Ecological Laboratories INC.
Solving Environmental Problems Naturally Since 1976

Product Application Guidelines for Microbe-Lift®

"NATURAL SOLUTIONS TO ENVIRONEMENTAL PROBLEMS"

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Microbe-Lift® Application Manual

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Bioremediation and Waste Management

CHAPTER 1

Many environmental systems such as polluted rivers and lakes and wastewater treatment systems facing many kinds of chronic problems without easy solutions. Examples of such problems are:

- Rivers and lakes with sever eutrophication and thick layer of organic bottom sludge;
- Non-performing municipal and industrial wastewater treatment systems caused by:
  - Undersized capacity due to high flow rate and/or organic overloading
  - Poor floc formation and poor clarifier settle-ability
  - Poor removal of specific degradable organics such as FOG, proteins, phenol, benzene etc.
  - Poor nitrification process
  - Excessive sludge disposal
  - Bad odor
  - System instability
  - Periodic shock loading and toxic upsets
  - Effluent cannot meet discharge standards, etc.

These deficiencies particularly in wastewater treatment system can involve hydraulic or solid retention times, reactor size, oxygen transfer, mixing, clarification, pump capacities and others. These items and their management, largely define the capacities of an indigenous biomass to degrade a particular wastewater.

As much as 70% of bioremediation is classified as “biostimulation”. This “classic” approach to bioremediation amounts to the controlled delivery of oxygen and nutrients, such as nitrogen and phosphorous, into wastewater treatment system, soil or groundwater. Manipulation of other environmental factors such as pH, temperature and site permeability is usually also involved. This approach stimulates growth of the indigenous microbial population has limited capability in improving overall system performance.

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Bioaugmentation, the addition of **Microbe-Lift®** consortium of specifically formulated microorganisms to the biomass of a wastewater treatment system, open water bodies or polluted lakes and rivers can dramatically improve results where biostimulation alone has proven inadequate or ineffective.

Bioaugmentation involves two phases of culture addition as follows:

1. An initial high seeding dosage typically first 7 to 21 days of treatment. An elevated dosing supplies the plant with a relatively high inoculum that will partially compensate for the lag phase that is seen in all bacteria growth;

2. Follow by a continuous very low maintenance application. The maintenance phase is designed to sustain the benefits of selectively adapted culture addition once the seed has been established.

Microbe-Lift® bioaugmentation has more than 40 years of field applications and often managed to partially and sometimes completely reduce the mechanical limitation with regards to treatment objectives. **Microbe-Lift®** bioaugmentation helps to achieve system performance often with very minimum or no system equipment upgrading. The value lies in potential saving on capital expenditure as compare to conventional approach to solving the non-performance problem.

Chronic problems, such as toxicity and poor removal of “non-biodegradable” or recalcitrant compounds occurs because the indigenous biomass simply does not have the required degradation ability. This is a biological problem. Toxic compounds often inhibit or destroy a portion of the cellular metabolic machinery, “non-biodegradable” and recalcitrant compounds often contain little food value, are overlooked in favor of energy-rich foods.

Continuous addition of a maintenance dose of **Microbe-Lift®** consortium of bacteria cultures that are targeted towards specific organic can establish and maintain the desired degradative ability in the biomass. These abilities already developed in our culture, are strongly expressed during production by exposing the culture to high levels of the targeted compounds. However, unless the system environment continues to select for these specific abilities, the bacteria can revert to simpler food sources. In other words, their degradative capabilities are not “locked” into a specific compound. It is also true that the grow rates of bacteria strains that degrade “non-biodegradable” or recalcitrant compounds are often low, resulting in their being washed out of the system unless regular replacement occurs.

Periodic problems, such as shock loads, variable loadings, spills and toxic upsets can simply overwhelm an indigenous biomass, causing instability in effluent quality. This is a fact of life for a majority of industrial plants, whose waste streams vary with season, plant spills, raw material availability, new process start-up, expansion of business, and so on.

The proper application of **Microbe-Lift®** bioaugmentation technology, including continuous maintenance dosing, almost invariably increases plant stability by imparting characteristics of the

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biomass that allow it to respond much more rapidly to loading fluctuations, significantly reducing effluent variability except under the most severe upset conditions. In the event of a severe upset (pH<2.0 or sudden influent of toxic chemical in the influent of example), the system recovered in a significantly shorter time compare to without our bioaugmentation.

