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SEAFRONT

Synergistic Fouling Control Technologies

Deliverable 5.49: Preparation of test panels and nets coated with up to six commercial coatings for in-situ deployment

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1 Introduction

Deliverable 5.49 has been delivered in time with the aim to prepare test panels and nets coated with up to six commercial coatings for in-situ deployment.

The purpose of the WP is to manufacture the substrates which will be deployed in another deliverable where coatings are exposed to their designated working environment and subsequently evaluated against the criteria specified by each end-user and against the performance of appropriate existing commercial coatings.

Technologies which have been down selected in SP4 will have their performance benchmarked against each other and suitable standards with regard to three performance criteria: (1) anti-fouling performance, (2) hydrodynamic efficiency and (3) corrosion resistance. This benchmarking will determine which systems are suitable for progression to full scale field-trials.

To benchmark the first criterion and for the resulting data to be relevant, antifouling testing must mimic in-service conditions as closely as possible. During the testing process, coated test coupons (wood/steel/composite panels, plastic nets and sheets) will be subject to the same environment as would be encountered by a coating when used in-service (depth, salinity, temperature, fouling challenge).

At the project outset when WP1–3 are still in their screening and early development stages this WP has begun immediately by conducting benchmark testing of existing technologies across the end-user markets. This time will be spent optimizing the testing procedures and streamlining the data analysis pathways to be applied when the developmental technologies become available for testing.

Reported here are the methodologies used to manufacture the test coupons for the benchmarking coatings which will be deployed by IP, MIN, BLUE, UNEW-MST and VAL.

1.1 Deliverable objective

Technologies will be evaluated using accepted standard performance metrics (ASTM D699-05, Standard Practice for Evaluating Biofouling Resistance and Physical Performance of Marine Coating Systems and ASTM D5618-94, Standard Test Method for Measurement of Barnacle Adhesion in Shear) and in-house methodologies (cleaning via low pressure water hose).

To complete these tests requires firstly preparation of the test coupons this is then followed by immersion of the coated test coupons and finally periodic assessment of fouling coverage and severity and interpretation and visualisation of this data. This method of test is largely carried out under static conditions, which is considered to be the most severe situation for fouling control coatings, as most commercial systems rely on hydrodynamic shear in order to work effectively. This is seen as a screening test for potential products, which will then be scaled up for test patch trials.

Due to the immense complexity and natural variability of biofouling field testing it is vital that as much standardisation as is practically possible in in place during coupon manufacture to help minimise variation in performance which could be attributed to differences in the coupon manufacture procedure and handling prior to immersion.

Reported here are the methodologies used to manufacture, package, store and dispatch the test coupons for the benchmarking coatings which will additionally be used as the basis of preparing the coupons for the prototype coatings ensuring like for like testing.

2 Partners involved

Preparation of panels and nets is being undertaken solely by IP. Subsequent deployment is being coordinated by IP but using facilities and infrastructure of IP, VAL, UNEW-MST, BLUE, SMAR; followed by data analysis by IP, UNEW-MST and BRIS.

3 Description of technology delivered

3.1 Handling of the materials

Prior to use of the wet paints an assessment of the risks involved in handling the samples and chemicals should be carried out. This should refer to the relevant material safety data sheets (MSDS) and suppliers' literature. Wear appropriate personal protective equipment (nitrile gloves, cotton lab coat, protective glasses etc.) and work in accordance with local environmental and Health & Safety rules including provision of local exhaust ventilation (LEV) to manage solvent vapour exposure.

When using multi-pack products or a coating scheme comprising of multiple coating layers (i.e. primer-tie coat-finish) refer to the appropriate technical data sheets (TDS). The TDS should instruct on mix ratios, mixing procedure, dry times and over coating times. These are often temperature and humidly specific so it is important this is considered and the appropriate guidance is followed.

Due to the coatings likely being solvent based, high quality professional grade application equipment (brushes, rollers and masking tape) should be used. Consumer grade equipment is often not designed for exposure to organic solvents and may degrade and contaminate the paint surface.

3.2 Preparation of panels

The degree of fouling of test panels is subject to a high level of natural variability. The standard testing method must take into account differences in fouling challenge which may be experienced by test coatings on different parts of a panel (both down and across) and at different panel locations on a test raft. This is important so that subtle differences in the fouling control performance of coatings and in particular non-toxic fouling-release coatings are not masked by such fouling variability.

In total 23 wooden panels comprising two different sizes have been manufactured. The substrate was 1 cm thick marine grade plywood and they were pre primed with Interprotect (YPA403/404) epoxy primer on both sides and the edges of the panel.

