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# EM•1

## Why use "good microbes"?

Good microbes hold the key to solving problems whether in your home, garden, or workplace.

## What are good microbes?

Good microbes are naturally existing microorganisms that are beneficial to people, plants, and animals, and are safe if ingested.

You are actually very familiar with the work of good microbes. They are the main actors in fermentation, that is, food-type fermentation, such as, pickling, curdling, baking, and brewing.

EM•1 consists of a combination of good microbes making it easy to use them for many things, including making nutrient-rich soil, growing quality foods abundantly without chemicals, cleaning, controlling odor, and keeping pathogens at bay.

If there was a way to use some powerful tools that exists in nature, this would be it.

## Key to good microbes:

- combination of different groups of dominant microbes
- fermentation which is the microbes main activity
- they prevent pathogens
- they attract other beneficial organisms
- they eat our waste--what we consider pollutants and toxins
- they produce (their waste) what's essential to life (antioxidants, enzymes, organic acids, amino acids, micro-nutrients, vitamins, trace minerals, etc.)
- they make nutrients more available and absorbable (by plants, in our body)

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## Why EM•1?

Well, microorganisms are everywhere! They make life possible. They were the first of all life forms, and we, including plants, animals, and insects have evolved with them.

While we have about 1 trillion human cells, we have 10 trillion microbes on us, inside us, coursing through our veins. They help us to digest, they make nutrients more available for our body, and so on.

We live in a layer of microbes, yet we are unknowingly at war with all of them: by killing the bad bacteria (such as, e. coli) with anti-bacterial products, bleach, chlorine, antibiotics, etc., we are also killing the good microbes.

- What if there was a way of dealing with bad microbes without using chemicals?
- What if we can use the good microbes to restrain the bad ones?
- What if we didn't have to guess or rely on waiting to find discoveries to solve environmental, ecological, agricultural, and such problems?
- What if we didn't have to guess at creating the right conditions to bring the right set of microbes together ? It is a blind effort and one knows not in which microbes are being brought. (compost tea, biodynamics, etc.)?
- What if we didn't have to go out and find all of the right microbes? We know what microbes are in EM•1, so you can, if you wanted to, to take the time, effort, equipment (microscope, culturing equipment, pH and other devices), money, and skills to bring together your own set of microbes.

Or you can just use EM•1 where the effort is done for you of putting together the right microbes plus they are in a stable state in order to have a reasonable shelf-life. There are methods of creating your own microbial mix that are very useful, such as compost tea and biodynamics. However, such methods rely on creating the right conditions with the right ingredients to create a useful product that essentially consists of certain types of microorganisms. Without direct control or influence of the microbes themselves, and without using the right equipment every time, you are leaving it up to chance that the conditions you created and ingredients you're using will produce the right kinds and amounts of microorganisms. You can end up, for example, with a compost tea, that was not good even though you did your best on the conditions and ingredients.

## What is "EM"?

EM stands for Effective Microorganisms. EM represents a group of several different species of microorganisms with the following characteristics:

- Exists naturally
- Non-pathogenic, nontoxic, not engineered, not genetically modified
- Safe for people, plants, beneficial insects and animals
- Safe if ingested (many of the microbes already exist in our bodies and in our foods)
- Coexists with the other microbes in EM and in nature
- Consists of species from mainly three groups: lactic acid bacteria, yeast, and phototrophic bacteria.
- The species selected are considered dominant and can complement the existence and growth of other beneficial microbes not in EM.
- The microbes exist together in a liquid medium of pH between 3.2 and 3.5 (pathogens are known not to be able to survive at these levels)
- The microbes function differently as a group than as individual species.
- For practical purposes, the group of microorganisms in EM is provided in a liquid form as EM•1, also called EM•1 Microbial Inoculant.
- The use of EM•1 and the methods, processes, and applications of it are referred to as EM Technology.
- EM and EM•1 cannot be patented because naturally existing life forms cannot be patented. However, products and formulas that uses EM•1 as an ingredient may be patentable, such as a cleaning product.

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**What is in EM•1?**
EM-1ingredients (U.S. version as of May 2010)
EM-1 is OMRI Listed (Organic Materials Review Institute), omri.org, and can be used by certified organic operations.