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CHAPTER 2

Products Used in Microbe-Lift® Industrial Applications

The Dosing Program recommended by this guide are based on over 25 years of applications experience worldwide from our international distributors and customers throughout the world. Note however that the effective dose for a particular plant may differ from those found in these tables. Site-specific experience will often determine the most cost-effective dose. Consult our worldwide distributors for specific dosing recommendation. The dosing charts apply to the following dry and liquid **Microbe-Lift®** products:

- **Microbe-Lift® IND**
  A highly active liquid culture consortium designed specifically for use in practically all environmental applications. **Microbe-Lift® IND** select cultures promote increase biological degradation capabilities in all types of designs of biological wastewater systems, open lagoon and polluted environments. **Microbe-Lift® IND** consortium is very effective in degrading hard to degrade compounds such as fatty acids, various chemical compounds, hydrocarbons and fibrous matters that indigenous bacteria often unable to degrade them, hence result in system performance deficiency;

- **Microbe-Lift® HOG**
  A highly active liquid consortium designed specifically for pig manure treatment;

- **Microbe-Lift® Aqua-C**
  A highly active liquid consortium designed specifically for commercial aquaculture farm water treatment. **Microbe-Lift® AquaC** consortium is very effective in degrading the excess high protein feed in the aquaculture pond/tanks. **Microbe-Lift® AquaC** has the unique unmatch capability in controlling the accumulation of bottom sludge, a layer that is often very detrimental to commercial aquaculture farming. **Microbe-Lift® AquaC**'s strength in degrading the protein, uneaten feed and fecal matter developed from very high density and high feeding inadvertently also generates much more ammonia compare to using normal spore bacteria. It is highly recommended to use **Microbe-Lift® AquaC** with **Microbe-Lift® AquaN1**, our high concentrate liquid nitrifying bacteria consortium;

- **Microbe-Lift® AquaN1**

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A highly specialized microbial consortium of nitrifying cultures designed specifically to promote, establish and maintain nitrification in commercial aquaculture farming;

- **Microbe-Lift® N1**
  A highly specialized microbial consortium of nitrifying cultures designed specifically to promote, establish and maintain nitrification in adequately designed wastewater treatment facilities;

- **Microbe-Lift® SA**
  A highly active microbial accelerator that is designed specifically to speed the biological oxidation process of slow to degrade organic matters. **Microbe-Lift® SA** has shown to enhance the biological oxidation of slow to degrade organic waste solids by as much as 80% over historical system performance. **Microbe-Lift® SA** is often recommended to use with **Microbe-Lift® IND**;

- **Microbe-Lift® DGTT**
  A liquid consortium that is designed specifically to rapidly degrade Fats, Oil and Grease in wastewater systems, including all forms of grease traps, waste sumps, re-circulation cleaning systems, storage lagoons and wastewater biological systems. **Microbe-Lift® DGTT** is a highly active microbial-based formulation that contains proprietary cultures that are extremely effective in dealing with overload FOG systems;

- **Microbe-Lift® OC**
  A liquid consortium that is designed specifically for the control of gaseous odorous reaction in contained wastewater system and solid waste odor control such as solid dump site, farm manure storage etc.;

- **Microbe-Lift® HYDRO**
  A dry consortium of bacteria culture formulated to be used in conjunction with **Microbe-Lift® IND** for hydrocarbon contamination clean up and hydrocarbon wastewater treatment;

- **Microbe-Lift® PP**
  A dry consortium of bacteria culture formulated to be used in conjunction with **Microbe-Lift® IND** to speed up the biodegradation of pulp and paper waste.

Microbe-Lift® Dosing Program

The below dosing programs serve as a general guide for new users. Bioremediation performance is influenced by many external factors that no one individual can predict the exact outcome of any treatment. Anyone who claims that they can predict the exact outcome of a biological remediation program is NOT telling the truth.

The performance of any wastewater treatment system has to take the followings into consideration:

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a) Regarding the wastewater system design;

b) Retention time;

c) Aeration, level of aeration, or lack of aeration;

d) Nature of the waste stream (must consider the difficulty to degrade) & cBOD/COD level;

e) Number of shifts per day, and days of operation weekly;

f) Flowrate over 24 hours, and the variations in flow;

g) Equalization, primary clarifiers, effluent clarifier, and where the effluent discharge goes to;

h) pH and controls available;

i) The specific problem;

j) Need to meet a target guide line;

k) Acceptable cost.

Consult your local dealers or distributors for specific treatment recommendation.