The standard panel design (of which 18 have been produced) allows six different coatings should be tested on the same panel. The plywood board is 60 cm x 60 cm in size allowing a 6x6 array of 9 cm x 9 cm trial squares with a 1cm gap between them. This provides a balanced experimental design as each row or column contains exactly the same number of trials of each coating type, which will allow effects of depth and column position to be taken into account

during fouling data analysis. This design provides the highest quality data due to its consideration of vertical and horizontal placement of replicate coatings (Fig 1).

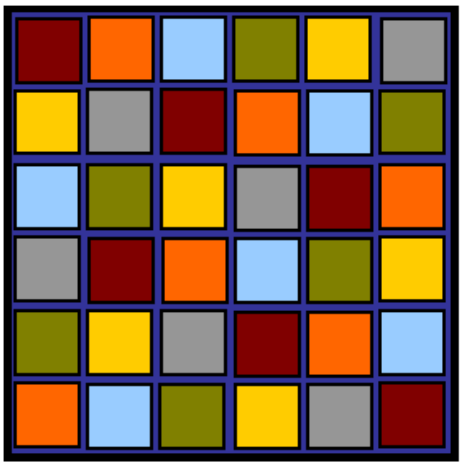


Figure 1: Latin square coating layout, with the 6 colours representing 6 coatings

The layout is first marked out with 1 cm masking tape and the coatings then applied buy brush. The same colour was used for all coating thus removing the unwanted additional variable of coating colour. All coatings were applied as a scheme; in the case of the biocide free coatings this consisted of a primer, a tie-coat and a finish and for the biocidal coating this was a primer and then finish. Two coats of the biocidal coatings were applied to ensure sufficient film thickness is obtained; this mimics the industrial use of such coatings where two coats are often applied to obtain the desired in-service lifetime. Upon application and drying of the test coatings and removal of the tape, the uncoated area and the back was then coated with Intersleek 1100SR. The panels were then marked with the panel reference number in a contrasting colour (Fig 2).

Coating	Name	Type	Scheme		
			Coating 1	Coating 2	Coating 3
1	Intersleek 700 Red	Biocide free	ENA	737	757
2	Intersleek 900 Red	Biocide free	ENA	737	970
3	Intersleek 1100SR Red	Biocide free	ENA	737	1100
4	Intersmooth 7460 Red	SPC Biocidal	JVA	BEA757	BEA757
5	Intersmooth 7460Si Red	SPC Biocidal	JVA	BEA817	BEA817
6	Intercept 8000 Red	LPP Biocidal	JVA	LPP873	LPP873

ENA=Intershield 300, 737=Intersleek 737, 757=Intersleek 700, 970=Intersleek 900, 1100=Intersleek 1100SR, JVA=Intertuf 203, BEA757=Intersmooth 7460, BEA817=Intersmooth 7460Si, LPP873=Intercept 8000. SPC=Self Polishing Co-polymer, LPP=Linear Polishing Polymer

Figure 2: Completed standard test panel

Five “mega board” panels have been prepared allowing nine coatings to be tested simultaneously; the additional three spaces have been assigned to yacht coatings allowing greater understanding of the relative performance of a wider spectrum of commercial coatings. The 90 cm x 120 cm panel accommodates a 9x9 layout of 9 cm squares in the same Latin square design as the standard panels.

The same making, painting and edging procedure was followed during manufacture ensuring consistency.

Coating	Name	Type	Scheme		
			Coating 1	Coating 2	Coating 3
1	Intersleek 1100SR Red	Biocide free	ENA	737	1100SR
2	Intersmooth 7460 Red	SPC Biocidal	JVA	BEA757	BEA757
3	Intersmooth 7460Si Red	SPC Biocidal	JVA	BEA817	BEA817
4	Intercept 8000 Red	LPP Biocidal	JVA	LPP873	LPP873
5	Micron 99 Red	SPC Biocidal	JVA	YBC	YBC
6	Interswift 6800HS Red	Hybrid Biocidal	JVA	BMA	BMA
7	Interspeed Ultra Red	CDP Biocidal	JVA	YBA341	YBA341
8	Trilux 33 Red	CDP Biocidal	JVA	YBA069	YBA069
9	Intersleek 700 Red	Biocide free	ENA	737	757

ENA=Intershield 300, 737=Intersleek 737, 1100=Intersleek 1100SR, JVA=Intertuf 203, BEA757=Intersmooth 7460, BEA817=Intersmooth 7460Si, LPP873=Intercept 8000, YBC=Micron 99, BMA=Interswift 6800HS, YBA341=Interspeed Ultra, YBA069=Trilux 33, 757=Intersleek 700. SPC=Self Polishing Co-polymer, LPP=Linear Polishing Polymer, CDP=Controlled Depletion Polymer.

