

Composition of microfouling on aluminium and fibre glass panels exposed in Agatti waters (Lakshadweep Island)

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Rate of microfouling build-up was high during the initial periods of exposure of test surfaces but decreased with the increasing duration. Fibre glass surfaces showed higher deposition than those of aluminium. Carbohydrates and lipids were the major constituents of fouling mass as compared to proteins. Fouling diatoms were dominated by the pennate forms (*Nitzschia*, *Navicula* and *Biddulphia*).

Studies on microfouling from Indian waters are rather limited¹⁻⁵. Some preliminary observations made on the microfilm formed on metallic and non-metallic surfaces exposed in Lakshadweep waters are presented here.

Cleaned panels of aluminium and fibre glass (15 × 10 cm), were deployed, in duplicate, in surface waters (depth ~ 0.5 m) at Agatti island (lat. 10° 55'N, long. 73° 10'E) for 6, 12, 24, 48, 72, 96 and 120 h (7-12 December 1988). On retrieval, the panels were scraped individually using a nylon brush and filter sterilised (0.2 µm) seawater³. The scraped sample of each panel was made up to a volume of 300 ml. Aliquots were filtered through preignited (450°C for 3 h) GF/C glass fibre filters for the analysis of organic carbon⁶, lipid⁶, carbohydrate⁷ and protein⁸. Subsamples preserved in Keffer's solution were analysed for diatom composition.

The change in physical appearance of the panel with the increasing period of exposure was very

evident. The scraped samples showed increasing green colouration with the time of exposure. Qualitative analysis of the samples revealed the occurrence of 8 genera of fouling diatoms on the panels (Table 1). Among them *Navicula*, *Nitzschia* and *Biddulphia* were the most common forms. Abundant occurrence of *Nitzschia* and *Navicula* was noticed on fibre glass panels exposed for 96 and 120 h. In general, larger number of diatoms were recorded on fibre glass panels. Apart from these, diatom settlement on aluminium panels was observed only on those exposed for 48 h. On the other hand on fibre glass panels, diatoms appeared just within 6 h of their immersion in seawater.

The microfouling biomass (total build-up during the period of exposure, as organic carbon) on both the aluminium and fibre glass panels increased with the duration of exposure (Fig. 1A). Maximum biomass values recorded during the present study were 1842.60 and 2882.88 µg C. 100 cm⁻² on aluminium

Table 1—Species composition and number of fouling diatoms (no. 100 cm⁻²) on aluminium (Al) and fibre glass (FG) panels
Duration of exposure (h)

Diatom species	6		12		24		48		72		96		120	
	Al	FG	Al	FG	Al	FG	Al	FG	Al	FG	Al	FG	Al	FG
<i>Biddulphia</i> sp.	—	24	—	144	—	72	96	—	192	72	48	—	—	—
<i>Navicula</i> sp.	—	—	—	24	—	96	168	24	—	—	216	8400	120	21600
<i>Nitzschia</i> sp.	—	—	—	—	—	—	—	24	—	—	456	465840	360	82512
<i>Rhabdonema</i> sp.	—	—	—	—	—	—	48	—	—	—	—	—	—	—
<i>Synedra</i> sp.	—	—	—	—	—	—	24	—	24	—	—	—	—	—
<i>Amphora</i> sp.	—	—	—	—	—	24	24	—	—	—	—	—	—	—
<i>Achnanthus</i> sp.	—	—	—	—	—	—	48	—	—	—	—	—	—	—
<i>Pleurosigma</i> sp.	—	—	—	—	—	24	—	—	—	—	24	—	—	24