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CHAPTER 3

Hog Farm Manure Treatments

Microbe-Lift® HOG can be diluted with non-chlorinated water and sprayed over the pens to eliminate bad odors. Dilute 1 parts of **Microbe-Lift® HOG** to 20 parts of water and sprayed generously over the pens and other areas that has possible contamination of manure using back packed sprayer or electric or petrol operated water pump.

Treatment for manure pond can be done by directly pouring of **Microbe-Lift® HOG** at the inlet of the manure pond. Dosing rate is generally based on estimated daily manure volume generated or pond size.

HOG Dosing Based on Pond Sizes

Pond Size		Inoculation (gal. per week)		Maintenance	Total Dosage (gal)	
m^3	gallon	Day 1	Next 4 weeks	Gal. per week	1st month	2nd month
30	8,000	3	1	0.5	7	2
100	27,000	5	1.5	1	11	4
300	80,000	6	2	1.5	14	6
1,000	265,000	8	3	2	20	8
2,000	530,000	12	4	3	30	12
4,000	1,060,000	15	5	4	35	16
>4,000	>1,060,000	*Use proportional amount as per last row*				

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Industrial and Municipal Wastewater Treatments

CHAPTER 4

Two classes of dosing tables are recommended for wastewater treatment system applications as follows:

- General system improvement performance such as lower BOD/COD effluent, improve nitrification, system stability, reduce solid disposal etc.;
- System upset recovery & Plant start-up

Principles of Dosing are:-

- Based on organic loading. That is flow rate and influent COD parameters;
- High dosing rate applied to smaller system flow rate;
- Significantly higher inoculation dosing for system upset recovery and plant start-up as compare to general system improvement applications, however, no difference in maintenance dosing for both types of applications;
- More frequent dosing is recommended for system with very short retention time;
- Separate dosing table for influent COD<1,000 mg/l, COD from 1,000 mg/l to 2,000 mg/l, COD for 2,000 mg/l to 5,000 mg/l and COD higher than 5,000 mg/l are to be used;
- It is assumed that plant with very high COD will have much larger treatment tanks, hence a significant higher maintenance dosing based on daily flow rate is recommended.

Table 1: Stability Related Applications Influent COD < 1,000 mg/l

Daily Flow Rate		Daily Recommended Dosage (gallons)				Monthly Dosage (gallons)	
m^3/day	GPD	Day 1&2	Day 3-7	Day 8-30	>30 days	1st mon	2nd mon
300	80,000	2.0	1.0	0.3	0.2	15.9	6.0
1,000	265,000	4.0	1.8	0.7	0.3	33.1	9.0
2,000	530,000	5.3	2.6	0.8	0.4	42.0	12.0
4,000	1,060,000	8.5	4.2	1.5	0.5	72.5	15.0
10,000	2,650,000	15.9	7.9	2.6	1.1	131.1	33.0
>10,000	>2.6MG	*Use proportional amount as per last row*					

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Table 2: Stability Related Applications Influent COD 1,000 mg/l to 2000 mg/l

Daily Flow Rate		Daily Recommended Dosage (gallons)				Monthly Dosage (gallons)	
m^3/day	GPD	Day 1&2	Day 3-7	Day 8-30	>30 days	1st mon	2nd mon
300	80,000	2.0	1.0	0.4	0.2	18.2	6.0
1,000	265,000	4.0	1.9	0.8	0.4	35.9	12.0
2,000	530,000	5.3	2.8	1.0	0.5	47.6	15.0
4,000	1,060,000	8.5	4.4	1.8	0.6	80.4	18.0
10,000	2,650,000	15.9	8.3	3.2	1.3	146.9	39.0
>10,000	>2.6MG	*Use proportional amount as per last row*					

Table 3: Stability Related Applications Influent COD 2,000 mg/l to 5,000 mg/l

Daily Flow Rate		Daily Recommended Dosage (gallons)				Monthly Dosage (gallons)	
m^3/day	GPD	Day 1&2	Day 3-7	Day 8-30	>30 days	1st mon	2nd mon
300	80,000	2.2	1.0	0.4	0.2	18.6	6.0
1,000	265,000	4.4	2.0	1.0	0.5	41.8	15.0
2,000	530,000	5.8	2.9	1.2	0.6	53.7	18.0
4,000	1,060,000	9.3	4.6	2.1	0.8	89.9	24.0
10,000	2,650,000	17.4	8.7	3.7	1.6	163.4	48.0
>10,000	>2.6MG	*Use proportional amount as per last row*					

