SYNECO BIOTECH
A DIVISION OF SYNECO SYSTEMS INC.

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Persnickety® Brand 713 Biological Inoculant

For control of Hydrogen Sulfide in Collection Systems, Tanks, Ponds and Lagoons.

The Problem

Hydrogen sulfide (H_2S) has been the source of countless odor complaints directed to those responsible for operating municipal and industrial wastewater facilities – probably the source for more complaints than any other malodorous compound. In addition to the rotten egg odor, H_2S poses serious corrosion problems costing many millions of dollars each year, serious health and safety concerns, and can diminish the effectiveness of any waste water facility.

The Cause

The biological transformations involved in the sulfur cycle are tremendously complex, but it is generally accurate to say that sulfate-reducing bacteria are the principal causal agents — reducing sulfate to sulfide. The biological production of H_2S requires anaerobic conditions (conditions deficient in dissolved oxygen [DO]), but the problem often occurs where design intends largely aerobic conditions. For example, sludge blankets in clarifiers are frequent culprits; stabilization ponds often stratify with heavy loadings, creating anaerobic, facultative and aerobic layers. (See Figure 1.)

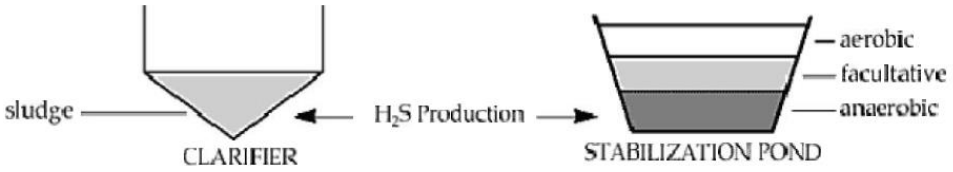

Figure 1. H_2S production in clarifier sludge blanket and anaerobic stratum of pond.

HISTORICAL SOLUTIONS

All of the following have been used to combat H_2S.

Method	Major Disadvantage
Aeration	Turbulence prevents settling, releases H_2S
Chlorination	Hazardous
Containment and Scrubbing	High capital and operating costs
Hydrogen Peroxide	Expensive (not reaction-specific with sulfide)
Iron Salts	Rarely fully effective
pH Shocking	Kills or inhibits treatment
Potassium Permanganate	Expensive

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Persnickety® 713 A proven and highly effective Biological Solution.

There is no magic involved with the biological creation of H_2S. Neither is there any magic involved with its biological removal. PERSNICKETY® 713 is a carefully developed, precisely balanced blend of proprietary, naturally occurring, strict and facultative anaerobic bacteria in a liquid medium. They are selected and cultured for their ability to reduce H_2S to elemental sulfur, which is stored inter-cellularly. The function is as follows: H_2S + PERSNICKETY® 713—> S + new PERSNICKETY® bacteria. All members are non-toxic, non-pathogenic, harmless to aquatic life and compatible with other desirable bacteria found in wastewater. They become a synergistic part of the biomass, and simply do what nature intended them to do.

An innovative process control tool for mechanical waste water treatment plants.

Much of our marketing focus is on ponds and lagoons because odor complaints commonly create the greatest sense of urgency for many of our clients, but potential benefits are much broader. You can reduce cost of and improve plant operations and effluent with Persnickety® 713. Here's an important example: 713 can reduce electrical cost. Since some members of 713 are facultative and can use combined oxygen, they can tap into a huge, unused resource. Other members are photosynthetic and will use CO_2 and produce oxygen when functioning in sunlight. While photosynthetic bacteria are uncommon, they do exist and should not be confused with algae. In fact, in most facilities algae commonly seen in clarifiers will be out-competed and slowly leave the system. Aeration in activated sludge basins can sometimes be markedly reduced and sufficient DO still retained. We have observed up to a seventy-five percent reduction in aeration employed.

A step by step summary of potential benefits in waste water treatment plants.

Pre-Treatment, Collections/Lift Stations: H_2S and grease control, reduced septicity, collections start to become part of the treatment system, improved safety.

Primary Treatment: H_2S and grease control, improved settling, improved BOD and solids removal, higher DO.

Secondary Treatment: H_2S and grease control, improved BOD and solids removal, improved flocculation, higher DO, aeration electrical savings, ponding and fly control in filters, better settling and improved clarity in final clarifiers.

Solids Handling: H_2S control, less solids, better settling, improved supernatant. Benefits and limitations described below apply to ponds, lagoons, and mechanical plants.

Benefits of Persnickety® 713

Primary– Complaints due to H_2S odors cease or are greatly diminished. As importantly, corrosion damage and the health and safety dangers posed by H_2S are correspondingly reduced. Cost of treatment is very competitive. Secondary – Even low levels of highly toxic H_2S can adversely affect the health of a biomass, greatly reducing its activity and efficiency. The impact of H_2S varies in specific effect from location to location, but a detoxified, rejuvenated biomass will perform more efficiently. Thus, potential exists for improving biochemical oxygen demand (BOD) and solids removals and for decreasing accumulations of organic solids.

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PERSNICKETY® 713 will also help to control animal and vegetable fats, oils and greases (FOG). These compounds are exceptionally stable and require extended time for breakdown. Certain members of 713 speed the process, creating intermediates (proteins, fatty acids, glycerols). These simpler compounds are converted far more readily by normally present bacteria. This benefit will usually be seen in domestic plants with normal domestic FOG loadings.

