1. Introduction

The deposition and growth of biologically active material, or biofouling, is inherent to most non-sterile aqueous environments. Such a phenomenon is particularly associated with industrial cooling water processes and is a major contributor to operating expenditure.

The morphology and development of biofilms are closely dependent on prevailing system characteristics, for example, fluid velocity and constituents. The surface characteristics of the material of construction will also affect the retention of biological material on the surface. As an alternative, or complementary to the use of biocides, it may be possible to choose a material of construction that is less hospitable to the adhesion of biofilms.

2. Materials and Methods

A rectangular flow unit has been developed to facilitate the study of microbial settling behaviour under controlled flowing conditions (Mott 1987). The objective of the system is to achieve a constant velocity profile across horizontally mounted test sections. The unit construction is required to permit the non-destructive removal of these sections preceding each experiment for staining and microscopic examination.

Perspex was chosen as the material of construction for the apparatus because it may be machined and assembled easily and has a smooth surface with the added advantage of visual assessment. Figure 1 details the overall structure of the closed unit. Sample fluid is passed over three 10 cm diameter glass discs at a constant controlled flowrate by centrifugal pumping. The fluid then collects in a holding tank prior to recirculation. To avoid flow disruption, it is necessary to insert discs flush with the fluid contact surface.

The rectangular flow channel is required to enclose completely the fluid so that no sample microbial aerosols escape to the atmosphere and also ensure the liquid always flows through a constant cross-sectional

area so that fluid flow characteristics such as Reynolds number may be calculated accurately.

The recirculating fluid consists of a 1 to $2 \times 10^7$ cells/ml *Pseudomonas fluorescens* suspension, dissolved nutrients and mains tap water which has undergone 5 μm and 1 μm pore filtration prior to system entry. *Pseudomonas fluorescens* cells are chosen due to their occurrence and slime forming properties in cooling water systems. The micro-organism is supplied aseptically from a continuously operating fermenter which provides cells within the logarithmic growth phase.

The components of the nutrient solution and to the circulating system are identical, and provides for glucose limiting conditions in the simulated cooling water together with trace elements. The nutrient is identical to that used by Miller (1982).

This paper reports settling and attachment behaviour of *Pseudomonas fluorescens* cells to glass and fluorinated ethylene polypropylene (FEP) test sections. These surfaces are exposed to recirculating sample fluids of mean velocities 0 to 0.41 m/s for periods of 0.5 to 5 hours.

Glass was selected as a control surface during these experiments due to its visual assessment capability, chemical inertness and smooth surface finish. FEP film is manufactured by Holscot Industrial Linings.