

Abstract

Background MFCs can treat wastewater with concomitant electricity generation. Various operational parameters need to be addressed for scaling-up¹. For example flow-rate (f) is important in controlling the volume to be treated and yet hydrodynamic conditions affect the behaviour of biofilm microbial communities².

Objectives Examine effect of (f) on performance during anodic maturation. Investigate performance of aerobic and anaerobic cultures. Study anodic development and internal resistance (R_{INT}) over time.

Methods Polarisation experiments were conducted at different (f). Four feedstock conditions (2-aerobic + 2-anaerobic) were used as inocula and fuel during continuous flow experiments. Anodic growth was observed using SEM.

Results After 5-weeks anodic development aerobic MFCs performed better at 125mL/h than they did a week earlier at 1.5mL/h (1.17mW/m² and 0.89mW/m² respectively) indicating the importance of colonisation time. However, anaerobic MFCs performed better at 1.5mL/h after 4-weeks anodic development than at 125mL/h, a week later (0.87mW/m² and 0.61mW/m² respectively) suggesting vulnerability to (f). SEM revealed biofilm growth variations between the 4 cases. Paradoxically, at low (f), both power and R_{INT} increased over time. Power curves showed an overshoot phenomenon.

Conclusions Aerobes in aerobic media may scavenge O₂ at higher (f) thus shielding electrogenic anaerobes. Clumpy biofilm growth was associated with lower power. An evolving microflora that consequently changes open-circuit redox could explain R_{INT} behaviour. Overshoot phenomenon may be a result of ionic depletion and microbial exhaustion. Complex microbial communities may be essential for wastewater treatment at higher (f). The use of immature anodes (<5weeks) or non-catalyst based O₂ cathodes may explain the low power levels compared to other published work.

References

- 1 Logan, B. *et al.*, 2006. *Environ Sci Technol.* 40, 5181-5192.
- 2 Rochex, A. *et al.*, 2008. *Water Res.* 42, 4915-4922.