

# ZeeLung\*

## an innovative & sustainable solution to augment wastewater treatment plant performance

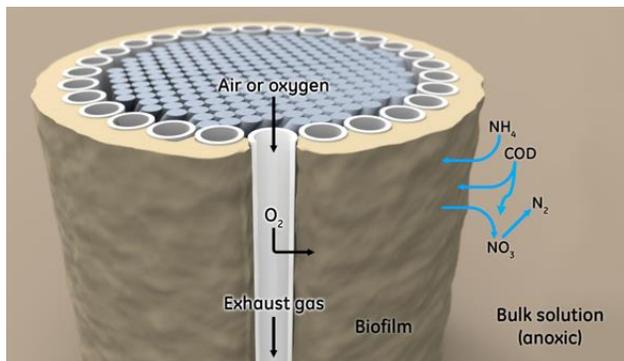
### introduction

Upgrading wastewater treatment plants for capacity expansion or nutrient removal is challenged by process complexity, the need for larger tank volumes and increased energy consumption.

ZeeLung is an innovative solution that maximizes the treatment capacity from existing tank volumes while also reducing energy consumption. Conventional solutions require the construction of new tanks and other process intensification technologies are complex and energy-inefficient. ZeeLung, on the other hand, is a simple solution that increases treatment capacity in existing assets and reduces energy.

### ZeeLung technology

ZeeLung technology employs a gas permeable media to deliver oxygen to a biofilm that is attached to the surface of the media (Figure 1). Oxygen is delivered to the biofilm by diffusion – without the use of bubbles. The result is 4X lower energy consumption for oxygen transfer than fine bubble aeration. Pollutants, such as ammonia and organics, diffuse from the bulk solution into the biofilm where bacteria in the biofilm have optimal conditions to remove them.



**Figure 1: ZeeLung operation principle**

The ZeeLung product is a reinforced media with a yarn-based core supporting multiple gas permeable filaments. This construction – referred to as a “cord” – is flexible yet unbreakable. Multiple cords are potted into top and bottom headers to create a module and modules are installed in a steel frame that forms a cassette (Figure 2). Cassettes are deployed in the mixed liquor in a biological reactor. Low-pressure air is delivered to the cassettes for transfer of oxygen and mixing of the system.



**Figure 2: ZeeLung cassette**

### ZeeLung enabled process intensification

Installing ZeeLung cassettes into an activated sludge reactor increases the inventory of biomass in the system without increasing the mixed liquor concentration. As a result, the same reactor volume has more treatment capability.

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The process interaction of oxygen and pollutants is different in a ZeeLung system compared to conventional active sludge and biofilm processes. With ZeeLung, oxygen and substrates – such as ammonia and organics – enter the biofilm from opposite sides in a counter-diffusion configuration. This creates conditions that favor the growth of nitrifiers in the biofilm. This can be explained by the high diffusivity of ammonia into a biofilm, as compared to organic substrates, and the availability of dissolved oxygen which is highest at the media surface. Preferential growth of nitrifiers versus heterotrophs means that the ZeeLung biofilm “supercharges” nitrification in an activated sludge system. Simultaneous nitrification and denitrification can be achieved by installing ZeeLung cassettes in an anoxic zone (Figure 3).

ZeeLung cassettes are simply deployed into existing tanks with minimal impact on the existing equipment and operations. This makes ZeeLung a cost-effective and versatile solution for augmenting plant performance.

## customer benefits

Key customer benefits include:

- **process intensification** – up to 50% more treatment capacity and/or performance in existing tank volumes
- **process resilience** – the attached growth biofilm is resilient to load variations and upset conditions
- **simple solution** – ZeeLung cassettes are installed into existing bioreactor tanks, avoiding the need to build new tanks and allowing fast implementation
- **energy savings** – oxygen transfer is up to 4X more efficient than fine bubble aeration, resulting in up to 50% energy savings

## contact us

For more information about how ZeeLung can augment the performance of your treatment plant, visit us online at our website.

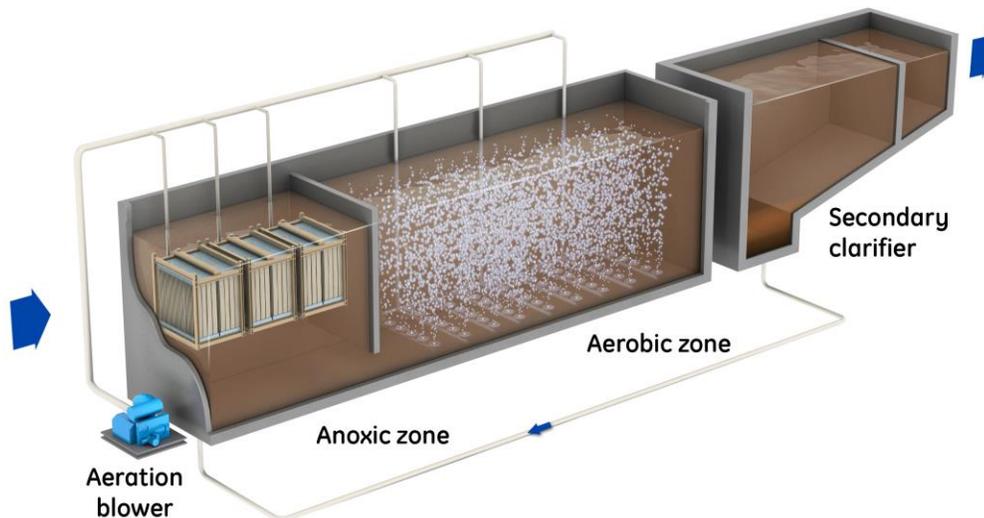


Figure 3: ZeeLung process flow diagram