Table 4: Stability Related Applications Influent COD > 5,000 mg/l

Daily Flow Rate		Daily Recommended Dosage (gallons)				Monthly Dosage (gallons)	
m^3/day	GPD	Day 1&2	Day 3-7	Day 8-30	>30 days	1st mon	2nd mon
300	80,000	2.4	1.1	0.6	0.3	24.1	9.0
1,000	265,000	4.8	2.1	1.4	0.8	52.3	24.0
2,000	530,000	6.3	3.0	1.7	0.9	66.7	27.0
4,000	1,060,000	10.1	4.9	3.0	1.2	113.7	36.0
10,000	2,650,000	19.0	9.1	5.3	2.3	205.4	69.0
>10,000	>2.6MG	*Use proportional amount as per last row*					

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Note:

1. The tables give the approximate dosage guide for general wastewater system improvement application. Dosages recommended are for **Microbe-Lift® IND** to be added to the influent of the system or aeration tank;
2. For new start up and upset recovery, use three times the recommended dosing for day 1-2 and 2 times the recommended dosing for day 3-7;
3. Determine the daily flow rate and influent COD value, then select the appropriate table and row to read the dosing. Example, daily flow rate is 3,000 m^3/day and COD is 2,500 mg/l. Choose Table 3 and read the dosing for row for 4,000 m^3/day, take the recommended dosing x 3,000 / 4,000;
4. For plant with HRT longer than 48 hours, maintenance dosing may be done every few days by consolidating they daily total for single dose;
5. If equalization tank is present, 10% of the dosing may be done at the equalization tank;
6. For system with separate aeration tanks follow by anaerobic tanks, add 30% of the dosing at the anaerobic tanks;
7. If sludge elimination is the main objective of treatment, add 20 to 30% **Microbe-Lift® SA** in each dosing;
8. **Microbe-Lift® N1** based on equal same dosing may be added to plants that need improve nitrification;
9. For pulp and paper wastewater treatment, you may add **Microbe-Lift® PP** (1 lb if dry products for every gallon of recommended dosing in the table) in addition to **Microbe-Lift® IND** and **Microbe-Lift® SA** treatment;
10. For plant with multiple series of tanks, first week dosing can be done on all tanks. Maintenance dosing can be done at the influent location only;
11. For more complex system, consult our local distributor.

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CHAPTER 5

Grease Traps

Grease traps are basically holding tanks with baffles which allow oil & grease in a usually warm or hot liquid waste stream to cool off, coalesce and float to the surface of the trap where the baffle keeps it from existing the system. In this way, the grease trap reduces the organic loading to the wastewater treatment system.

Indigenous bacteria degrade the oil & grease that accumulate in the grease trap while new oil & grease are being built up. The speed of new oil & grease build up often exceed the natural biological degradation. The excess floating oil & grease requires regular pumping for disposal. **Microbe-Lift® DGTT** remediation of grease trap helps to speed up the speed of oil & grease degradation and eliminate bad odors particularly during pumping of excess oil & grease.

Grease traps are generally designed with a minimum of one hour hydraulic retention time during the peak flow. Dosing rate is based on grease trap size, however, should peak flow rate per hour higher than the grease trap size, dosing should be based on the peak flow rate volume. **Microbe-Lift® DGTT** is recommended for grease trap treatment.

Tank size or peak flow rate	Week 1 (inoculation)	Week 2, 3 and 4	Maintenance
<5m^3 (<1,500 gallon)	One (1) gallon	One (1) quart per week	One (1) quart per month
5 to 20 m^3 (1,500 to 5,000 gallon)	Two (2) gallon	Two (2) quart per week	Two (2) quart per month
More than 20m^3 (>5,000 gallon)	One (1) gallon per 10 m^3	1 quart per week per every 10m^3	1 quart per month per every 10m^3

Note:

It is best to dose immediately after shut down of the day's operation when flow is low. If a period of very low flow is unavailable, continuous dosing via a dosing pump or a simple drip system may be used. For grease traps with very high oil content, equal amounts of **Microbe-Lift® IND** may be added to increase performance.

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Septic Systems

CHAPTER 6

Septic systems are on-site waste treatment systems for household and facilities that do not have access to a public sewer system. Septic tanks are generally designed for very low flow system and long hydraulic retention time. Over time, a layer of bottom sludge builds up as while as floating scum at the top. Both bottom settle sludge and floating scum reduced the effective hydraulic retention time of the septic tank. This result in the septic system unable to degrade the waste to meet discharge standards. Bad odor often emanated from such poorly maintained septic system effluent.

