土木学会第50回年次学術講演会（平成７年９月）

Temperature effects on sulphate reduction and phosphate release in anaerobic-oxic activated sludge

Kanazawa University, BOSQUE-HAMILTON E.K, Student Member
Kanazawa University, IKEMOTO Ryoko, KOMORI Tomoaki, Member
MIYAKE Yuji, HIMURO,Atsushi

1. Introduction

Activated sludge systems, in practice, never operated at constant temperatures because of natural environmental conditions such as seasonal changes in waste inflow temperatures. However, one of the causes of a common phenomenon such as bulking in activated sludge has not been attributed to temperature changes because the mechanisms are not yet fully understood. This paper presents results from the first in a series of experiments to investigate the effect of temperature changes on the activated sludge system and its implications for the Poly-P; and sulphate reducing bacteria which is a trigger for filamentous bulking as reported by (Yamamoto et al,1990) and the Poly-P bacteria .

2. Materials and methods.

2.1 Batch experiment: The sludge used for these experiments was collected from a city sewage plant. Part of the sludge was centrifuged and added to settled sewage in a BOD bottle. 50mg/l of sulphate was added and the bottle was incubated under anaeerobic conditions with constant stirring at 4°C, 20°C and 30°C at 0, 6, 24 and 48 hrs intervals after which chemical analysis were made.

2.2 Storage experiment

Activated sludge from the same plant were stored in 300 ml conical flasks under anaerobic conditions at 4, 20 and 37°C. Samples were then drawn for chemical analysis after 0,1,2,4 and 7 days of incubation.

2.3 Chemical analysis: Organic acids and components were analyzed by gas chromatography, Phosphates, sulphate, acetate and lactate by ion chromatography and H_2S by gas detection.

3. Results and Discussion.

3.1 Batch experiment: Figure 1 shows the profiles of PO_4 and SO_4 concentrations. Concentrations tended to increase with increasing temperature, which is a general phenomenon for microbiological reactions. Rates also varied slightly with different MLSS concentrations. At 20°C and 30°C (Figs 2 and 3) sulphate reducing rates rose temperature increase. At 4°C, the reverse was the case. Release of phosphates at 4°C appeared to be higher than sulphate reduction. At 30°C, PO_4 released from MLSS concentration of 2000 mg/l did not level off after 24 hours but continued to rise. This probably suggests further PO_4 release from biomass decomposition. At 4°C, (Fig 3) organic acids produced from the biomass decomposition were few. At higher temperatures more organic acids were formed (Fig 1.4 and 1.5). This suggests the biochemical reactions of the system are largely affected by temperature changes.

3.2 Storage experiment:

Figure 2 shows the profiles of PO_4 and SO_4 concentrations in the storage experiments. The profiles were similar to the batch experiment results. Much higher PO4 levels were observed at 37°C, higher rates were also observed. In figs 2.3, 2.4 and 2.5, the organic acids profile showed slightly different curves though more organic acids were produced at higher temperatures.

4. Concluding remarks:

This preliminary investigation shows that elevation of temperatures tends to increase sulphate reduction and phosphates release. At 4°C, sulphate reduction was much lower than PO_4 release. Higher temperatures at 20 and 30, 37°C favoured the production of organic acids in anaerobic conditions. The results suggests that differences in temperature affect reactions in an activated sludge and this has implications for the sulphate reducing bacteria and poly-p bacteria. Further studies will be made in the next set of experiments.

5. References

1.Yamamoto, R; Matsui,S; Komori (1990) Filamentous Bulking and hindrance of PO4 removal due to SO_4 reduction, Wat.Sci.Tech.23, Kyoto, pp927-935.

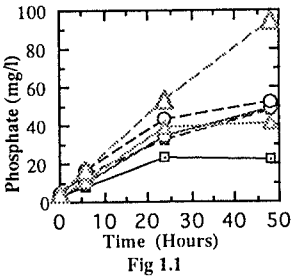


Fig 1.1

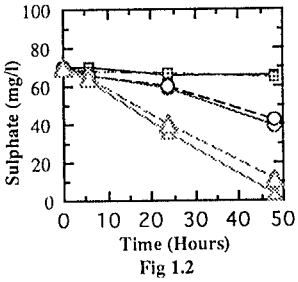
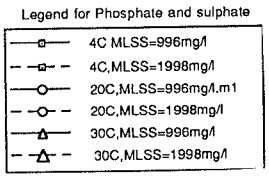


Fig 1.2



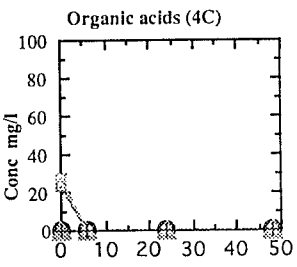


Fig 1.3

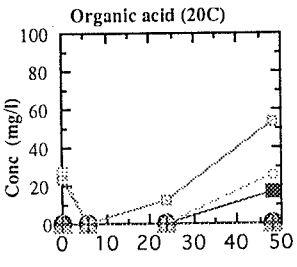


Fig 1.4

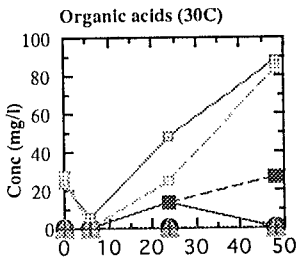
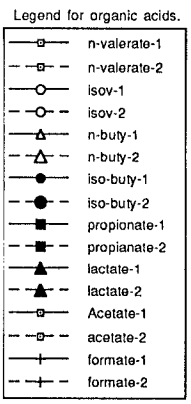


Fig 1.5

Figure 1: Results of batch experiments



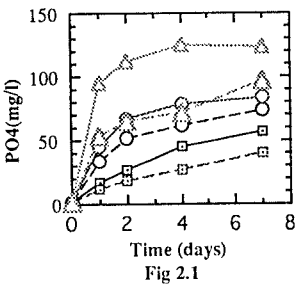


Fig 2.1

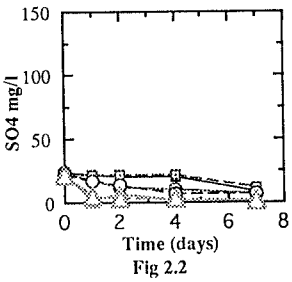


Fig 2.2

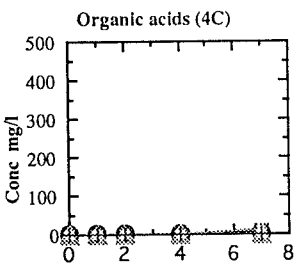


Fig 2.3

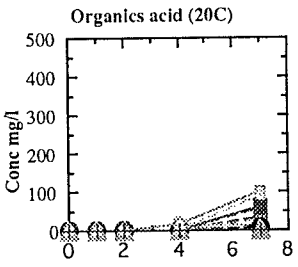


Fig 2.4

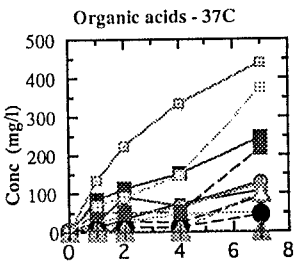


Fig 2.5

Figure 2: Results of storage experiments