Results After Using BIO ENERGIZER®

INFORMATIONAL

How to Cut Wastewater Treatment Plant Costs and Optimize Your System

A powerful proven strategy for cutting costs and optimizing the wastewater systems of food manufacturing plants

Wastewater from food manufacturing processes typically lacks the adequate nutritional building blocks necessary to effectively sustain microbial life. As a result, operational problems occur and inefficient waste stabilization results. Signs of nutrient deficiency include: sludge bulking, foaming, poor settleability, inefficient removal of suspended solids, excess sludge accumulation, and inefficient removal of BOD^5 and COD. (*Wastewater Biology; The Life Process*, WEF)

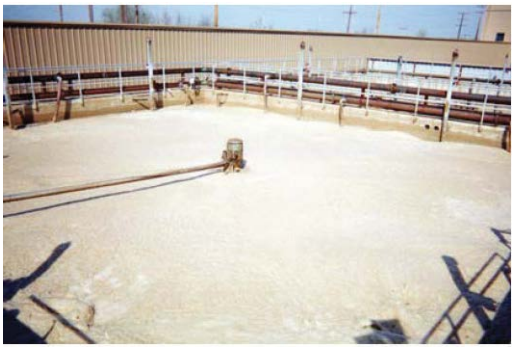
Laboratory studies on a range of effluents have established that industrial wastes, including those from the food, drink, and fermentation industries, are not nutritionally balanced for optimal wastewater treatment. (Wheatley et al.)

Wastewater microbes are the same as all other life on this planet—they need adequate nutrition to thrive, metabolize, grow, and pass their genes on to the next generation. This happens more or less efficiently in wastewater treatment plants depending on the condition and nutritional composition of the wastewater to be treated.

In nature, each microbe fills a unique niche and has a specific function to perform within that niche to further nutrient cycling and nature's own "self purification" cycle. Just as each microbe has a unique duty to perform, each mineral and vitamin essential to the growth and metabolism of that microbe also has a unique and specific function to perform within the microbes cell.

Some minerals are used as enzyme activators called coenzymes, others are used to transfer electrons, and still others serve as regulators of osmotic pressure. Iron for example is important in cytochrome development and cobalt is essential in the formation of Vitamin B12.

When a nutritional deficiency occurs in the reactor of a wastewater treatment plant, metabolic inefficiencies set in and wastewater treatment effectiveness suffers with problems like foaming, bulking, poor settleability, and excess solids accumulation.



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Nutritional deficiency in a wastewater treatment plant is expressed by this simple Monod equation:

$$u = u_{max} \frac{S}{K_s + S}$$

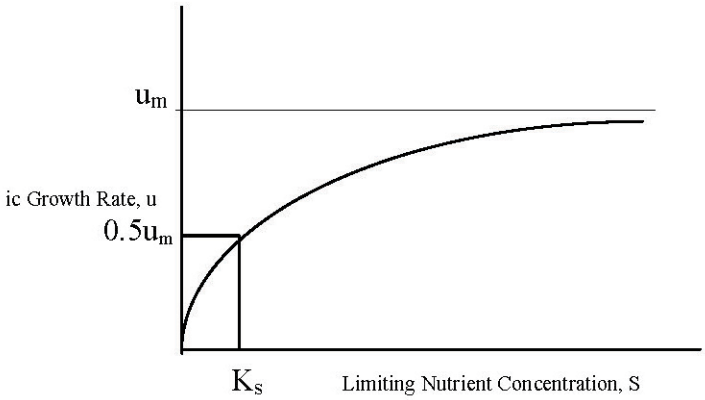
u = specific growth rate

u_m = maximum specific growth rate, d^{-1};

S = limiting nutrient concentration, mg/l; and

K_s = half saturation constant, mg/l.,

The influence of a single limiting nutrient:



When nutrients are deficient growth rate becomes limited

(Rich)

The influence of limiting nutrients apply to aerobic and anaerobic wastewater treatment plants alike. In anaerobic systems trace nutrient deficiencies will lead to increased volatile fatty acids which depresses pH, increases BOD, and solids accumulation, and severely limits the overall treatment efficiency. "[A]dequate trace metal bioavailability and sulfide presence must always be guaranteed for anaerobic biotransformation of wastewater. Every case of elevated volatile acids in an anaerobic effluent should be considered a potential case of trace metal deficiency..."(Speece)

Where proper nutrition exists, a wider variety of different microbial species will work together to further efficient nutrient cycling for more complete stabilization of waste. "Limiting or deficient [nutrient] concentrations may shift the population in favor of those organisms requiring less of the element or those organisms more capable of assimilating trace elements in extremely dilute solutions." (Wood & Tchobanoglaus) This will lead to operational problems like bulking, foaming, poor solids removal, and inefficient BOD^5 removal.

