TE TECH
PROCESS SOLUTIONS

te-cyc™

The te-cyc™ process is a reduced footprint advanced cyclic activated sludge technology that is well established with over 500 reference plants, treating a wide variety of wastewater types in a range of climatic conditions.

The process provides BOD removal, simultaneous nitrification and denitrification, enhanced biological phosphorus removal and very effective solids removal, in a single treatment stage.

The performance of the process make it an ideal solution to meet the current challenges faced by the UK water industry, addressing growth drivers and tightening discharge consent standards in a more cost effective and sustainable way.

te-cyc™ modular

In response to market demand, Te-Tech Process Solutions has developed the te-cyc™ process into a range of standard modular treatment systems to provide all of the established process benefits for small to medium sized works.

The modular systems are designed in-house based on a DfMA approach with off-site manufacture and assembly at our own fabrication facilities. The advantages of a DfMA approach are recognised and include:

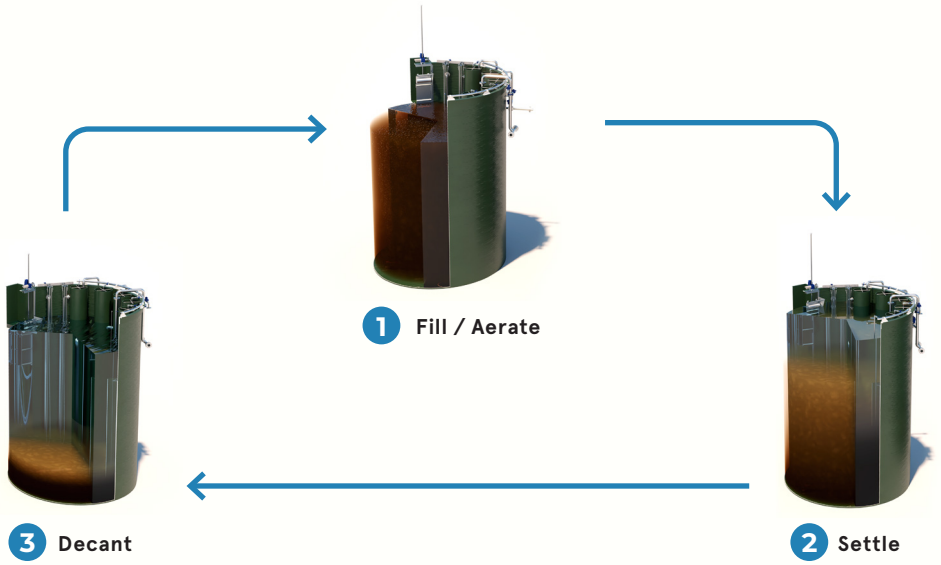
- Improved safety
- Reduced site time and overall programme
- Reduced carbon
- Overall cost reduction
- Better quality control

Process Description

The te-cyc™ process consists of a number of standard circular GRP or glass coated steel tanks, each containing a selector zone, aeration zone, internal recycle, decanting arrangement and associated pipework, instrumentation and access steelwork. The modular systems are provided complete with a service module containing air blowers, oxygen uptake rate (OUR) aeration control system and MCC.

Installing a modular system with two or more te-cyc™ tanks or basins in parallel allows for continuous throughput and eliminates the need for upstream buffer tanks, mixing devices, and tertiary settling tanks, which ultimately reduces the overall site footprint by approximately 50% when compared to traditional activated sludge or conventional sequencing batch reactor processes.

The te-cyc™ process consists of three distinct stages that operate on a cycle in a sequence



1 Fill/Aerate

During the fill/aerate stage water enters a single te-cyc® basin into the aerated zone via the anaerobic selector. Throughout this fill stage, the aeration zone is continually aerated at a controlled rate and a portion of the sludge is constantly recycled to the inlet of the selector. The design of this selector and recycle rate allows for the formation of macroflocs in which simultaneous nitrification/denitrification, BOD^5 removal and biological phosphorus removal occurs. Moreover, non-floc formers and filamentous microorganisms are suppressed to the best possible extent by natural selection mechanisms.

2 Settle

During the settling phase, the inlet to the particular basin is closed, the internal recycle is stopped, and the sludge formed in the previous stage aggregates as a blanket and settles to the base of the reactor tank leaving a top layer of clear treated effluent. In typical wastewater applications, the settled sludge layer has a mean biomass concentration of around 10 g/l and operational sludge volume index (SVI) of typically 60 – 100 ml/g.

3 Decant

In the decant phase, the mechanically driven decant weir moves from the top water level to the bottom water level to remove approximately one third of the reactor volume which will be clear treated effluent. The decant weir also features a scum guard which prevent floating solids from discharging into the treated effluent. At the end of the decant phase, the decant weir is returned to its parking position. Towards the end of the decant phase, a portion of the settled surplus sludge at the base of the reactor is discharged. The rate at which the decant weir is lowered and, hence, the rate of treated wastewater discharge, can be varied during the decant phase.

This cycle is typically 4 hours duration for dry weather flow and is repeated continuously as shown below.

Basin 1	Fill/Aerate		Settle	Decant
Basin 2	Settle	Decant	Fill/Aerate	
Basin 3	Fill/Aerate	Settle	Decant	Fill/Aerate
Basin 4	Decant	Fill/Aerate		Settle
Hour	1	2	3	4

Typical cycle sequence

Having multiple reactor basins in parallel, with their cycles out of phase with each other, means that the total system can handle continuous flow without the need for an upstream buffer tank.