Figure 3: Completed "mega board" test panel

3.3 Preparation of nets

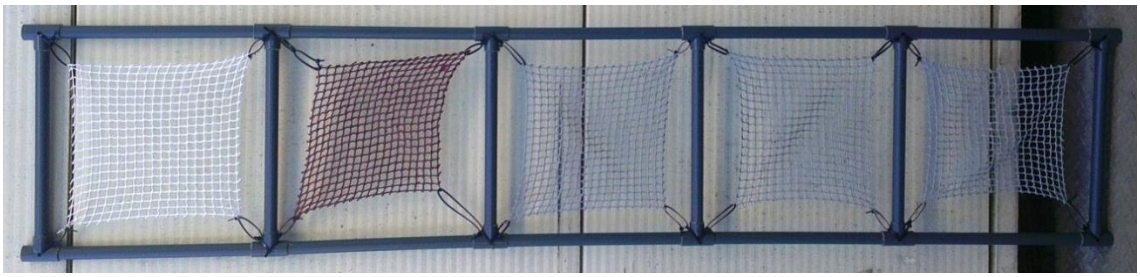
Samples of nylon fishing net (30 cm x 30 cm) were coated with three non-biocidal Intersleek coatings (Intersleek 700, Intersleek 900 and Intersleek 1100SR) and one biocide containing coating (Intercept 8000 LPP) by IP with three replicate nets for each coating prepared.

The nets were cut from a larger roll of standard net and used as delivered with no pre-treatment or cleaning. Adhesion testing showed that all four coatings had adequate adhesion direct to the net negating the need for primers or tie coats.

The standard commercial practice for preparing coated nets is via dip coating in a bath of paint followed by hanging to air dry. A smaller scale mimic of this was used whereby; the samples were submerged in a vat (500 mL) of wet paint and stirred gently for 5 minutes. They were then removed from the vat, the excess removed by squeezing and wringing and left to hang vertically whilst stretched, overnight for the coatings to dry and cure. The weights were attached to the bottom corners of the net so that the square shape was retained after cure.

Approximately 100 g of paint was applied to each net sample. Adhesion of all coatings was good direct to the net material. Flexibility of the nets coated with the Intersleek products was lower than the uncoated net although they retained a significant degree of flexibility. The biocidal coated net however, was largely rigid although it could be manipulated by hand

The deployment coupon used to house the coated nets was constructed from PVC pipe (Georg Fischer 2m PVC, 25mm Outer Diameter 1.9mm Wall Thickness). 2 m lengths of pipe were cut to 40 cm sections and these were formed into a grid using Tee shaped pieces (Georg Fischer 90° PVC-U Equal Tee, 25mm x 25mm, L.66mm) using Tangit as a gap filling solvent cement for jointing the PVC pipe with the fittings by creating a chemical bond. The nets were then mounted to the frame via zip lock ties (Fig 4).



Uncoated control: **Nylon**	Copper containing biocidal coating : **Intercept 8000 LPP**	Non-biocidal coating 1: **Intersleek 1100SR**	Non-biocidal coating 2: **Intersleek 900**	Non-biocidal coating 3: **Intersleek 700**

Figure 4: PVC test frame with coated fish nets attached via cable ties (top) and layout of the test coatings (bottom)

3.4 Packaging and dispatch

The finished panel coupons were dispatched to the deployment site via courier. Cardboard spacers were placed at the panel edges allowing them to be stacked and protecting the corners during transit and they were then wrapped in a sheath of corrugated cardboard and brown paper (Fig 5). The same approach was used for the net coupon but without the corner spacers as the frame geometry prevented contact of two nets even when stacked.

Figure 5: Cardboard spacers (left) and packed panel coupons (right)

4 Conclusions

In conclusion panels have been prepared and deployed with nine commercial coatings and nets coated and deployed with four commercial coatings. The coatings comprise a mixture of biocidal and biocide free fouling-control coatings from the Marine and Yacht markets with a range of relative performances.

The panels are to be deployed from the raft sites operated by IP located in UK, Singapore, Florida, Italy and at sites operated by BLUE and MIN and the nets at the commercial; fish farm of VAL.

The aforementioned techniques will be utilised to prepare any further coupons generated within the consortium either commercial or prototype.

5 References

None