Optimizing the microbial growth environment by the addition of trace nutrients and vitamins is the most cost effective way to double treatment plant efficiency. Small nutritional changes to the growth environment will release more of the microbes full potential and send dramatic changes throughout the entire treatment system. "Trace metal supplementation is [no longer] a scientific anomaly; it is an engineering necessity, as evidenced by numerous field studies...Trace metals exert a surprisingly critical influence upon successful methanogenesis, so the data illustrating this indispensable factor should be considered." (Speece)

Understanding the power that trace nutrient addition can have on wastewater treatment plants has lead Probiotic Solutions® to create BIO ENERGIZER®. BIO ENERGIZER® is a microbial nutritional formula and stimulant that optimizes the microbial growth environment for enhanced microbial functioning.

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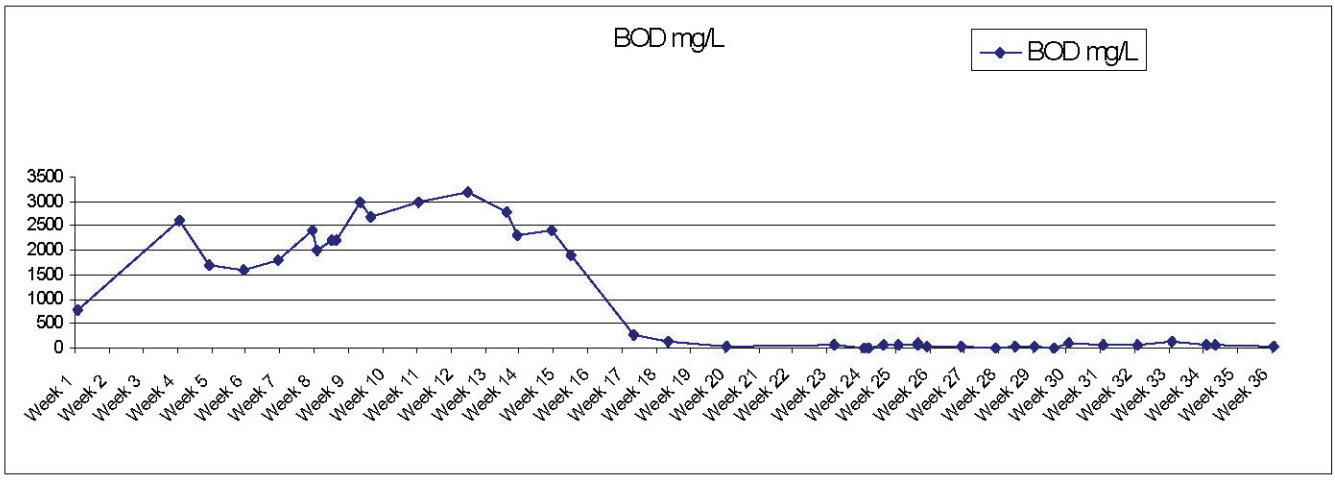
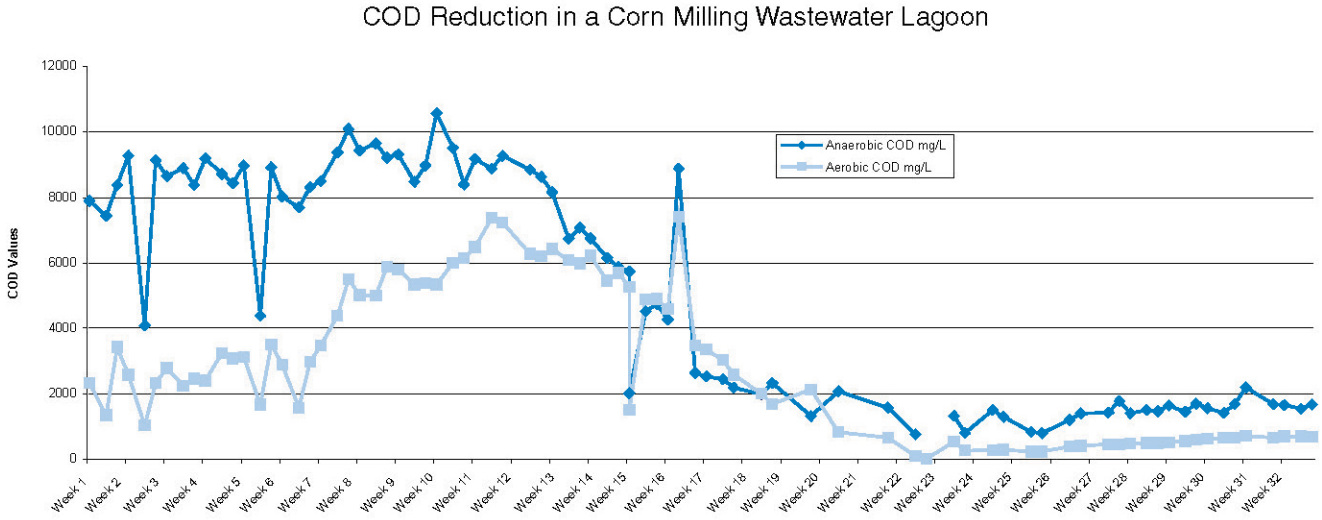
The following is a before and after example of what adding BIO ENERGIZER® will do to an improperly balanced and nutritionally stressed high strength corn milling wastewater.