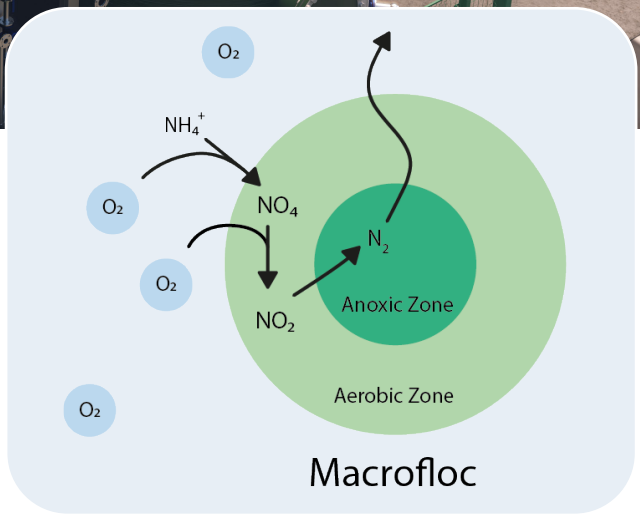
The flow and aeration control systems are designed with dry weather flow and wet weather flow operating protocols as standard, with maintenance cycles available with 3 or more parallel reactor basins. The transition between cycles, whether automatic or manual, is done via the PLC system without affecting the continuity of the plant operation.

OUR (Oxygen Uptake Rate) Control

The OUR control system is particularly applicable to biological nutrient removal. It uses only a measurement of the dissolved oxygen within a reactor basin to determine the actual oxygen uptake rate of the biomass available. In doing so, the required duration of the fill/aerate cycle and the rate of aeration to achieve complete nitrification and BOD/COD removal are calculated and implemented. Employing the control system prevents over-aeration of the reactor basin and creates energy savings. On average the energy required for plants using OUR control is 27% less than those without, and compared to traditional ASP and SBR processes, the energy requirement of the process is on average around 70% less.

Macrofloc Formation

The anaerobic selector zone and internal recycle of the te-cyc® system allows for the formation of so-called "macroflocs" in which extracellular polymeric substances (EPS) produced by the floc forming microorganisms under stress conditions act as a "glue" between the microorganisms. The enhanced size of these macroflocs means that each floc contains an external aerobic zone and an internal anoxic/anaerobic zone during the aeration phase of the process cycle. This means that both nitrification and denitrification occur simultaneously within the same reactor zone and cycle phase, reducing both the required reactor volume and overall cycle time when compared to traditional ASP or SBR processes.



Enhanced Bio-P Removal

The anaerobic selector zone provides the perfect conditions for the growth of polyphosphate accumulating organisms (PAOs) within the macroflocs. The mechanism for removal begins with the PAOs releasing all of the polyphosphates contained within them in the selector zone and then uptaking a greater amount of phosphate from the surrounding bulk liquor within the aerated zone. This is the so-called luxury uptake cycle for enhanced biological phosphorus removal. The phosphate-rich organisms are then periodically removed with the settled sludge during the period of sludge wasting in the decant phase. Under favourable conditions the te-cyc can provide treated effluent phosphorus concentrations of less than 1 mg/l P without the need for chemical dosing.

Summary

The te-cyc™ with over 500 installations worldwide is ideally suited to meet the requirements of the UK wastewater market. The introduction of the modular te-cyc™ advanced cyclic activated sludge process, enables the benefits of an enhanced biological process to be delivered to small and medium sized sites based on a low cost, sustainable DfMA approach.

te-cyc™ Advantages:

- Continuous throughput allowing for the elimination of buffer tanks
- Significant reduction of the overall plant footprint compared to conventional ASPs
- Anaerobic Selector designed for:
  - Formation of macroflocs for simultaneous nitrification and denitrification
  - Formation of PAOs for enhanced biological Phosphorus removal
  - Suppression of bulking sludge forming bacteria
- Excellent effluent quality guaranteed - BOD:SS:TN:TP of < 10:10:10:1 mg/l
- Capital savings of around 10-20% when compared to conventional ASPs
- Energy savings of around 75-85% when compared to conventional ASPs
- Elimination or significant reduction of chemical dosing
- Reduction in chemical sludge treatment, storage and disposal costs

te-cyc™ Modular System Advantages:

- Quality manufacture & assembly in a controlled off-site environment
- Reduced contract programme
- Reduced site installation activities
- Improved health & safety and risk mitigation
- Project cost reductions
- Carbon reduction

te-cyc™ Applications:

- Growth schemes
- Enhanced biological Phosphorus removal
- Simultaneous Nitrification / Denitrification
- Effective solids removal
- Nutrient removal or removal of BOD_5 / COD only
- Simultaneous sludge stabilisation
- Nitrification at very low temperatures
- Application with or without primary settlement

Contact Us

TE TECH
PROCESS SOLUTIONS

Ashton Dewey
Chief Operating Officer
ashton.dewey@te-tech.co.uk
T: +44 (0) 23 8235 1600

Mike Froom
Business Development Director
mike.froom@te-tech.co.uk
T: +44 (0) 23 8235 1600

2 Contech House
Unit 2 Chapel Lane
Rushington Business Park
Southampton SO40 9AH

T: +44 (0) 23 8235 1600
E: enquiries@te-tech.co.uk

www.te-tech.co.uk