

ClearBlu

ENVIRONMENTAL

ClearBlu Aerobic Digestion Process

This is an example of a treatment system with two aerobic ponds utilizing ultrafine bubble aeration and the addition of a concentrated bacteria blend.

Pond A : Primary Aeration:

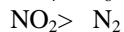
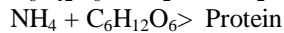
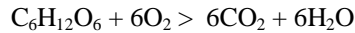
Bacteria

Bacillus and *Pseudomonas*

Pseudomonas putida AD-21

Nitrosomonas and *Nitrobacter*

Reactions:



In the primary aeration pond facultative heterotrophic bacteria of the genus *Bacillus* and *Pseudomonas* digest organic carbon to CO₂ as their primary reaction. These species will also assimilate nitrogen for the production of protein in an amount approximately equal to 10% of the volume of carbon consumed. Some portion of the NO₂ produced by autotrophic ammonia oxidizers will be directly converted to N₂ in the transition zone where organic carbon is present but no longer sufficient to allow heterotrophic dominance.

Pseudomonas putida (strain AD-21) will assimilate ammonia but at the same time will also denitrify NO₃ in the liquid to N₂ gas as a partial reaction. The volume of NO₃ denitrified will depend on how much ammonia is converted to NO₃ by the autotrophic bacteria and the C:N ratio.

The autotrophic genus *Nitrosomonas* will oxidize ammonia to NO₂.

The autotrophic genus *Nitrobacter* will oxidize NO₂ to NO₃.

Pond B: Secondary Aeration:

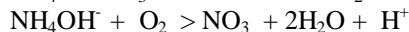
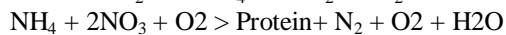
Bacteria

Bacillus and *Pseudomonas*

Pseudomonas putida AD-21

Nitrosomonas and *Nitrobacter*

Reactions



Because organic carbon will have become depleted by the second pond bacterial, metabolism will be dominated by adissimilatory process in which the source for nutrients become the bacteria themselves. *Bacillus* species produce lytic enzymes that begin to dissolve their cell mass as they condense DNA into spore packets. This provides organic carbon and ammonia to neighboring heterotrophs and autotrophs. In the process solids are converted to CO₂ and are lost from the system. *Pseudomonas putida* AD-21 will become more active in the aeration zone as the C:N ratio will allow for aerobic denitrification.

Nitrosomonas and *Nitrobacter* will dominate this pond since they utilize inorganic carbon in the form of CO₂ as their carbon source and competition from heterotrophic bacteria, dependent on organic carbon, will be diminished. Any residual nitrogen will be fully converted to NO₃ at this stage.

It should be noted that the above reactions are complex and unpredictable in an open situation such as a wastewater treatment system. A strict accounting of the reactions is impossible. However, experience with this system demonstrates empirically that approximately over 99% of the carbonaceous BOD can be removed a large percentage of the total nitrogen will be removed with the remainder passing out of the system in the form of NO₃.



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