DEVELOPING A NOVEL AERATION Stream **STRATEGY FOR BIOLOGICAL** WASTEWATER TREATMENT SYSTEMS David Pryce MD David Armstrong Prof. Fayyaz Memon The Industrial Doctorate Centre for the University of Exeter University of Exeter EliquoHydrok Ltd Water Sector Can nutrient removal performance and stability be enhanced in biological wastewater treatment systems with alternating aeration intensity (AAI)? A similar aeration strategy, intermittent aeration (IA), has shown good potential in integrated fixed film activated sludge (IFAS) reactors but issues remain..... Energy savings of over 27% in an IFAS reactor¹ Reduced settling characteristics due to increased possible extra-cellular polymeric substances (EPS)¹ Improved simultaneous nutrient removal (SNR) Premature settling in aerobic tank due to no efficiency²

possibility of supplemental mixing²

Can SNR be achieved with AAI without compromising energy savings?

The AAI concept



Phosphate-accumulating organisms (PAO) require aerobic-anoxic cycling to proliferate³

Oxidizing groups require aerobic conditions for nitrification

- Filamentous bulking due to very low dissolved oxygen (DO) in non-aerated phase²
- Increased nitrous oxide (N₂O) production due to exposure of ammonia-oxidizers to anoxic conditions³

Can these issues be overcome with AAI?

Objectives

- **Compare SNR performance of IFAS reactors** operating IA and AAI
- Compare the stability of IFAS reactors operating IA and AAI
- Optimize aeration intensity in each phase of AAI and aeration cycle fractioning

Methods



Engineering and Physical Sciences

Research Council

Denitrifiers prefer anoxic conditions as more energy yielded from nitrate than oxygen

References

Aeration manipulated in two parallel IFAS reactors (15L) operating IA and AAI strategies while observing performance.

Singh et al. (2018) Effect of intermittent aeration cycles on EPS production and sludge characteristics in a field scale IFAS reactor. Singh et al. (2017) Effect of intermittent aeration strategies on treatment performance and microbial community of an IFAS reactor. Kim et al. (2010) Nitrous oxide emission from nitrifying activated sludge dependent on denitrification by ammonia-oxidizing bacteria. Kim et al. (2010) Effects of IFAS media on activated sludge settling in biological nutrient removal systems.

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