Examples of BOD / COD reduction after the addition of BIO ENERGIZER® from Probiotic Solutions®
BIO ENERGIZER® was added during week 8, odor control was achieved in 30 days



"In nutrient limited activated sludge plants the effluent BOD concentration can be several times higher than in nutrient balanced systems." (Grau)

Industrial wastewater microbes experience tremendous nutritional pressures with heavy competition for a limited supply of trace nutrients. Competition for trace nutrients is not simply limited to biological demands alone but also include physical and chemical demands as well. Adsorption, hydroxide precipitation, and hydrogen sulfide precipitation all act to withhold essential nutrients and "starve" industrial wastewater microbes creating problems for operators. (Wood & Tchabanoglaus)

When wastewater is subject to anaerobic conditions, sulfates are reduced to sulfides, which form highly insoluble metal sulfides:

$$Fe^{2+} + HS^- \rightarrow FeS + H^+$$

(*Wastewater Biology: The Life Process*, WEF)

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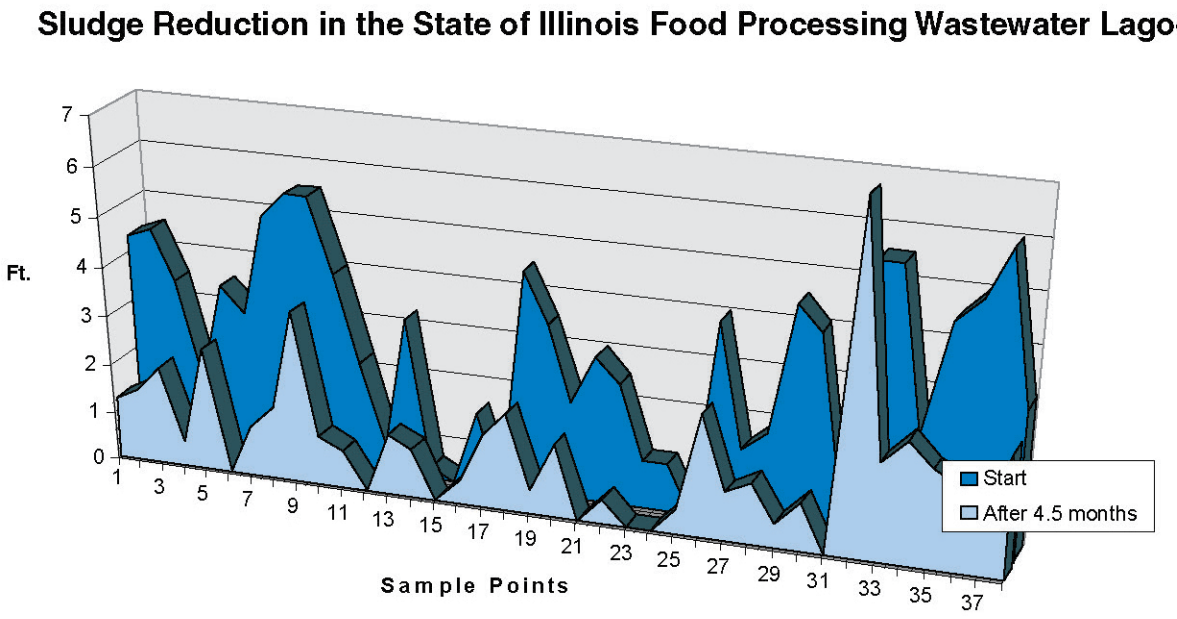
Under this stress, iron and other essential nutrients become tied-up and biologically unavailable—useless to the existing biomass. The addition of vitamins and trace nutrients will overcome nutrient deficiencies and the competition that exists for essential cellular building blocks.