Simple dosing of **Microbe-Lift® IND** into the septic system via the inlet flow such as kitchen basic or toilet flushing system helps to reduce the bottom sludge and floating scum layer and improve overall biodegradation of the waste, improve effluent water quality and elimination of bad odor.

Dosing is based on septic tank size.

Tank size or peak flow rate	Week 1 (inoculation)	Week 2, 3 and 4	Maintenance
<5m^3 (<1,500 gallon)	One (1) gallon	One (1) quart per week	One (1) quart per month
5 to 20 m^3 (1,500 to 5,000 gallon)	Two (2) gallon	Two (2) quart per week	Two (2) quart per month
More than 20m^3 (>5,000 gallon)	One (1) gallon per 10 m^3	1 quart per week per every 10m^3	1 quart per month per every 10m^3

Maintenance dosing can be extended to 3 to 6 months for small septic tank build for single household where volume of sewerage discharge is very low.

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CHAPTER 7

Polluted Lakes and Lagoons

Lake or large lagoon system associated with very long hydraulic retention time with very low organic waste in the water such as polishing ponds required much lower maintenance dosing compare to farm manure pond treatment. The objective of such treatment more often is to achieve biodegradation of the thick layer of accumulated bottom sludge over a long period of time.

Microbe-Lift® IND is generally recommended for such treatment.

Dosing recommendations are as follows:

Pond Size		Inoculation (gal. per week)		Maintenance	Total Dosage (gal)	
m^3	gallon	Day 1	Next 4 weeks	Gal. per week	1st month	2nd month
30	8,000	3	1	0.5	7	1
100	27,000	4	1	1	8	2
300	80,000	5	1.5	1.5	11	3
1,000	265,000	6	2	2	14	4
2,000	530,000	10	3	3	22	6
4,000	1,060,000	12	4	4	28	8
>4,000	>1,060,000	*Use proportional amount as per last row*				

20 to 50% of **Microbe-Lift® SA** may be added to speed up the organic solid degradation.

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Highly polluted single pass through open series connected lagoons such as POME waste

In remote location where large land space is easily available such as palm oil mill effluent treatment, a series of very large facultative open lagoon system is often used. Influent waste can have COD exceeding 10,000 mg/l and total hydraulic retention time exceeding 6 months.

Upstream sets of lagoon are often covered with a thick layer of floating scum. It is also expected that there will be a thick layer of bottom sludge accumulated over time for most cases. The top and bottom sludge reduces the effective hydraulic retention time, therefore reducing the biodegradation capacity of the indigenous microorganisms.

Microbe-Lift® bioremediation with **Microbe-Lift® IND** and **Microbe-Lift® SA** helps to reduce the top and bottom sludge layer, thereby restoring back the lost effective pond volume. **Microbe-Lift®** microbes also speed up the bioremediation of hard to degrade waste, hence achieving a reduction for effluent water discharge parameters.

Dosing for such lagoon system is based on pond volume as follows:

Pond Size		Inoculation (gal. per week)		Maintenance	Total Dosage (gal)	
m^3	gallon	Day 1	Next 4 weeks	Gal. per week	1st month	2nd month
1,000	265,000	8	3	2	20	8
2,000	530,000	14	5	3	34	12
4,000	1,060,000	20	7	4	48	16
10,000	2.65M	40	15	8	100	32
>10,000	>2.65M	*Use proportional amount as per last row*				

20 to 50% of **Microbe-Lift® SA** may be added to achieve faster sludge degradation.

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Biogas Digester

CHAPTER 8

Hog farm manure and municipal and industrial wastewater primary and secondary clarifier sludge with high carbogenous content are often treated with a biogas anaerobic digester to generate biogas for power generation or heating use. Typical 2,000 sow farm normally use a simple covered anaerobic lagoon of 5,000 to 10,000 cu. m size to generate biogas. The same size digester can used for 5,000 to 10,000 pig farm.

Typical pig manure biogas digester

Typical industrial wastewater digester

Microbe-Lift® IND contains methanogenic archaea that improves the production of biogas by 30% to 50% easily after 3 months of treatment. It is important to maintain pH of 6.8 to 7.2 for effective functioning of any biogas digester.

