Nanoparticle-based antifouling coating for cage netting

Saly N. Thomas and P. Muhamed Ashraf

ICAR-Central Institute of Fisheries Technology, Cochin

Fouling is a major problem in cage aquaculture and is more severe in tropical waters where the rate of fouling is very high. In cage culture, fouling results in reduced water exchange, low oxygen level and accumulation of faeces in the cage affecting the fish health. There is wastage of money, time and man hours in cleaning the clogged netting, and periodical net changing is a laborious process causing additional stress to the culture organism. Besides, heavily fouled netting adds extra weight, causes deformation of the net resulting in net failure and escape of the cultured organism incurring huge economic loss.

The use of metal based antifouling paints though effective, their use in cage aquaculture is undesirable due to possible effects on the caged fish and on the environment. Copper and titanium dioxide are known biocides and are extensively employed in antibacterial applications. Recently ICAR-CIFT, Cochin initiated a study incorporating nano-sized copper oxide and titanium for fouling control in polyamide (nylon) netting. On application of the nano biocides, the nylon netting samples inhibited fouling even after 90 days of exposure to estuarine waters.

Coatings of nano-sized copper oxide (CuO) alone and mixtures of nano-sized (APS 40 nm)

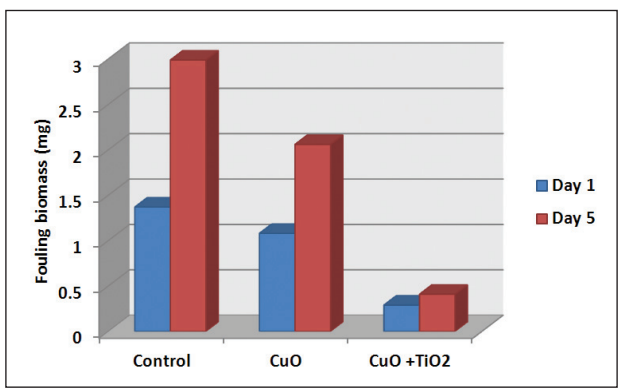

Fig. 1. Fouling biomass on nylon netting treated with nano biocides (0.005%)

Control | CuO (0.01%) + TiO_2 (0.02%)

Fig.2. Images of fouling accumulation on control and nano biocide coated nylon netting after 90 days exposure to estuarine waters

copper oxide and titanium oxide (TiO_2) in different concentrations were applied on nettings of polyamide (nylon) 210x2x2 having 30 mm mesh size. Netting, coated with mixture of copper oxide and titanium oxide showed better fouling resistance than copper oxide alone (Fig. 1).

Among different concentrations, netting coated with mixture of CuO (0.01%) and TiO_2 (0.02%) gave maximum fouling inhibition. Netting after 90 days exposure to estuarine waters showed very good fouling inhibition compared to control (Fig. 2).

The biocides play an important role in determining the attachment of microfouling and subsequent attachment of macrofoulers. The present study demonstrated that coating of netting with mixture of nano-sized CuO and TiO_2 was very effective in controlling fouling on nylon netting. The outcome of this study has a very positive effect on cage culture. The advantage of nano-sized particle is the requirement of less amount of particle and more coverage. Further studies with other netting materials such as high density polyethylene (HDPE) used extensively as cage netting is under progress.