



FREQUENTLY ASKED QUESTIONS

Q: What is Citadel Bio-Cat+™

A: Citadel BioCat+™ is a bioactive solution produced by the fermentation of natural plant material including marine organisms, developed from years of experimentation and development.

A cocktail comprising micro-organisms, micro-nutrients, co-factors and phages

- Micro-organisms including naturally occurring bacteria, crenarchaeota and euryarchaeota from both land and marine sources. Most species are not identified being un-culturable as isolates, but their extent can be determined by 16S rDNA analysis.
- The product enhances the performance of indigenous micro-organisms elevating their metabolism due to the fermentation products, micro-nutrients and co-factors. We refer to them as affecters. Increased metabolism leads to faster waste breakdown and reduced biological sludge production.
- Phages may explain some anti-biotic properties observed and may be co-responsible for observed reductions in sludge accumulation.

No single component of the BioCat+™ can be isolated as being the active factor, rather it is a synergy between various components as well as components of the biosphere it is applied to.

Q: What pH range can Citadel Bio-Cat+™ withstand?

A: Citadel Bio-Cat+™ can be effective in pH as low as 0.5 or as high as 13.

Q: How does Citadel Bio-Cat+™ compare to enzyme products?

A: Enzyme products used to increase the rate and extent of wastewater breakdown have generally failed. Enzymes are very specific; they act on a specific bond in a specific molecule or class of molecules. Wastewater has innumerable variations of molecules and bonds. As yet, no unique enzyme target has been identified to make enzyme treatment effective.



Q: What is the role of Citadel Bio-Cat+™ in waste breakdown?

A: The simplest explanation of the role played by Citadel Bio-Cat+™ is by the consideration of a two-step process:

Step 1: As waste enters a lagoon from an industrial or agricultural operation, bacteria break it down to acids, alcohols, ammonia and insoluble sludge. These breakdown products poison bacteria and slow/stop them. The sludge, alcohols, acids, ammonia, hydrogen sulfide, etc. produced by bacteria are the end products remaining in the lagoon unless Step 2 occurs.

Step 2: The unique microbes found within Citadel Bio-Cat+™ breakdown the sludge and other poisonous materials to water, carbon dioxide, methane, and nitrogen gas. Pathogens are reduced and water-holding capacity is increased. The end products of Step 2 are not toxic and waste breakdown proceeds to completion.

Q: Are there any long or short-term threats to the health of animals or plants that come in contact with Citadel Bio-Cat+™?

A: There are no long-term threats to animals or plants coming into contact with Citadel Bio-Cat+™. Short-term, the patented dry product does contain a fine powder that could cause irritation to the eyes and sinuses if either not handled in a well-ventilated area or some type of respirator were used. An MSDS sheet has been created to address any health concerns associated with the product.

Q: Will Citadel Bio-Cat+™ reduce Ammonia levels?

A: Ammonia removal is accomplished by two mechanisms.

1. Incorporation of ammonia into amine groups on larger compounds – amino acids and proteins primarily.
2. Enhanced nitrification, denitrification.

Nitrate reduction to nitrite is not particularly efficient. Oxygen is a preferred electron donor. However, at low dissolved oxygen levels nitrate reduction takes place.

Denitrification is completed by species of Paracoccus, Pseudomonas and Rhodobacter. They reduce nitrite all the way to N₂. The intermediaries of this reduction are toxic to these species. Citadel Bio-Cat+™ can promote the consumption of a portion of these poisonous materials and allow the reaction to proceed to completion at a greater rate.



Q: How does Citadel Bio-Cat+™ compare to aeration?

A: Increasing aeration is often thought to be the solution to waste breakdown. In fact in some cases it can be detrimental since only organisms suited to high oxygen conditions can flourish, often these lack the ability to break down waste components. Citadel Bio-Cat+™ enables waste breakdown without high cost aeration additions.

Q: Will Citadel Bio-Cat+™ aid in the reduction of pathogen counts?

A: One of the constant findings in years of commercial use is a dramatic reduction of coliforms and pathogens when Citadel Bio-Cat+™ is used in any application. Coliform counts are usually in the 1000's and are often reduced to less than 50 in lagoon processes. Even in activated sludge plants significant coliform reductions are seen.

Q: What is the definition of COD (Chemical Oxygen Demand)?

A: The chemical oxygen demand (COD) is the amount of oxygen required to degrade the organic compounds of wastewater. The bigger the COD value of wastewater, the more oxygen the discharges demand from water bodies.

Q: What effect will Citadel Bio-Cat+™ have on COD?

A: Citadel Bio-Cat+™ is the only product that completely eliminates COD. The other technologies use a lot of oxygen that converts the COD to smaller molecules and then oxidizes them. Consequently, you end up with small, oxidized molecules. Citadel Bio-Cat+™ converts COD to water, oxygen, nitrogen, carbon dioxide, and methane. The portion that goes to methane does not require oxygen; therefore less total oxygen is needed. There is no residual COD in any of the molecules.