The digester is fully enclosed and inaccessible for inoculation and maintenance dosing. Dosing of **Microbe-Lift® IND** has to be done at the inlet of the manure or sludge. Pig manure biogas digester dosing recommendation is based on number of sow or pigs. Based on a 2,000 sow or 5,000 pig farm, 1 gallon per day should be dosed at the inlet for first 14 days, follow by 1 gallon every alternate day for the next 14 days. This high inoculation is to help speed up the microbial seeding inside the digester. Maintenance will be 1 gallon twice per week thereafter. For pig farm of different size, use proportional quantity for the dosing.

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For industrial wastewater sludge biogas anaerobic digester, dosing is recommended based on average daily sludge volume flow into the digester.

Dosing for Industrial Wastewater Sludge Biogas Anaerobic Digester

Daily Flow Rate		Daily Recommended Dosage (gallons)				Total Dosage (gal)	
m^3/day	GPD	Day 1&2	Day 3-7	Day 8-30	>30 days	1st mon	2nd mon
300	80,000	4.4	2.1	1.1	0.7	44.6	21.0
1,000	265,000	8.7	4.1	2.4	1.5	93.1	45.0
2,000	530,000	11.6	5.8	3.0	1.9	121.2	57.0
4,000	1,060,000	18.6	9.3	5.2	2.4	203.3	72.0
10,000	2,650,000	34.9	17.4	9.2	4.8	368.4	144.0
>10,000	>2.6MG	*Use proportional amount as per last row*					

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CHAPTER 9

Composting

The general goal for composting is to get the pile to ideal temperature of 60°C to 75°C (140°F to 175°F) which then leads to volume reduction as the organics degrade and gas-off, leaving the hard to degrade carbons and nutrients namely nitrogen, phosphate and other micros)… eventually reaching the stage of stabilization.

System effectiveness is measured in three manners:

a. The speed to achieve ideal temperature;
b. Shortening the duration for volume reduction;
c. The quality of the stabilized material fertilizer.

1. Heap Method

By just piling leaves and grasses. This is a slow method that can take many months to a year and the reaction would end up with a slimy, moist gooey mess due to lack of aeration.

Therefore, it is a common practice to bulk-up the pile with coarse material like wood chips to allow air circulation.

Microbe-Lift® IND should be sprayed on the pile as it is created and churned periodically in order to get more even distribution.

Microbe-Lift® IND should reduce the time for composting by 35 to 50%.

2. In Vessel Method

Like a bio-reactor, the compost is tumbled into a container, or more periodically moved from one container to another. This mixes the compost, aerates and allows for settling. Compost can be generated in a month.

Microbe-Lift® IND can be applied when the compost is being moved or agitated. **Microbe-Lift® IND** should reduce the time for composting by 20-25%.

3. Wind Rows Method

Using tractor-like machines, the compost is chopped and mixed as the machine moves over the compost, leaving piled rows. The compost is usually turned periodically, allowing reaction similar to in Vessel Method.

Wind Rows Method takes 45 to 90 days normally.

Microbe-Lift® IND can be applied through the sprayer attachment to the rows as they are being formed.

Microbe-Lift® IND should reduce the time for composting by 30 to 40%,

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Dosage Recommendation

Dilute **Microbe-Lift® IND** with water at 1:50 ratio for heavy application and 1:100 ratio on the lighter side. About 2 to 4 litre of solution is needed for 1 m^3 of compost. Approx 1~2 gallon per 100 tons of raw material per application. Spray the solution evenly to the compost mix once every one to two weeks.

Benefits

Compost contains high levels of nutrients which are not readily bio-available. As **Microbe-Lift® IND** breaks down the compounds in compost, they convert the nutrients in these compounds to more usable forms. The bacteria will absorb some of the nutrients as part of their own requirements. The plants in **Microbe-Lift® IND** compost treated plot are healthier, less susceptible to disease and pest, have faster growth rate and higher yield per acreage when compared with control.

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Aquaculture Farm Water Treatment

CHAPTER 10

Products

The suggested pond water enhancement biological treatments technologies will consist of:

Microbe-Lift® AquaC, Microbe-Lift® AquaSA and Microbe-Lift® AquaN1

- **Microbe-Lift® AquaC** consists of a select consortium of vegetative waste degrading microorganism to include important classifications of various Heterotrophs, Phototrophs, Autotrophs and Chemotrophs in a complex bio formulation ideal for water enhancement. This novel bio technology offers the capability to degrade a far wide range of slow to degrade and difficult to degrade organic matter to include; slow to degrade; fat, protein, and fatty acids. These slow to degrade compounds are not normally degraded by indigenous bacteria within the ecosystem, so they build up to contribute to declining water quality and pollutants.
- **Unique Benefit** -This novel technology also has the capability to achieve nitrate reduction through a biological process known as denitrification, there by achieving a reduction in toxic nitrate. Denitrification occurs within the ponds bottom muck layer, within the anaerobic zone, in a process termed anoxic respiration, this unique function assists in the removal of nitrate, increases bottom solids reduction due to the increase respiration rate associated with anoxic respiration, through the products anoxic denitrification function and pathways. This unique biological process also reduces hydrogen sulfide generation by blocking the anaerobic sulfate pathway, thereby reducing the production of toxic hydrogen sulfide gas, and contributes to improved bottom solids removal.
- **Microbe-Lift® AquaC** enhances water quality by removing a wider range of organic matter, improves nitrification (drives nitrification) by removing suppress organic compounds that can block nitrification, and has the capability to achieve nitrate reduction via denitrification.
- It is noteworthy that indigenous microorganisms and most competitive products, fail to degrade fat, protein, and fatty acids, and they lack the capability to achieve denitrification.
- **Microbe-Lift® AquaSA** is a natural highly bio active soil derived science, designed specifically as a bio stimulant to increase the biological availability of difficult substrate to microbial enzymatic breakdown and oxidation reduction. When combined and used with **Microbe-Lift® AquaC**, **Microbe-Lift® AquaSA** can improve the biological oxidation

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reduction of bottom solids by as much as 30 to 70%, depending on the nature of the waste. These two combined biotechnologies have shown to effectively control, reduce and eliminate bottom solids.

- **Microbe-Lift® AquaN1**– Is a consortium of two specific microorganism: Nitrobacteria sp and Nitrosomonas sp designed for use in the enhancement or achieving nitrification. While the nitrification process normally follows waste biological conversion, heavily loaded organic wastewater processes and those containing a high level of nitrogen baring compounds often require microbial augmentation with nitrifying cultures to assure the nitrification process matches the ammonia conversion and loading to the aquatic environment.

- **Monitoring Requirements**

  Due to the capability of **Microbe-Lift®** technologies to degrade a wider range of slow to degrade waste matter for improved water quality, with the breakdown and removal of difficult nitrogen barring compounds such as protein, there is a requirement to manage the nitrification process closely, assuring proper pH ranges and carbonate levels at all time during the grow cycle, and especially as the shrimp grow and the feed rate is increased, this due to the fact that the biological break down and conversion of these nitrogen containing compounds will result in an increase their conversion to ammonia.

  Microbe-Lift® AquaC heterotrophic organisms will be sufficient to control most to all of the organic waste generate within the ecosystem, however in the rare case the nitrification process can't match the increased ammonia loading due to their slow growth, the addition of **Microbe-Lift® AquaN1** Nitrifying cultures are suggested should ammonia levels exceed standard monitoring levels.

  Microbe-Lift® AquaN1 consists of high concentration of autotrophic nitrifying bacteria designed for use when ammonia levels exceed 0.75 ppm or higher. Nitrifying bacteria are slow growing bacteria, hence a high inoculation dosage is recommended prior to stocking of post larva shrimp, or at any time ammonia level start to increase.

  Different dosing are recommended for different types of breeding as follows:-

A) Open mud pond with hardy fish – pangasius and tilapia

Pond Volume	Product (gallon)	Wk 1	Wk 2	Wk 3-7	>Wk 8	20 Wk Total
1 acre x 1.2m (4,800 m^3 or 1.3M gallon)	Aqua-C	2.3	1.5	0.6	0.9	**18.5**
	Aqua-SA			0.4	0.8	**12.4**
	Aqua-N1	1.5	2.3	0.4	0.8	**16.2**
1 ha x 1.2m (12,000 m^3 or	Aqua-C	6	3.8	1.5	2.3	**47.2**
	Aqua-SA			1	2	**31**

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3.3M gallon)	Aqua-N1	4	6	1	2	**41**

B) Open mud pond with shrimp culture

Pond Volume	Product (gallon)	Wk 1	Wk 2	Wk 3-7	>Wk 8	20 Wk Total
1 acre x 1.2m (4,800 m^3 or 1.3M gallon)	Aqua-C	3	2	0.8	1.2	**24.6**
	Aqua-SA			0.5	1	**15.6**
	Aqua-N1	2	3	0.5	1	**20.5**
1 ha x 1.2m (12,000 m^3 or 3.3M gallon)	Aqua-C	7.5	5	2	3	**61.5**
	Aqua-SA			1.3	2.5	**39**
	Aqua-N1	5	7.5	1.3	2.5	**51.5**