Limitations

PERSNICKETY® 713 is not appropriate in all circumstances. It is formulated to function in open tanks, ponds, lagoons, ditches and the like, where anaerobic conditions allow sulfate reducing bacteria to flourish and produce H_2S. It is not normally recommended for severely anaerobic conditions such as those found in anaerobic digesters and highly septic collection lines. Here are a few simple checks to determine appropriateness:

- pH– must be between 6.0– 9.0.
- eH– must not be below – 350 millivolts
- Temperature– must not exceed 108° F.
- H_2S– must not exceed 80 ppm dissolved when 713 is introduced.
- Toxic conditions– which adversely affect the naturally present biomass will do the same to 713.

A biological process takes time. 713 populations must build to equal the problem. PERSNICKETY® 713 is not an instant answer, but once established (approximately 10 days), it serves remarkably well.

Inoculation techniques and rates

The application of PERSNICKETY® 713 is straightforward— batch dose 2 times per day, either manually or by metered pump, at a point which provides maximum dispersion. All members of 713 will metabolize and reproduce. However, it is important to recognize that the normally present bacteria have an ecological advantage over those introduced. PERSNICKETY® 713 can never dominate a system. Without repeated inoculations, the 713 populations will be overwhelmed and will eventually disappear. Table 1 details required rates of inoculation. The task is to build and maintain populations of PERSNICKETY® 713 in sufficient numbers to keep up with the amount of H_2S produced. Potential for H_2S production is governed by favorable conditions for its production and the amount of food available for conversion. The figures on the next page are good starting guidelines. Once H_2S is firmly controlled, it may be possible to reduce inoculation levels slowly and incrementally to determine minimum amounts.

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Important

- For the first 10 days of inoculation, triple the recommended rates.
- If a system is killed by toxic shock, start over.
- If organically shocked, triple rates until recovery is complete.
- If H_2S control is only partial or sporadic, increase incrementally until control is firm.
- If wastes are known to be rich in sulfur compounds, double recommended rates.

TABLE 1.

RECOMMENDED DAILY INOCULATION RATES		
BOD STRENGTH IN MG/L	* 713 PPM : FLOW/VOLUME	
<100	1	2
100-299	2	2
300-499	4	3
500-699	6	4
700-999	8	5
1-2000	10	6
2-3000	20	7
3-4000	30	8
4-5000	40	9
5-6000	50	10
6-7000	60	11
7-8000	70	12
8-9000	80	13
9-10000	90	14
> 10,000 – consult your sales representative.		
* When treating problematic ponds or lagoons receiving no flow, read Volume column only. For those receiving Flow, add both Flow and Volume columns and use this level until H_2S has been reduced to desired level. Then treat using Flow column only.		

Measuring Results

Your nose will tell you of your success, but it will not quantify reductions in H_2S. Quantification can be accomplished using Standard Methods testing. Both the iodometric and methylene blue methods can suffer from interfering substances. It is vital to pretreat samples (Standard Methods 427 B. “Sample Pretreatment to Remove Interfering Substances or to Concentrate the Sulfide”) for accurate results. Another, and very simple way to measure dissolved sulfide, is to use sulfide ion analyzer tubes. They will provide a reading in less than two minutes, and are very useful field tools. They will not provide the precise accuracy of Standard Methods testing. The importance of measuring reductions is two-fold. Firstly, reductions can be demonstrated to those concerned. As importantly, the measurements will allow you to optimize inoculation rates – i.e.

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if readings begin to creep up, increase; if control is steady and firm a decrease may be possible. (Bench Testing– It is very difficult, if not impossible, to obtain results in laboratory studies which can be projected to a full-scale, dynamic system. In a small, confined culture, minute shifts in conditions can rapidly occur, affecting the entire colony, greatly favoring one species and skewing results. Conditions such as oxygen levels, anaerobiosis, carbon dioxide, pH, vitamins, amino acids, iron-chelating compounds, unsaturated fatty acids, nucleic acid bases, inorganic ions, trace elements, temperature, exoenzymes and many more are tremendously influential. Truly, with such complexities present, the only process known for determining the efficacy of a biological product is a full-scale field application.)

PHYSICAL AND SAFETY DATA	
General Description – Strict and facultative anaerobes in a liquid medium. Gram-negative. Cell shape varies from spherical to rod shaped to vibrio and spiral shaped. Individual cell size from .3 microns to over 6 microns. Color of cell suspensions from purple-violet, purple, red, orange-brown to brown. Multiplication normally achieved through binary fission although some members have a polar type cell growth and multiply by budding.	
Key Characteristics – Motile via polar flagella. Some members exhibit excellent growth at low (4°C) temperatures. Growth over 6.0 – 9.0 pH. Growth possible using sulfide as sole electron donor. Will utilize molecular hydrogen or organic compounds as the electron donor in the absence of hydrogen sulfide/	
Weight per Gallon Weight per Liter	8.34 lbs 2.2 lbs.
Specific Gravity @ 77° F Specific Gravity @ 25° C	1.0 1.0
Boiling Point ° F Boiling Point ° C	208° 98°
Flash Point ° F Flash Point ° C	> 200° > 93.3°
Odor	Slight H_2S odor
Color	Clear to light gray
Toxicity	Non-toxic, non-hazardous. Good housekeeping procedures and general principles of safety should be observed.
First Aid	Skin contact – in cases of prolonged skin contact, wash off with soap and water. If any irritation exists, seek medical advice. Eye contact – wash eyes with lots of water for at least 10 minutes and seek medical advice.

Packaging	55 U.S. gallon drums, bulk
Shelf Life	36 months or more in proper storage conditions.
Storage	Protect from freezing. Do not store in temperatures above 108° F, 42 ° C, nor in direct sunlight.

