Benefits of IFAS for Enhanced Biological Nutrient Removal

What is Biological Nutrient Removal?

One of the major concerns regarding municipal wastewater treatment plant discharge is the rising concentration of nutrient compounds, specifically nitrogen and phosphorus.

Nitrogen and phosphorus are the primary causes of cultural eutrophication (i.e., nutrient enrichment due to human activities) in surface waters. The most recognizable manifestations of this eutrophication are algal blooms that occur during the summer. Chronic symptoms of over-enrichment include low dissolved oxygen, fish kills, murky water, and depletion of desirable flora and fauna.

Algal blooms can present problems for ecosystems and human society.

Challenges Faced by Existing Plants

Wastewater treatment plants that employ conventional biological treatment processes designed to meet secondary treatment effluent standards typically do not remove total nitrogen (TN) or total phosphorus (TP) to the extent needed to protect receiving waters.

However, wastewater treatment facilities are increasingly being required to address this issue by implementing treatment processes that reduce effluent nutrient concentrations to levels that regulators deem sufficient to protect the environment. Implementation usually involves major process modifications to a plant, such as: making a portion of the aeration basin anaerobic and/or anoxic, which reduces the aerobic volume and limits nitrification capacity. Clarifier solids loading is usually the factor that limits the concentration of biomass available for nitrification, so common practice is to increase bioreactor volume in order to increase treatment capacity. This can be very expensive and sometimes impossible if space is limited.

Technology Advantages

- **Stable Process -** Due to attached growth, toxic upsets and hydraulic 'wash out' events affect only the top layers of the biofilm containing the microbial population, thus process recovery is fast and smooth
- **Excellent Nitrification -** The IFAS process enables quantitative nitrification even at a low sludge age of the activated sludge by maintaining a separate population on the media
- **Effective During Temperature Lows -** A biofilm rich with autotrophs allows stable nitrification even at low temperatures
- **Improve Sludge Quality -** Nitrification in the IFAS system occurs at low suspended-sludge age, resulting in better sludge settling properties

End-User Benefits

- **Cost-Effective -** Lower capital and operation costs than conventional alternatives
- **Small Footprint -** Allows for expansion / upgrade without additional tankage
- **Low Maintenance -** Self regulating process automatically responds to fluctuations in organic loads, without the need for operational adjustments
- **Expandable -** The IFAS process allows gradual, multi-step, plant expansion, due to the progressive addition of media

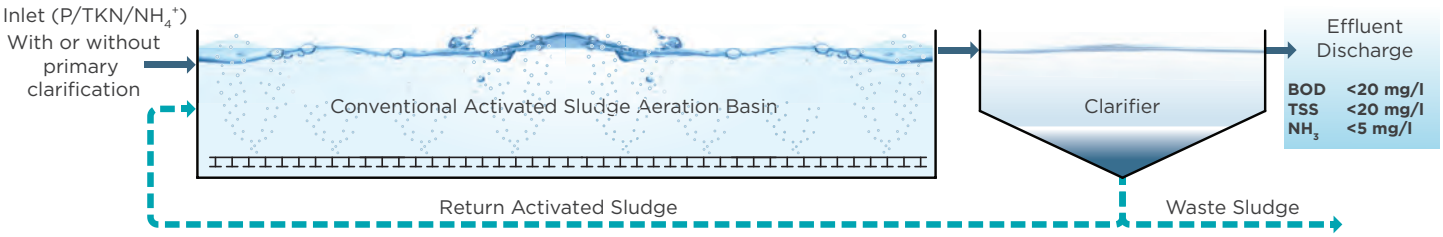
ActiveCell® Solution

One cost-effective solution to achieve Biological Nutrient Removal is the ActiveCell process, developed by Headworks BIO Inc. The ActiveCell process employs the benefits of fixed-film systems into the suspended growth activated sludge process. This hybrid process is referred to as Integrated Fixed-film Activated Sludge (IFAS) technology.

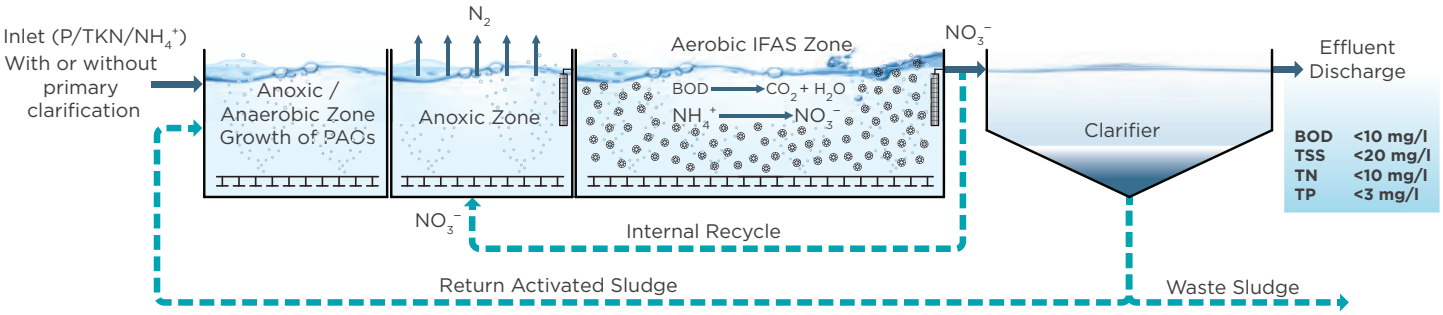
The ActiveCell IFAS process is typically divided into a series of stages that include anaerobic, anoxic, and aerobic volumes, in a similar way to some well known BNR configurations. Within the ActiveCell IFAS process, media is filled in the aerobic stages and retained by stainless steel wedge-wire screens located at the effluent end of the process stage.

Each individual piece of ActiveCell media has been specifically designed with a very high surface area-to-volume ratio to support the growth of biofilm.

EXISTING ACTIVATED SLUDGE PLANT



ACTIVATED SLUDGE PLANT CONVERTED TO IFAS



Note: Adding a post-denitrification step can reduce total nitrogen even lower, to < 3 mg/l. TSS removal can be enhanced by further filtration.

Placing ActiveCell media into activated sludge basins creates a combination of suspended and attached growth biology that optimizes the benefits of both of these systems. Each individual piece of ActiveCell media has been specifically designed with a very high surface area-to-volume ratio to support the growth of biofilm. The surface area provided by the ActiveCell media creates additional active biology above and beyond the limits of the suspended activated sludge system.

This can increase reactor capacity, in terms of organic loading, or support more advanced treatment of the wastewater due to longer sludge age. The additional fixed film biomass does not need to be settled out and returned and therefore does not increase the solids loading to the secondary clarifier, a factor that often limits the treatment capacity of activated sludge systems. IFAS technology addresses the need for increasing activated sludge plant capacity without additional clarifier or aeration basin volume. The fixed biomass also contributes to the ability of the process to respond to organic or hydraulic shock loads and to recover from upsets.

The ActiveCell IFAS process is the perfect solution for upgrading existing plants to support Biological Nutrient Removal without adding reactor volume. Portions of existing aerobic zones can be partitioned into anaerobic or anoxic zones for advanced BNR treatment and the addition of ActiveCell media to the remaining aerobic zones increases the Solids Retention Time (SRT) to a level needed for nitrification.

The team of process design experts at Headworks BIO employs advanced modeling and design tools to determine the size, location, and quantity of ActiveCell media for each stage of the process to achieve the desired level of nutrient removal.

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