

ODOR CONTROL With BIO-ORGANIC CATALYSTS

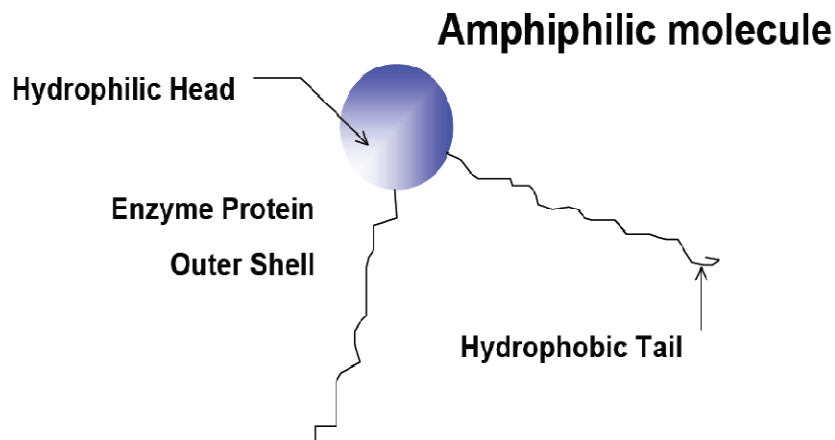
Introduction

Neozyme International, Inc. manufactures a patented bio-organic catalyst (BOC) technology for odor control and wastewater treatment and has developed proprietary systems for the application of this technology. The technology neither is an odor-masking agent (such as essential oils), nor is it a bacterial or enzyme product. It is a combination of constituents with the unique odor eliminating properties described below. Neozyme and its distributors have field-tested and demonstrated the effectiveness of the technology, and have developed an extensive body of highly successful results.

Organic Odors

Odors associated with organic wastes and wastewaters are caused by gases produced by the decomposition of organic matter under anaerobic (without oxygen) conditions by microbes that live without oxygen. Under aerobic conditions, organic wastes undergoing microbial decomposition may have distinctive, disagreeable odors that become significantly more objectionable when conditions become oxygen-limited. The most characteristic odor of anaerobic decomposition is that of hydrogen sulfide (H₂S) gas, which is produced by anaerobic microorganisms that reduce sulfate to sulfide as part of their metabolism. The characteristic "rotten egg" odor is detectable by humans at very low concentrations (less than 0.00021 parts per million). Other malodorous substances that may be present in organic wastes and wastewater include amines (fishy), ammonia, diamines, mercaptans (skunk), organic sulfides (rotten cabbage) and skatole (fecal matter).

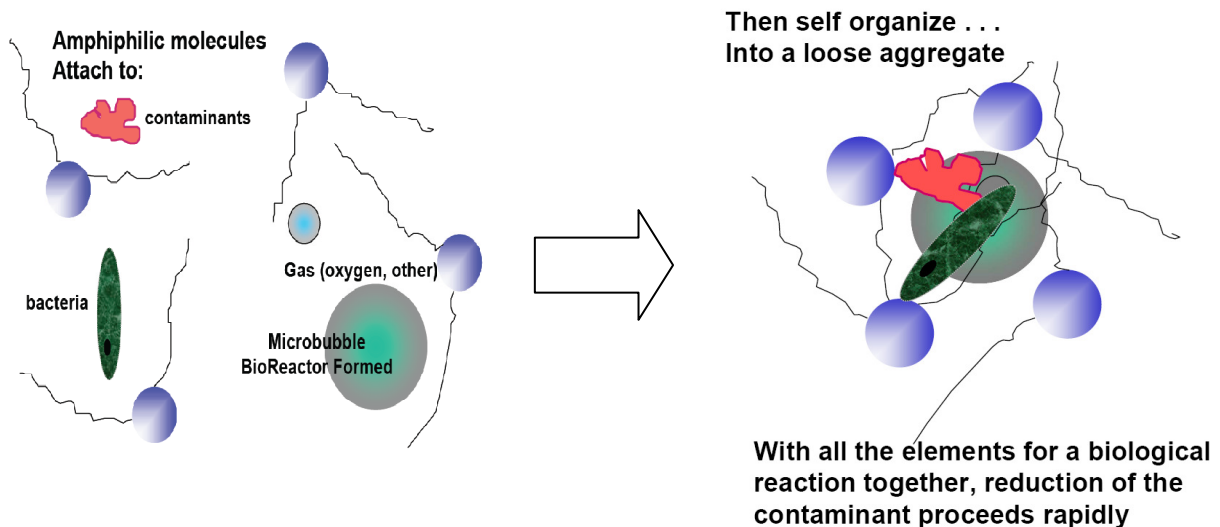
How Does the Bio-Organic Catalyst Technology Work?



Bio-Organic Catalyst Technology

The BOC technology is a hybrid compound with both the surface modifying and aggregating properties of surfactants, and the catalytic properties of enzymes. The BOC eliminates odors through two principle mechanisms: 1) Physically altering the shape of the odor-causing molecules; and 2) Changing the microbial ecology to a more aerobic state to rapidly oxidize odorous gases and prevent their additional formation.

The BOC contains amphiphilic substances that have a high affinity for physically combining with organic molecules and inorganic substances such as H₂S. In addition, these molecules form physical complexes, or aggregates that reduce odor by altering the physical shape of malodorous molecules so that they are not recognized by odor receptors in the human olfactory system. Further, these aggregates become the platforms for subsequent chemical (oxidation) and biological reactions resulting in the elimination of odor-causing molecules. Based on the known oxidative properties of the BOC, it is assumed that amines and mercaptans are eliminated primarily through oxidative reactions, although other chemical reactions are also possible contributors to odor elimination. This mechanism of action takes place both in odorous air and water streams, and on the surface of odor-generating solids, at normal ambient temperatures.