Q: What is the explanation of BOD (Biological Oxygen Demand)?

A: The biological oxygen demand (BOD) is a measure of the oxygen used by microorganisms to decompose waste. If there is a large quantity of waste in the water supply, there will also be a lot of bacteria present working to decompose this waste. In this case, the demand for oxygen will be high (due to all the bacteria) so the BOD will be high. As the waste is consumed or dispersed through the water, BOD levels will begin to decline.

Nitrates and phosphates in a body of water can contribute to high BOD levels. Nitrates and phosphates are plant nutrients and can cause plant life and algae to grow quickly. When plants grow quickly, they in turn die quickly. This contributes to the organic waste in the water, which is then decomposed by bacteria. This results in a high BOD level. When BOD levels are high, dissolved oxygen (DO) levels decrease because the bacteria are consuming the oxygen that is available in the water. Since less dissolved oxygen is available in the water, fish and other aquatic organisms may not survive.



Q: What effect will Citadel Bio-Cat+™ have on BOD?

A: Citadel Bio-Cat+™ is the only product that completely eliminates BOD. The other technologies use a lot of oxygen that converts the BOD to smaller molecules and then oxidizes them. Consequently, you end up with small, oxidized molecules which may still have a BOD demand. Citadel Bio-Cat+™ converts BOD to water, oxygen, nitrogen, carbon dioxide, and methane. The portion that goes to methane does not require oxygen; therefore less total oxygen is needed. There is no residual BOD in any of the molecules.

Q: How is Citadel Bio-Cat+™ applied?

A: Depending upon the size of the application, vertical bulk storage tanks ranging from 200 liters to 5000 liters will be used. Applications sometimes require multiple tanks. The tanks are colored to prevent light entering in order to inhibit the growth of algae within the tanks. They are connected to a potable water source, and emitters within the units control flow rates.

A pre-determined amount of Citadel Bio-Cat+™ is introduced to the bottom of the tank to provide a bottom substrate layer. Another pre-determined size cartridge is suspended at the top of the unit to provide upper material. At a steady state, there will be a pre-determined ratio of bottom substrate and upper substrate. The micro-environment at the bottom and top of the tank are different and important in propagation and production of co-factors. The upper cartridges degrade and release substrate to the bottom replacing substrate consumed in producing the Citadel Bio-Cat+™. There may be more at start-up to facilitate needed activity.

As the potable water enters the tank through the emitters, the water comes in contact with the Citadel Bio-Cat+™ substrate. The water encourages its growth, and as the tank fills, the water carrying the microbes exits the tank by gravity through a bulkhead. The bulkhead is fitted with a PVC outlet pipe that runs from the tank to the body of water being treated.

Q: Does the water supply to the Citadel Bio-Cat+™ generating tank need to be potable?

A: Yes. The addition of non-potable water to the Citadel Bio-Cat+™ generating tanks may cause contamination by unwanted microbes which can prevent production of the co-factors and dramatically reduce the concentration of desired organisms.



Q: How is the Citadel Bio-Cat+™ substrate packaged?

A: The Citadel Bio-Cat+™ substrate is packaged in various sizes of natural cotton cartridges (depending on application) and in loose substrate. The biocatalyst cartridge can be used suspended from the top of the tank, the loose substrate is placed in the bottom. The cartridges are exchanged on a weekly or fortnightly basis (depending on COD loading and flow) the spent cartridges are left in the generator tank and add to the volume of bottom substrate, the cotton sleeve completely biodegrades.

Q: How often does the Citadel Bio-Cat+™ substrate need to be replaced?

A: The aerobic substrate will be fed once per week/month depending on the application. In certain instances a total system restart may be indicated after 2 or 3 years.

Q: Does the Citadel Bio-Cat+™ generating tank need electricity?

A: The tank only requires electricity if a heating unit is needed for adverse weather conditions. The heating units are designed to run at 30 degrees C.

Q: Does the Citadel Bio-Cat+™ generating tank need to be sheltered from weather?

A: Whenever possible, the installation should occur somewhere at the facility where it is protected from the weather. If this is not possible, it may be necessary to construct a shelter for the installation and insulate the generator.

Q: How much maintenance is involved with the installation?

A: Aside from adding the new bag of product weekly/monthly, very little maintenance is required of the tank. The flow emitters should be checked to make certain they are flowing properly, as well as the PVC line feeding product to the lagoon/treatment tank.

Q: How do I know if the Citadel Bio-Cat+™ is doing its job?

A: Success is gauged on both qualitative and quantitative results. Qualitative results include items such as: physically measuring reductions in sludge, physical characteristics of the sludge, activity on the surface of the lagoon (eruptions, bubbling and foam), odor reduction, and changes in water clarity. The quantitative results are based upon laboratory analysis, and depending upon the type of application, the tests conducted vary. Laboratory testing is normally conducted on a quarterly basis as a minimum but larger applications and regulatory requirements may increase the frequency even to daily analyses.

