ClearBlu ENVIRONMENTAL

ClearBlu Microbes

ClearBlu Microbes are a highly concentrated mixture of spores and vegetative bacteria. Six patented Bacillus bacteria combined with two Pseudomonas species provide a diverse enzyme blend. This mixture produces cultures with enhanced capacity to digest high strength organic waste including carbohydrates, sugars, and proteins, and will also degrade surfactants, hydrocarbons, and other chemicals.

Depending on the application, this blend is offered in a hydrated form, as a bulk powder, and in 8-ounce water-soluble packs.

Applications include winery wastewater, brewery wastewater, food processing wastewater, and other wastewater treatment applications.

PRODUCT SPECIFICATIONS

pH range.....6 - 10
Temperature range.....5°C - 55°C
Oxygen requirements .....aerobic
Facultative anaerobe

Bacteria Count CFU/gram

5 billion.....10^9

Enzymes Produced

Protease Lipase
Amylase Urease
Cellulase Nitrate Reductase

Routine use of ClearBlu Microbes

- Reduce BOD
- Lower COD
- Reduce Suspended Solids
- Control Odor
- Lower FOG
- Reduce Sludge Volume
- Control Hydrogen Sulfide
- Reduce surfactants/chemicals
- Improve start up and recovery from shock loading

Please contact ClearBlu for pricing and application guidelines.

USING GREEN TECHNOLOGIES TO TREAT WASTE WATER

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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:	Reactions:
Bacillus and *Pseudomonas*	$C_6H_{12}O_6 + 6O_2 > 6CO_2 + 6H_2O$
	$NH_4 + C_6H_{12}O_6 >$ Protein
	$NO_2 > N_2$
Pseudomonas putida AD-21	$NH_4 + 2NO_3 + O2 >$ Protein$+ N_2 + O2 + H2O$
Nitrosomonas and *Nitrobacter*	$NH_4OH^- + O_2 > NO_3 + 2H_2O + H^+$

In the primary aeration pond facultative heterotrophic bacteria of the genus *Bacillus* and *Pseudomonas* digest organic carbon to CO_2 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 NO_2 produced by autotrophic ammonia oxidizers will be directly converted to N_2 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 NO_3 in the liquid to N_2 gas as a partial reaction. The volume of NO_3 denitrified will depend on how much ammonia is converted to NO_3 by the autotrophic bacteria and the C:N ratio.
The autotrophic genus *Nitrosomonas* will oxidize ammonia to NO_2.
The autotrophic genus *Nitrobacter* will oxidize NO_2 to NO_3.

Pond B: Secondary Aeration:

Bacteria:	Reactions:
Bacillus and *Pseudomonas*	Protein $+ O_2 > NH_4 + CO_2 + H_2O$
Pseudomonas putida AD-21	$NH_4 + 2NO_3 + O2 >$ Protein$+ N_2 + O2 + H2O$
Nitrosomonas and Nitrobacter	$NH_4OH^- + O_2 > NO_3 + 2H_2O + H^+$

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 CO_2 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 CO_2 as their carbon source and competition from heterotrophic bacteria, dependent on organic carbon, will be diminished. Any residual nitrogen will be fully converted to NO_3 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 NO_3.

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