Applied Biological Nutrient Removal (BNR)

Bio-Bubble Technologies specialise in the development and supply of high quality wastewater & sludge treatment systems. Research with a strong emphasis towards environmental concerns led to the development of the Advanced Aeration process, which has made a major impact not only with the impressively high and stable effluent quality the process effortlessly yields, but also with a remarkable ability to impart high stabilisation and significant reduction to sludge waste production, whilst notably reducing the energy input of the entire treatment works.

Advanced Aeration has demonstrated a capacity to produce a final effluent quality better than 10: 15: 02 (BOD: Suspended Solids: Ammonia) with overall respective quality of 05: 03: 0.5, in addition to reducing sludge waste production on average by 90% less than any other system. No other biological process has successfully emulated this. Furthermore, Bio-Bubble sludge thickening can produce sludge for disposal to agriculture that will meet the requirements of the enhanced treatment specified within the “Safe Sludge Matrix”, which surpasses the requirements of the EU sewage sludge directive [86-278-EEC].

A significant and noteworthy emphasis is that all of the above can be achieved with far less overall energy or carbon emissions than conventional systems, with lower requirements for operational tasks and asset maintenance, and without chemical additives. This inspired outlook undoubtedly provides testimony to a genuine environmental approach.

The aerobic operation of Advanced Aeration holds a 100% track record with all applications, including industrial wastewater treatment for meeting final discharge qualities without encountering process difficulties such as poor settlement, excessive sludge production or filamentous proliferation. This has in the main been attributed to the built-in qualities that allow the system to ‘breathe’ rather than following the intensified design of other processes. A long process sludge-age and low food to biomass ratio together with the applied selective shift patterns also promotes very favourable conditions to stimulate a healthy, naturally selected micro-organism proliferation.

Although the process requires larger basins than the intensified design of other systems, Bio-Bubble have succeeded with finding the most favourable balance to allow the system to be installed within the confines of urban wastewater treatment works. In fact, the application of Advanced Aeration will in most cases reduce the overall footprint.

ADVANCED-AERATION APPLIED TO BIOLOGICAL NUTRIENT REMOVAL APPLICATIONS

Under aerobic operation alone, influent nutrient concentrations will reduce to between 60-75 % total organic nitrogen (TON) and 20-50 % total phosphorus (TP) prior to the effluent being finally discharged. Evaluation of numerous analysis results over a number of years also provides testimony of very good nitrification and demonstrates denitrification occurring within the region of 30-45 % N reduction. This is generally attributed to anoxic conditions prevailing internally within the sludge flocculent mass and during the settlement phase, where depleting oxygen levels encourage bacteria to use the oxygen from the nitrate for biodegradation of organic matter.

Where nutrient reductions are obligatory, this can be achieved by adjusting the operation of the receiving balance tank and including anoxic phase periods within the reactor. Certain applications may also require a fermenting tank to receive settled sludge from the reactor. The sludge will be retained within the fermenting tank to decompose prior to being introduced into the balance tank or back into the reactor. Fermented sludge may be used to either accelerate the denitrification rate or increase the uptake of phosphorus. In general, it would normally be applied to meet final effluent qualities requiring ≤ 1.0 TP.

The application of Advanced Aeration imposes selective pressures and shift patterns for biological nutrient removal. Where required, minimum adjustments to existing works can be undertaken to achieve nutrient removal rates of ≤ 1.0 NH3-N: ≤ 1.0 TN: < 1.0 TP. When applied as a BNR process, Advanced Aeration is capable of instilling improved stability similar to the conditions applied with non-BNR and chemical removal systems by taking advantage of the available dilution capacity.

WITH BNR APPLICATIONS, THE BALANCE TANK MAY ;

a) include an inlet anaerobic section to receive returned settled sludge and/ or fermented sludge, allowing contact with the Readily- Biodegradable COD (RBCOD) source within the incoming effluent.

b) Include a single balance tank to receive fermented sludge from the fermenting tank and allowing contact with the incoming effluent prior to being transferred into the reactor. Also, the balance tank may be designed to receive settled sludge from the reactor following the settlement phase allowing contact with the incoming effluent prior to being transferred back to the reactor. Selection of any of the above methods will depend upon suitability to the application taking into account other factors such as energy, odour, operation, maintenance and asset costs.

Determination of the reactor operation, the time domain of each phase to be applied, oxygen requirements, selective pressures and shift patterns will be evaluated during both tender and process design stages for each individual application. The denitrification rate will be calculated taking into account the selected carbon source produced inherently from the process; or from other available sources and, the aeration phase will be assessed by applying both Bio-Bubble and WRc formulae to determine the required air volume and process oxygen requirements.

Bio-Bubble are both pioneers and leaders for initiatives and developments towards reducing carbon emissions from wastewater treatment and, the initiator for proposing a carbon/energy rating applicable to all systems through national and governmental organisations in the UK and EC. For this reason, the objective for any design will be to conserve all energy in a holistic manner that encompasses all equipment, operations and asset management, including import/ exports such as chemicals and sludge along with any requirement for further off-site processing.

ADVANCED AERATION

UVDB UTILITIES PREQUALIFICATION SCHEME Supplier Number: 77131

SAFEcontractor APPROVED

constructionline Registration No: 56860

ISO9001 UKAS 015

Achilles

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