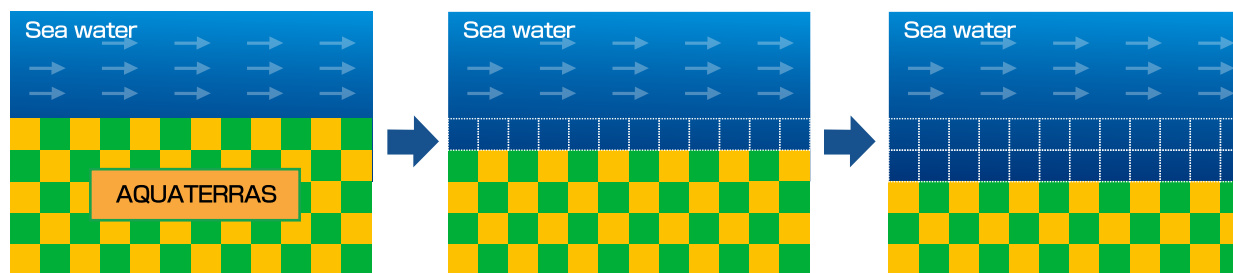
AQUATERRAS - Antifouling mechanism

Aquaterras is based on totally new hydrolytic antifouling technology

- Nippon Paint have long researched into which materials should be used to provide reliable antifouling performance without the use of any biocidal substances or repellents.
- To solve this problem, Nippon Paint made extensive testing into many hundreds of kinds of materials. Finally we found and modified a totally new chemistry that had been used successfully in medical antithrombotic polymers used for synthetic blood vessels.
- It is generally well understood that antithrombotic polymers prevent blood clotting due to the formation of a micro domain structure on its surface.



- Nippon Paint's chemists then developed a way to create a new antifouling technology which forms hydrophilic and hydrophobic micro domain structure on the surface to prevent biofouling.
- The surface of this new coating can be effectively refreshed by the development of a constant hydrolysis reaction and in this way AQUATERRAS will provide long-term performance.



AQUATERRAS - Low friction mechanism

Low friction effect

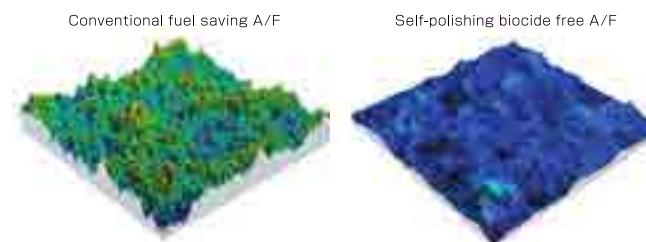
AQUATERRAS reduces frictional resistance by approximately 15% of (Frictional resistance of flat plate) generated at the interface between hull structure and sea water compared to regular SPC antifoulings.

(1) Super low roughness

Compared with standard SPC antifouling paint, AQUATERRAS (AQT) forms an ultra-flat & smooth film. Because it contains no heavy pigment particle matters such as cuprous oxide. This significantly decreases expected hull roughness.

(2) Hydrolysis reaction

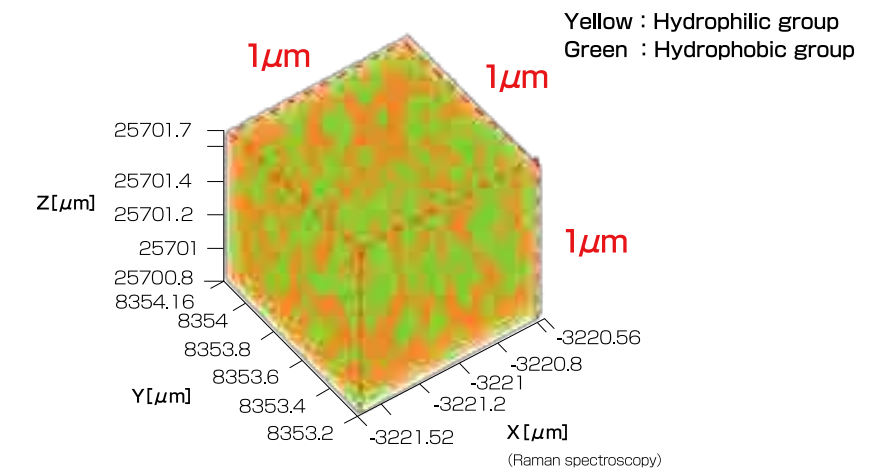
The smooth surface of the AQT coating is sustainably refreshed and maintained by a constant hydrolysis reaction.



AQUATERRAS - Verification

Hydrophilic & hydrophobic micro domain structure

Using specialised Raman spectroscopy, we can detect a concentrated distribution of both hydrophilic and hydrophobic groups in the new coating film.



Antifouling performance

Long term antifouling performance confirmed.



AQUATERRAS - Antifouling performance

(1) INCE PONT



(2) Fukae Maru



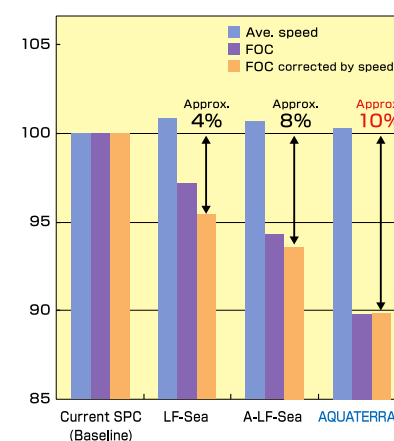
(3) Yuge Maru



Low friction effect

(1) Fixed point test - Kobe University FUKAE MARU

- Aquaterras demonstrates its performance on a ship over one year on a fixed route test



| Year | Applied A/F | Test period |
|------|-----------------|-------------------|
| 2010 | Current SPC A/F | Feb 2010-Jan 2011 |
| 2011 | LF-Sea | Feb 2011-Jan 2012 |
| 2012 | A-LF-Sea | Feb 2012-Jan 2013 |
| 2013 | A-LF-Sea | Feb 2013-Jan 2014 |
| 2014 | AQUATERRAS | Feb 2014-Jan 2015 |

(2) Sea trial - Newbuilding at Imabari Shipbuilding

- Aquaterras demonstrates a 4% reduction in shaft power v speed on a new building ship compared with a sister vessel applied with LF-Sea