In municipal and industrial wastewater treatment applications, the BOC has also been shown to significantly reduce fats, oils and greases (FOG), biochemical oxygen demand (BOO), chemical oxygen demand (COD), total suspended solids (TSS), and sludge volume. One of the most important functions of the BOC technology in wastewater treatment is its ability to cause the formation of microscopic sized bubbles in aeration systems. These microbubbles vastly increase the efficiency of conventional aeration devices allowing such systems to reduce energy consumption while increasing the concentration of dissolved oxygen. Higher dissolved oxygen levels in wastewater treatment systems provide aerobic microorganisms a favorable environment for the rapid oxidation of organic wastes and prevent the localized anaerobic conditions that encourage growth of the anaerobic and facultative microorganisms that can cause odor emissions.

Neozyme manufactures the products based on this BOC technology using a proprietary fermentation process. The products are in a concentrated liquid form, are derived from plants and minerals, are free of bacteria, are non-toxic, and are biodegradable.

Conventional Odor Control Methods

The principal conventional methods for controlling odors originating from organic sources can be classified as physical, chemical, and biological. These methods are listed as follows;

Physical

- Containment
- Dilution with odor-free air
- Combustion
- Adsorption to activated carbon
- Adsorption on sand, soil, or compost beds
- Masking agents

Chemical

- Scrubbing gases with alkali chemicals
- Injection of air or oxygen to enhance oxidation
- Oxidation with chlorine, ozone, hydrogen peroxide, or potassium permanganate
- Precipitation (i.e. precipitation of sulfide with metallic salts such as iron)

Biological

- Biological Oxidation with trickling filters or activated sludge
- Biological stripping for gases

The BOC technology works in a manner different from these conventional methods, but similar to some, such as the chemical and biological oxidation methods. Where containment and/or dilution are not practical, the BOC technology can be a very cost-effective alternative to these methods. In addition, the non-toxic nature of the BOC prevents the worker safety problems inherent with many of these methods.

Case Studies

The following are brief descriptions of successful application of the BOC technology for odor control in municipal wastewater sludge processing, meat packing and processing, food processing, and livestock production applications.

Sludge Dewatering and Composting Facility. San Diego. CA

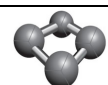
This facility is located on Fiesta Island in San Diego, and receives an average of 1.1 million gallons per day of sludge from anaerobic digesters at the City's Point Loma wastewater treatment plant. Sludge is dewatered using belt filter presses, then is placed in drying beds and composted for additional drying and stabilization. The facility received an average of 100 odor complaints per month in the summer months from the neighboring resort hotels. The BOC was applied at a rate of about 36 gallons per day by injection into the liquid sludge prior to the belt presses. The operators noticed an immediate drop in the ammonia odor following treatment and the odor remained undetectable for 14 days in the drying beds. Odor complaints were reduced by 95%.

Rendering Plant Los Angeles. CA

This plant processes animal blood, fat and bones into gelatin, blood meal, protein products and lard. The plant had a difficult odor problem throughout the facility; especially in the areas where the animal parts and grease trap pump trucks would unload. The processing equipment was constantly covered with a greasy coating that also was the source of much of the odor, and was difficult to clean. The facility was only partially enclosed, and the facility created chronic odor problems in the neighborhood. Odor masking perfumes had been used without success at the plant.

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The BOC product was applied in a 5% mixture with fresh water through simple spray mechanisms onto the odorous solids and the conveying and processing equipment. The application equipment included a timing mechanism to spray during the times of heavy material receipt and processing. The odor was effectively eliminated and the floors and equipment were maintained in a much cleaner condition.

Vegetable Processing Plant Carlsbad. CA

This plant processes and cooks vegetables (including garlic, zucchini, bell peppers and others), and sells the pre-cooked products to national restaurant chains and branded consumer food producers. Odors from the cooking operations have been a chronic problem. The company had spent years trying different odor control products and \$100,000 to install scrubbers, without complete success. The company was cited for violations of air quality nuisance ordinances. The BOC is applied through spray systems in to the odorous exhaust streams, and has been effective in eliminating the odors.

Soy Sauce Brewery. Wisconsin

This major soy sauce manufacturer is located near a resort area, and had received numerous odor complaints, particularly in the summer months. The source of the majority of the odors was the facility's wastewater pretreatment plant. Low dissolved oxygen in the aeration basins were causing anaerobic conditions leading to odor generation. Application of the BOC at rates varying from 5 ppm up to 40 ppm effectively raised the dissolved oxygen levels in the aeration basins by a factor of between 3 and 6 times. This increased dissolved oxygen correlated with the elimination of the odor problem. The plant has been using the BOC for about four years, and odor complaints are now rare.

Sausage Processing Facility. Illinois

This facility cooks and flash-freezes sausage for consumer branded products. The source of odor at the facility was the wastewater pretreatment plant caused by anaerobic conditions in the equalization basin, accumulations of grease in floating grease caps in the clarifiers, and low dissolved oxygen conditions in the aeration basin. Application of the BOC at about 50 ppm in the wastewater stream effectively reduced the odor generation, eliminated the growth of the grease cap, and improved the overall operations of the treatment plant.

Swine Finishing Operation, Nebraska

This facility is an 18,600-head capacity hog grower-finisher that utilizes a single anaerobic treatment lagoon for the animal wastes. The lagoon had a strong odor of swine fecal matter and ammonia. The BOC product was introduced into the flush water system in the barns before the wastes entered the lagoon at about 50 ppm. Among other benefits, the BOC significantly reduced the odor generated by the lagoon.

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