C) RAS and Bio-floc System

Water Volume	Product	Wk 1	Wk 2	Wk 3-7	>Wk 8	20 Wk Total
Per m^3 water	Aqua-C	20 ml	15 ml	4 ml	6 ml	**133 ml**
	Aqua-SA		8 ml	2 ml	4 ml	**70 ml**
	Aqua-N1	15 ml	11 ml	4 ml	6 ml	**124 ml**
1,000 m^3	Aqua-C	5 gal	4 gal	1 gal	1.5 gal	**33.5 gal**
	Aqua-SA		2 gal	0.5 gal	1 gal	**17.5 gal**
	Aqua-N1	4 gal	3 gal	1 gal	1.5 gal	**31.5 gal**

NOTE:

All Dosing Units in US Gallons (3.785L)

1. **Microbe-Lift® AquaC** and **Microbe-Lift® AquaSA**- core consortium of waste degraders extremely effective in elimination of bottom sludge and maintaining low organic loading in water;
2. Need to monitor and maintain kH level above 100 ppm at all time;
3. Keep pH between 7.0 to 7.5 at all times
4. Increase dosing of **Microbe-Lift® AquaN1** when there are signs of ammonia spikes.

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5. May use **Microbe-Lift®** Dry Ammonia Removal for emergency ammonia reduction.

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Landfill Odor Control

CHAPTER 11

Dump sites are one of the most complicated waste handling sites because they consist of many forms of chemical and organic materials. The solid wastes are left on the dump sites for natural decomposition where mostly anaerobic activity occurs resulting in high levels of ammonia and hydrogen sulfide.

There Are Three Main Method of Odor Control:

1. Using chemical to stop bacterial degradation. If you kill all bacteria in the dump site, you stop biodegradation, there will be no biodegradation, hence no smell. This is a very effective way to control bad smell, but an extremely poor approach to solving your environmental problem. You stop natural biodegradation of the solid waste, hence less compaction and very hamrful to the environment, a method that no environmentalist will accept. Further, the chemical will only have limited effects and need to be repeated very often;
2. Using perfume to mask the bad odor. This is feasible for small scale, but impossible for any large solid dumpsites.
3. The most viable approach to landfill odor control is biological treatment. As stated above, dump site waste is very complex, you need very effective bacteria consortium with very good anaerobic and facultative strains that can work effectively. Biological approach uses beneficial bacteria to help degrade the complex organic matters, in the process, helps to speed up the compaction, increase the holding capacity of the landfill. In the process, more ammonia and hydrogen sulfide are generated due to increase biological degradation. However, **Microbe-Lift®** consortium has both the waste degrader bacteria as well as nitrifying bacteria that convert the ammonia to nitride and nitrate and denitrifying bacteria that convert the nitrate to nitrogen gas and return to the air via the natural nitrogen cycle. **MicrobeLift®** bacteria also has several strains to degrade the sulfite components and eliminate the bad odor from hydrogen sulfide.

In a nutshell, using **Microbe-Lift®** technology to control bad odor at landfill gives you more than just odor control. You get:

a) A very effective bad odor reduction, it is practically not feasible to achieve a completely no odor situation in any landfill. We have experience in Vietnam where the landfill using **Microbe-Lift® OC,** the there is hardly any noticeable odor;

b) Better solid compaction, hence increase landfill capacity;

c) Improve leachate water quality in the drainage canals;

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d) Increase biogas generation if there is such system in place.

Microbe-Lift® IND and **Microbe-Lift® DGTT** are generally recommended for full treatment including improve waste degradation objective. **Microbe-Lift® OC** and **Microbe-Lift® DGTT** are recommended for mainly odor control treatment. For existing waste, 4 weekly treatment only are recommended as follows:

Recommended Dilution for Existing Waste:

	Microbe-Lift® IND/OC	Microbe-Lift® DGTT
1st Application	1:100	1:100
2nd Application	1:100	1:100
3rd Application	1:200	1:200
4th Application	1:200	1:200

Dilute both products to the same non-chlorinated water, spray generously over the existing solid waste at 10 litre per sq. m surface. Use electric or petrol driven pump similar to those used for floor or car washing.

For newly dumped waste, use 1:100 dilution for both products, spray generously as the waste are being dumped at the site. Estimate product usage 3 to 5 gallon each per 100 tons of waste material.

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