**ACTIVE INGREDIENTS:**
Microorganisms: 1 million colony forming units/cc (units/ml), 1%: Lactobacillus plantarum, Lactobacillus casei, Lactobacillus fermentum, Lactobacillus delbrueckii, Bacillus subtilis, Saccharomyces cerevisiae, Rhodopseudomonas palustris.

**INACTIVE INGREDIENTS:**

- 96% Water and 3% Molasses
- **L. plantarum - Lactic Acid Bacteria** - in saliva (first isolated); liquefies gelatin [foods found in: sauerkraut, pickles, brined olives, kimchi, Nigerian ogi, sourdough, cheeses, fermented sausages, stockfish]
- **L. casei** - in human intestine and mouth; known to improve digestion and reduce lactose deficiency and constipation ; complements growth of L. acidophilus [foods found in: cheddar cheese, green olives]
- **L. fermentum** [foods found in: sourdough]
- **L. delbrueckii** [foods found in: yogurt, mozzarella cheese, pizza cheese, Hartkäse, Berg-Alpkäse, Bleu de Bresse, Bleu de Gex, Fourme d'Ambert]
- **Bacillus subtilis** - commonly found in soil; can survive extreme heat; natural fungicidal activity; used in alternative medicine; can convert explosives into harmless compounds; used in safe radionuclide waste; produces amylase enzyme (present in saliva; breaks down starch into sugar) [foods found in: Japanese natto (fermented soy beans), Korean cheonggukjang (fermented soybean paste)]
- **Saccharomyces cerevisiae - Yeast** - brewing and baking, top-fermenting yeast (ale) [in foods: baked breads, coffeecakes, pastries, croissants] [in beverages: beer, wine, mead, cider, vinegar]
- **Rhodopseudomonas palustris - Phototrophic Bacteria** - naturally found in soil and water, a food source for small organisms (zooplanktons, small crustacea); a natural detoxifier; degrades odors in agricultural and industrial waste; stimulates growth of actinomycetes (white mold) which suppresses the growth of pathogenic fungi, improves soil structure, humus formation, helps soil retain water, and breaks down tough plant materials; benefits growth of certain crops and fruits; also found in earthworm droppings, swine waste lagoons, marine coastal sediments, pond water. [foods found in: Swiss cheese]

**EM-1 NOTES:**

- **Phototrophic bacteria,** in general, uses light as an energy source, capable of assimilating carbon dioxide and molecular nitrogen (nitrogen fixation) (denitrification and decarboxylation proceed nearly to completion); a food source for small organisms in water and soil (animal plankton, zooplankton, brine shrimp, fishes: loach, goldfish, carp, ark shell, sweetfish, eels, prawns, etc.--increase in weight, survival rate, decrease in diseases); can deal with the toxic hydrogen sulfide (converts H2S into nonpoisonous sulfur compounds); excretions benefit growth in number of grains per [rice] plant; accelerates the formation of flower buds, the setting and thickening of fruits; accelerates the natural purification of waste water (i.e., lower BOD); in egg-laying poultry: lay eggs earlier, increase yolk index and color, increase in Haugh-Unit Coefficient (eggs maintain freshness better in storage), increase in carotene content, feed efficiency, body weight, weight of total eggs per hen; contain antiviral substances, effectively suppresses Marek's virus diseases; source of nutrition for roots of higher plants; can correct nutritional problems in the soil (such as from damage from continuous cropping of tomato, cucumber, eggplant, etc.); stimulates growth of actinomycetes; improves yield of fruit, elevates sugar level, taste, color and gloss; deodorizes: eliminates substances responsible for offensive odors (acetic acid, propionic acid, butyric acid, iso-butyric acid, valeric acid, iso-valeric acid--present in pig waste; putrescine, cadaverine, hydrogen sulfide, mercaptans); higher effectiveness in light, but also works in the dark; medicine: remedy for myocardial infarction (the ubiquinone in ptb).

- **White mold**: actinomycetes (fungi-type bacteria): antioxidants, prevents pathogens, suppresses growth of pathogenic fungi, improves soil structure, humus formation, help soil retain water; earthy smell of compost; breaks down tough plant materials (bark, woody stems, newspaper)--cellulose, lignin, fibers, chitin).

- **Maggots**: 3 benefits (from medical uses): debridement (eats rotting parts only), secretion kills pathogens, excretion promotes growth of

healthy tissue.