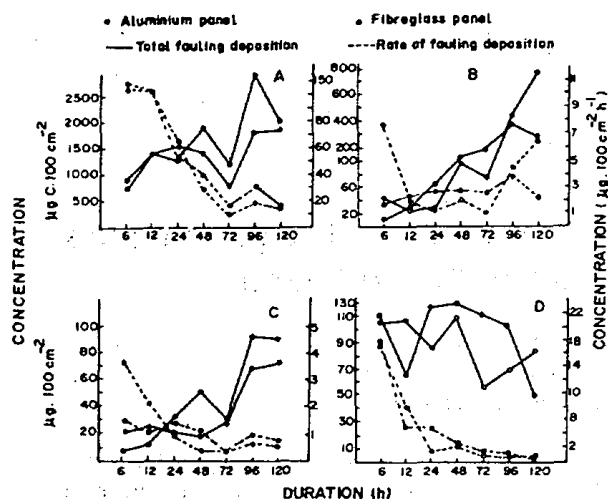


Fig. 1—Concentration of (A) organic carbon, (B) carbohydrates, (C) proteins and (D) lipids in the microfilm developed on aluminium and fibre glass panels exposed in Agatti waters

and fibre glass panels, respectively. However, the rate of build-up (microfouling build-up during the period of exposure/duration of exposure) decreased with time (Fig. 1A).

The maximum concentration ($\mu\text{g. } 100 \text{ cm}^{-2}$) of carbohydrates recorded were 763 and 275 on aluminium and fibre glass respectively (Fig. 1B). The total build-up of carbohydrates showed an increasing trend with the increasing duration of exposure of the panels. However, their rate of build-up showed a decreasing trend (with the exceptions of panels exposed for 96 and 120 h) on aluminium panel and a very slight increasing trend on fibre glass panel with the time of exposure (Fig. 1B).

Maximum concentrations of proteins recorded were 73 and 94 $\mu\text{g. } 100 \text{ cm}^{-2}$ on aluminium and fibre glass respectively (Fig. 1C). Their total build-up, in general, showed an increasing trend with increasing duration of exposure. At the same time, rate of accumulation of protein, as in the case of organic carbon, showed a decreasing trend on both the surfaces (Fig. 1C).

The maximum recorded values of lipids, ($\mu\text{g. } 100 \text{ cm}^{-2}$) were 108 on aluminium and 129 on fibre glass (Fig. 1D). No trend in accumulation of lipids with time was noticed. However, in similarity to the other biochemical parameters, their rate of accumulation decreased with time (Fig. 1D).

Diatom population of the microfilm mainly comprised the pennate forms. Of the 8 genera recorded from the panels, 6 of them belonged to this group. According to Characklis and Cooksey⁹ and Cooksey *et al.*¹⁰ diatoms which foul man-made surfaces in temperate waters are usually of the pennate type. The dominance of pennate diatoms

have also been reported in the microfouling developed on test coupons exposed in the Arabian Sea^{3,11}. This is contrary to the dominance of centrales observed in the water column¹¹. Unlike centrales, pennales possess a raphe¹¹ and the mucilagenous secretion of the raphe may be facilitating their adhesion onto the panel surface^{10,12}. *Navicula*, *Nitzschia* and *Biddulphia* were found to be the dominant forms on the panels. Dominance of the latter 2 species in the microfilm developed on aluminium panels exposed in the Arabian Sea have already been reported³.

As mentioned earlier, microfouling biomass as well as its biochemical components (total build-up) exhibited a general increasing trend with the increase in exposure time. However, comparatively low values were observed on 72 h panel. The diatom count on this panel was very low. Occasional grazing by fishes and/or by migratory zooplankton¹³ probably could explain this observed irregularity.

The biochemical analyses of the biofilm revealed its lipopolysaccharide composition^{3,14}. Probably the large amount of lipid, carbohydrate and protein in the biofilm may be serving as a food source for the larvae of macrofoulers thereby influencing their settlement onto the surface^{15,16}.

As evident from the diatom count, biomass and the biochemical components, fibre glass panels supported higher microfoulers compared to aluminium panels. Srivastava *et al.*⁵ also observed a richer biofilm on nonmetallic surface (perspex) compared to metallic panels (titanium and stainless steel) till 10 d of exposure. However, on prolonged exposure, higher film was developed on metallic surfaces⁵.

From the foregoing account, it is obvious that there is a high rate of microfouling deposition during the initial periods of exposure of the test panels. As the exposure time increased, the total microfouling build-up increased, but its rate of build-up decreased. The fibre glass panels supported higher microfoulers as compared to the aluminium panels.

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