PROBLEMS ASSOCIATED WITH THE OVER PROTECTION OF FISHING TRAWLERS AGAINST SEA WATER CORROSION & FOULING*

**K. RAVINDRAN & R. BALASUBRAMANYAN
Central Institute of Fisheries Technology. Cochin-682011

INTRODUCTION

The Indian fishing fleet at present is being considerably improved and expanded consequent to the development of the Indian fishing industry. Commercial exploitation of the living resources of the seas around India is very much dependant on the efficient functioning of the fishing fleet engaged in the various types of fishing operations. The present fishing fleet comprising of modern mechanized vessels of different sizes and shapes are mostly built out of either wood or steel. Newer materials like aluminium, glass or fibreglass reinforced plastics (GRP or FRP) and ferrocement (steel and cement) are slowly being brought into use as suitable alternatives to the conventional materials.

The indiscriminate use of metals in sea water for structural purposes poses a serious problem as they are prone to marine corrosion unless they are adequately protected with anticorrosive coatings. Similarly wood and other organic materials decompose and deteriorate in sea water due to certain marine organisms. Further, all these materials when they are constantly under immersion in sea water tend to develop a dense settlement made up of a large number of marine organisms which can be prevented by suitable toxic coatings of antifouling paints. Eventhough the use of anticorrosive as well as antifouling paint coatings are the two accepted methods of preventing corrosion and fouling in the fishing boats respectively, the nature and extent of protection is much dependant on the choice of protective paint and the method of their proper application. The successful prevention of galvanic corrosion on the underwater hulls of the fishing boats is

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**Present address: Marine Products Export Development Authority, Cochin-682016

normally achieved by the installation of suitable anodes. Again the right type of anodes for ship-bottom, their quality and quantity and their proper location are the important parameters that require special consideration. Their improper use is likely to create conditions that are more favourable for an acceleration of corrosion or fouling. The present paper attempts to lime light the problems associated with the over protection of boat hulls vis-a-vis the improper use of protective measures against marine corrosion and fouling.

Surface Preparation

In order that any painting system has to be successful the surface preparation techniques adopted have to be satisfactory. Patches of mill scale and rust together with clean metallic surface can cause the flow of appreciable quantity of galvanic corrosion current. Though a perfectly clean surface as required for the cause of metal coating is not essential, often the degree of cleanliness that is necessary for a painting system is hardly maintained resulting in a pre-mature failure of the entire paint system. The Swedish Standard Meddelande No. 16 is a useful guide, which has received wide recognition, to the surface preparation practice for steel. Sand-blasting or shot-blasting can provide a satisfactory surface and the condition of the overall surface texture can then be judged from the surface profile traces. Shot-blasted surface intended for painting, with a 90% clean surface and peaks not more than 75 microns high is considered to meet with the required standard (Singleton & Wilson, 1968). For ships' hulls that require renewal of paints after service, the surface preparation is difficult owing to the presence of several corrosion pits. In such cases coarse grit or crushed iron abrasives are preferred. Aluminium hulls usually do not present problems; for new surfaces, paints can be applied after de-greasing and for old surfaces a brisle brush or a wire brush can be used for cleaning the corrosion products.

Modern Marine Paints

As the intensity of corrosion varies from region to region on the surface of the hull, paints with characteristic features and cathodic protection measures are required. The recent trend is to employ "high performance" coatings so that the interval between the docking periods could be increased to more than three years. Of late growing acceptance has been gained by newer marine coatings based on vinyls, chlorinated rubber, epoxies etc. in place of conventional matrices based on alkyds, oleo-resins etc. Marine paints based on the latter group are easily saponified especially on cathodically protected vessels but the synthetic resins belonging to the former group are capable of forming heavy duty films. At the stern quarter where galvanic currents originating from dissimilar structural components cause severe corrosion, as well as in the presence of the enormous force caused by the cavitation phenomenon, paints that are capable of forming very tough and erosion resistant films and also possessing very high electrical resistance are required.

Protection of aluminium sheathing

Inadequately protected aluminium will be subjected to corrosion in the form of pits which occasionally reach the wooden hull. Vinyl zinc chromate applied on

aluminium after a treatment of etch primer, by virtue of its passivating effects, has given satisfactory results. The flow of galvanic currents in the propeller region has been further taken care of by two coats of "Apexior No. 3" (a proprietory product marketed by M/s British Paints Ltd). A final top coat of an antifouling composition incorporated with compounds of copper, arsenic and mercury at the optimum level provides a lethal environment for effectively suppressing the growth of marine organisms. The release of the toxic ion can take place by any one of the following mechanisms:

i) diffusion through the matrix
ii) continuous contact between the particles
iii) dissolution/degradation of the matrix.

A successful antifouling composition maintains a steady leaching of poisons for a prolonged period, say two to three years. While dealing with the painting of underwater aluminium structures it is essential that zinc chromate base anti corrosive paints or non-toxic high build barrier coats over zinc chromate primer are applied to prevent the access of leached ions to the base metal.

Excess current density on anticorrosive and antifouling coatings

Often with a view to afford protection to the components in the screw area of the hull, an indiscriminate use of zinc anodes has been made. Apart from the wastage of the protective current this practice is detrimental to the life of the paint system. Depending on the current density and the availability of dissolved oxygen the cathodic reaction would result in the formation of hydrogen or hydroxyl ions. The alkalinity caused by the OH^- damages the paint films and in case of oil or oleoresinous medium it undergoes saponification. The effect will be more pronounced at the immediate vicinity of the anodes.

An experiment has been performed on the effect of cathodic protection on an antifouling paint. A soluble matrix type paint based on copperacetoarsenite toxic (Gopalakrishna Pillai *et al.*, 1968) is applied, as in the service condition, on mild steel panels and scribed in the standard manner to stimulate the effects of damaged areas. The panels were immersed in sea water and cathodic protection was applied.

Effect of applied potential on copperacetoarsenite toxic based antifouling paint.

Applied Potential V sce	Condition of the Paint film
-0.80	Satisfactory
-1.00	,,
-1.50	Flaking and failure of the coating

The above results show that the paint is suitable for application on aluminium sheathed wooden trawlers which are cathodically protected at a potential not exceeding -1.0V (Ravindran & Balasubramanyan, 1973).

A case of "copper conversion" in vinyl antifouling paint applied on cathodically protected ships of the Canadian Navy has been reported (Anderton, 1969). The cathodic reduction is generally more likely to occur at the vicinity of the anodes where the potential is more

negative. This phenomenon is of practical and economical importance because it impairs both the cathodic protection system and antifouling measures.

Conclusion

In this communication some of the problems associated with the indiscriminate use of the protective measures have been dealt with. The salinity, constant biological activity and suspended particles make sea water a highly corrosive natural environment. Coupled with the problem of marine fouling the task of protection of underwater marine structures is extremely complicated.

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