## EM Label Information

Dr. Teruo Higa's Original™ EM•1® Microbial Inoculant

Original Authentic Effective Microorganisms™ Concentrated Soil Conditioner. EM•1® Microbial Inoculant is a naturally fermented live microbial product. EM•1® is a safe alternative to synthetic chemicals that can be used for all plants, soils, cut flowers, fish ponds, composting, and deodorizing that is completely non-toxic and safe for humans, animals, and the planet.

NOT A PLANT FOOD INGREDIENT
White Flakes may appear on the surface and are natural due to live cultures. Some sediment at bottom of bottle is natural.
Made in the USA. Produced by EMRO USA in Tucson, AZ (www.emrousa.com). Distributed Exclusively in the U.S.A. by TeraGanix, Inc. of Alto, TX (www.teraganix.com)

USES:
For all garden & horticultural applications.

DIRECTIONS:
Apply EM•1® with a water can, any type of sprayer, or inject through an irrigation system at the rate of 1 ounce per gallon of water. For best results, apply EM•1® once a week.
For detailed programs and instructions on making Activated EM•1®, please visit us online at www.TeraGanix.com.
Do not store EM•1® in direct sunlight. Store in closed container at room temperature. Do not freeze.

OMRI™ Listed (Organic Materials Review Institute), omri.org - products that are OMRI Listed can be used by certified organic operations.

Sizes available: 1 Quart, 1 Gallon, 5-Gallon, 55-Gallon drum, 275-Gallon tote.

Edited by E. Shig. Matsukawa (GoodMicrobes.org) and Eric Lancaster (TeraGanix.com). Reference: EM Research Organization (EMRO) emro.co.jp (English version: emrojapan.com). TeraGanix (teraganix.com) dba EM America. Made in the USA.

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# Story of EM

- In the **1960's**, Teruo Higa, who became a professor of horticulture, was promoting modern agriculture in Japan, which meant the use of agricultural chemicals.
- He became sick from the chemicals and began searching for a safer and better way to do farming.
- Along the way, Higa focused on microorganisms after learning about others' successes with their use in growing fruits.
- Since he did not want himself and others to get sick again, he studied only naturally existing and safe microorganisms and were mainly of those found in foods and recognized as generally as safe.
- By around **1982**, his discovery was by accident and went something like this. Each microbe he studied in the lab he disposed of into the same liquid container. One time, he had to go on a trip. Since the microbes were safe, he decided to pour the liquid onto a grassy area before leaving. When he came back from his trip, that spot had grown lush compared to the surrounding area. He wanted to make sure that no one else had done anything there and so asked everyone around and looking through his notes, discovered the key to using the microbes: the combination.
- He labeled this combination of different groups of microbes as Effective Microorganisms or EM.
- His mission was to have every farmer see the benefits of using EM as a safer yet effective alternative to the chemicals.
- Although he understood the need for commercial enterprises to produce EM in quantity and quality for farmers, his experience with businesses led him to having to maintain control of the production of EM so that farmers' interests and users' interests held priority over the business or corporate interest. This meant everything from affordability, accessibility, availability, un-compromised ingredients, and so forth.
- He initially wanted to form a foundation to manage and maintain the production know-how, as well as, the research and development in the applications of EM, including the teaching of others in its use. Japan's restrictive approach to foundations meant possible interference and roadblocks to the growth and development in the use of EM.
- So Higa instead helped to establish a regular business entity and called it EM Research Organization, or EMRO.
- EMRO was owned and run by people who understood EM, most of whom were his former students at the university he taught. They also understood the principles of EM which Higa laid out from observing the EM microbes.

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- These principles are in EMRO's mission statement: To build a coexisting and co-prosperous reviving type of society based on safety, convenience, low cost, high quality, quality exchange of information, and sustainability.

**EM Intellectual Property:**

- EM is not patented because naturally existing, living organisms cannot be patented.
- EM is trademarked basically so that users would know that what they are getting is based on Higa through EMRO and EMRO's partners.
- Otherwise, besides the trademarks, the main important intellectual property held by EMRO is the production know-how of EM. Although EMRO openly lists the microbes that are in EM, the know-how is in the production of a stable liquid product with at least six months shelf life where the different groups and species of microbes are cultured, combined, and coupled and are viable when used thus allowing the ability to consistently get results on a wide variety of applications, such as, to be able to ferment all food waste consistently.

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