IDENTIFYING THE HIDDEN ENEMY - BIOFILM

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INTRODUCTION

Biofilms have been a major problem in many industries especially in the water and health industry. It is found to be the cause of around 80% of all infection's cases recorded [1]. This has led to around $ 5 billion losses in the Health care Industry. In the Food Industry, the food chain has to be stopped for about 8 hours for cleaning biofilm contamination (if any). If there was any means of detecting biofilm, this time can be reduced significantly. This alone points out the importance of detecting biofilm. Figures 1 & 2 shows Biofilm presence in some day-to-day applications.

Figure 1 | Biofilms in city water supply pipe.

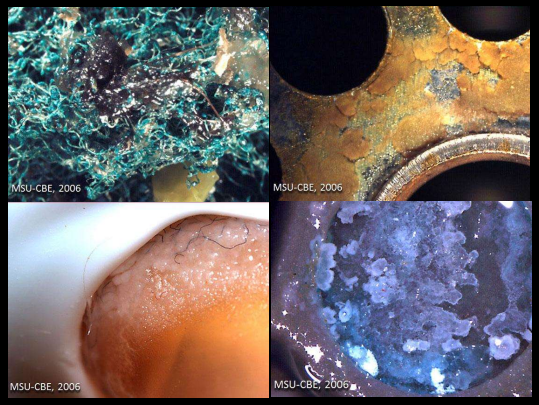

Figure 2 | (From Left to Right) Biofilms in Kitchen Sponge, Sink Strainer, Baby Pacifier, Shower Heads

OBJECTIVES

The primary objective of this research is to develop a novel method for an early-stage detection of thin film Biofilm.

APPROACH

To observe changes in the black box measured output as biofilm grows. *E. coli* is grown in a controlled environment to enable easy measurements. The black box is designed such that it produces a voltage corresponding to the presence of biofilm. Testing is also done with PolyHEMA which mimics the presence of Biofilm. The black box is also being tested in a real-world environment to understand how the device responds to real-world parameters. An alternative laboratory pipe loop study is also being done to establish baseline results for the actual real-world study.

CURRENT RESULTS

- The Black box was capable of giving an indication of the presence of test objects when using test objects readily available in the laboratory. Figure 3 shows a schematic for the testing and how the results were interpreted.
- When a test object is present in the testing chamber, the measured output voltage decreased (depending on the type of the material of the test object).
- The laboratory pipe loop studies have generated a few data points which correlate with the active growth of biofilm inside a plastic pipe.
- Other parameters being considered in the pipe loop study are the response of the black box to corrosion inside the pipe structure and development of scaling.
- The dataset is also populated with the turbidity, conductivity, temperature, and total dissolved chlorine for better understanding and validation.

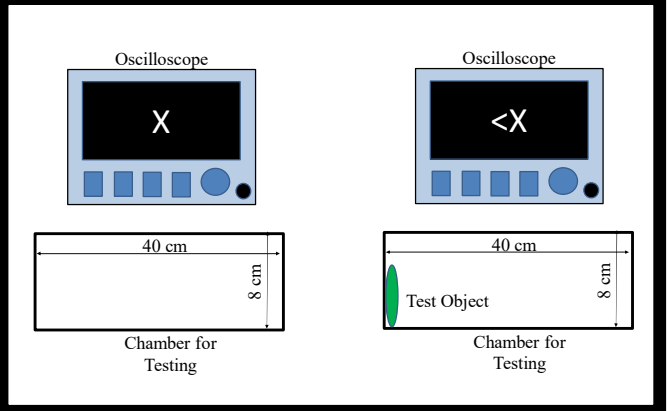

Figure 3 | Schematic of the testing environment – a visual representation of how the data is interpreted.

CONCLUSION

The goal of this research is to develop a device that would be a great replacement to the current technology used in the determination of the presence of Biofilm. The black box is a stand-alone device and sized such that it can easily be mounted on the surface of a pipe.

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REFERENCES

1. Bryers J. D. (2008). "Medical biofilms". Biotechnology and Bioengineering. 100 (1): 1–18. doi:10.1002/bit.21838. PMC 2706312 Freely accessible. PMID 18366134.