A food processing facility in Illinois began using BIO ENERGIZER® to reduce 5.5 million pounds of accumulated sludge. It packs 9 million cases of peas, corn, carrots, and lima beans each year. One aerated lagoon and 2 facultative lagoons are used to stabilize the 2.5 million gallons of wastewater generated daily.

After 4 1/2 months of use, the sludge blanket depth in the aerated lagoon reduced by 20 inches and cut the sludge mass by 3.2 million pounds. All lagoons were kept on line for the season's vegetable pack. Using BIO ENERGIZER® is saving the company hundreds of thousands of dollars in dredging costs plus improving their effluent water quality—while the lagoons stay on line. The company now amends their wastewater yearly to stay ahead of sludge accumulation.



Sludge blanket reduction in an aerated wastewater lagoon treating corn, pea, and Lima bean waste

With BIO ENERGIZER®, wastewater microbes function more efficiently to break down organic waste as well as promote richness in species diversity. A wider variety of different microbes (greater species diversity) working together in a microbial community, allows for increased nutrient cycling, creating more efficient and complete wastewater treatment.

BIO ENERGIZER® is a complex formulation of biostimulants, vitamins, and trace nutrients that are blended by design to optimize the microbial growth environment for faster more complete sludge digestion and better settleability and decant. BIO ENERGIZER® improves the efficiency and speed of a plant's naturally occurring microbes. With broadened species diversity and greater rates of bio-oxidation, BIO ENERGIZER® can help double and many times triple plant capacity without the need for expensive concrete and steel upgrades.

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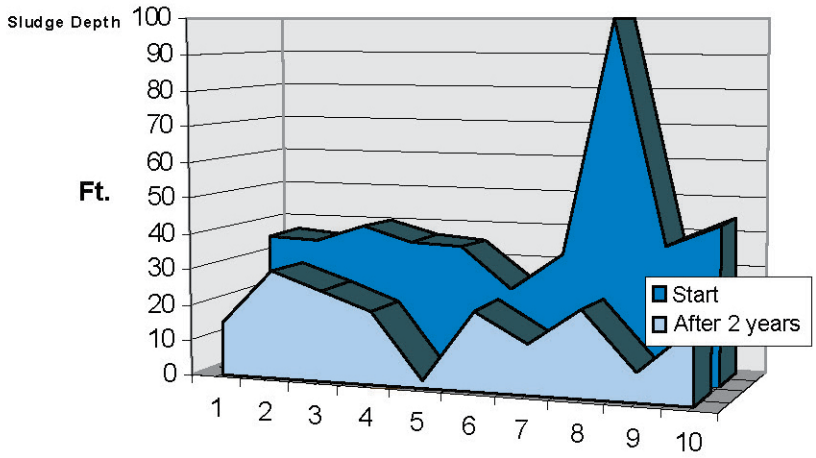
Another food processing facility in Indiana operates a 500,000 gpd 3 cell aerated lagoon system to treat high strength tomato waste. The company uses BIO ENERGIZER® to accomplish results similar to the Illinois Foods Company.

Sludge Reduction in the Indiana Food Processing Wastewater Lagoon #1



Sample Points

	1	2	3	4	5	6	7	8	9	10	
Start	36	35	40	36	35	24	34	100	38	44	**Ft.**
After 2 years	15	30	25	20	2	22	14	24	8	21	**Ft.**
Reduction	21	5	15	16	33	2	20	76	30	23	**Ft.**

Sludge blanket reduction in a wastewater lagoon treating high strength tomato waste after the addition of BIO ENERGIZER®

Trace nutrient and vitamin addition to food processing wastewater is the low cost alternative to adding expensive concrete and steel plant upgrades or lagoon dredging. Supplemental trace nutrient and vitamin addition to wastewater systems activate the enzymes responsible for degrading wastes and allows for maximal growth, reproduction, and metabolism of wastewater microbes.

For faster more complete sludge reduction and less waste sludge hauled, for improved settleability, better decant, and increased capacity, for less bulking and foaming, wastewater operators must consider nutritionally balancing their wastewater. This strategy for efficiency improvements and cost cutting is hundreds of thousands of dollars, and possibly millions of dollars less expensive than a plant upgrade or expansion.

Supplemental trace nutrient addition for microbial optimization is an engineering and scientific fact, (and a microbial necessity) proven by extensive research and countless field trials. Adding BIO ENERGIZER® to wastewater treatment systems is a powerful and proven strategy to cut wastewater treatment costs.

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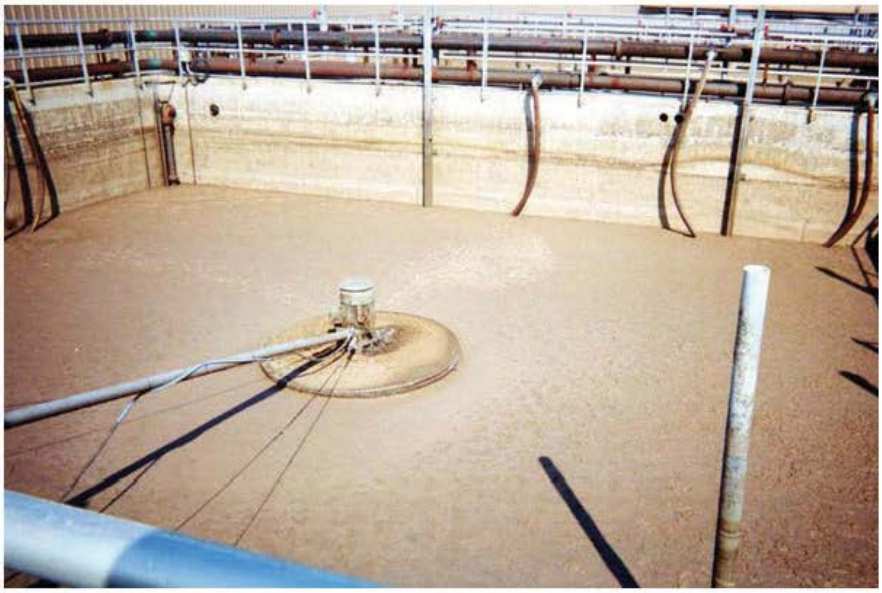
The nutrient package referred to in this paper is commercially available under the trade name BIO ENERGIZER® produced by Bio Huma Netics, Inc. and distributed by Probiotic Solutions® of Gilbert, AZ. (480) 961-1220

Notes:

For those interested in the subject of nutrient addition to aerobic wastewater treatment processes, chapter three of *Wastewater Biology; The Life Process* is highly recommended.

For those interested in industrial anaerobic wastewater treatment, *Anaerobic Biotechnology for Industrial Wastewater* is an excellent book. References are made throughout the book to the problems of nutrient deficiencies and chapter nine is devoted entirely to the subject of trace nutrient addition.



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Probiotic Solutions® Product Information

BIO ENERGIZER® is a broad-spectrum bio-activator containing over 30 essential microbial growth-promoting ingredients. By design, BIO ENERGIZER® is a balanced formulation of vitamins, trace nutrients, enzymes, organic acids, and biostimulants that motivate the existing microbial community to greater metabolic capacity and efficiency. BIO ENERGIZER® is not a bacterium nor an inoculum.

For many years, wastewater operators have continued to use BIO ENERGIZER® to cut their sludge hauling costs.

Operators Using BIO ENERGIZER® Report:

1) Increases in BOD removal efficiency. BIO ENERGIZER® improves treatment plant removal efficiency to increase plant treatment capacity and more easily meet effluent requirements.

2) The elimination of expensive dredging costs. BIO ENERGIZER® converts sludge into gases and water, reducing sludge accumulations. No draining, drying, excavating, or inconvenient down time.

3) The reduction of odors and aeration costs. BIO ENERGIZER® enhances aerobic and facultative biological eco-systems to reduce the production of objectionable and offensive odors. BIO ENERGIZER® also increases the dissolved oxygen levels which decreases the need for aeration.

BIO ENERGIZER® enhances endogenous respiration for faster and more complete oxidation of sludge into carbon dioxide and water.

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