

## Lesson Sheet 4 — Bokashi and EM

Terminology. bokashi, EM (Effective Microorganisms).

Definition. **bokashi**: fermented organic matter (a generic, Japanese term);

**EM**, Effective Microorganisms: combination of 3 groups of microbes: lactic acid bacteria, yeast, and phototrophic bacteria.

### History of bokashi.

It is not clear when bokashi was first used by farmers. Some say bokashi has been used by farmers since the 1940's while others say that there may be mention of it in the ancient records of around the early Edo period (mid 1600's) in Japan. The practice of making and using some form(s) of fermented organic matter may have also been used in other cultures throughout the world in ancient to recent past (think of silage as one such practice that's still being done today).

In the past, bokashi was made by farmers by collecting several different kinds of organic matter (in which were the main source of the microbes), including mountain soil, or soil and moss from pristine valleys and forests or wooded areas, and some say by placing rice balls under a layer of leaves in the mountain.

The farmers would then mix the collected materials with their post-harvest residue and other plant matter (weeds, leaves, wood particles), and keep them under a covering (e.g., hay) in order for the mix to ferment. From there, there may be various methods to manage the mix in terms of moisture and temperature. After the material has fermented, the farmers would then use it as a soil amendment to add nutrients and organic content matter to their farm. What they may not have known was that it also added beneficial microorganisms to their farm soil.

**Bokashi methods**: bokashi farming (original method), bokashi gardening, bokashi composting, and bokashi bioremediation.

**Different kinds of bokashi (types by application)**: anaerobic bokashi, aerobic bokashi; the use of different ingredients depending on the application type (see Uses of bokashi below).

### Purpose of bokashi:

Microbial inoculant — to introduce microorganisms, improve microbial density and diversity, as a fermentation starter.

Nutrient bioavailability — to help release nutrients already in the soil; to add nutrients in the bokashi material.

Organic matter content — bokashi itself as an organic matter source; help with organic matter buildup from surrounding sources.

### Uses of bokashi:

Soil amendment — various materials can be used to make bokashi based on nutrient needs, aspects of the soil needing improvement, and availability of the materials (generally, local, free or cheap, and abundant).

Soil remediation — applied on its own to soil, or in conjunction with other methods, including Activated EM application(s), and EM mudballs (used for soil and water bioremediation).

Animal feed additive — about 3% – 5% is added to the animal feed as a probiotic.

**Fermentation starter** — ferments organic waste, including yard waste, animal waste, human waste, and **food waste**.

The basic ingredients to make bokashi are: wheat bran\*, water, blackstrap molasses, and EM-1.

\* Other materials can be used instead of, or mixed with wheat bran, including rice bran, coffee chaff, cocoa husk, coconut coir (shredded), leaves, and wood shavings (e.g., walnut, teak, pine, mahogany; but avoid maple and poplar—did not ferment properly).

**Effective Microorganisms, EM, EM-1** (full name in the U.S., “EM•1 Microbial Inoculant” — EM•1 Microbial Inoculant is OMRI Listed)

**Lactic acid bacteria** — from the *Lactobacillus* genus; the same ones found in yogurt, cheese, sauerkraut, etc.

**Yeast** — *Saccharomyces cerevisiae* species; used by bakers and brewers (beer, wine).

**Phototrophic bacteria** (syn. photosynthetic bacteria) — *Rhodospseudomonas palustris* species; a natural detoxifier; found in soils and water, in earthworm castings, hog waste lagoons.

See Microbes in EM-1 for the list of the specific species in EM-1.

These microorganisms are naturally found throughout world, but are not normally found together. The microbes are not only combined in EM-1, but they also form a bond with each other (symbiotic relationship).

Effective Microorganisms was discovered in 1982 by Teruo Higa, professor of agriculture (horticulture) at Meio University; professor emeritus, University of the Ryukyus, both universities are in Okinawa, Japan. Further information: <https://www.emrojapan.com/dr-higa/>

He discovered that if you combine the three groups of microbes (above), that they function differently than when they are just among their own kind. He needed to refer to this grouping by a name, so he called it Effective Microorganisms or EM, and EM-1 refers to the actual liquid containing these three groups of microbes.

With the discovery of EM-1, it became easier to make bokashi and make it consistently. So, the term "EM Bokashi" (or EM-1 Bokashi) is also used and would mean bokashi fermented with EM (EM-1). By the way, bokashi can be made with other cultures of microorganisms. The reason we use of EM-1 to make bokashi includes many reasons, such as, that bokashi was revived and expanded upon in its applications and developed into other areas besides farming, right after the discovery of EM; the phototrophic bacteria in EM-1 is a key part of the effectiveness and development of EM and bokashi applications; and in many other countries, the spread of the use of EM-1 (largely by community volunteers) also helped spread bokashi along with it (making bokashi an important part of using EM-1). The use of EM-1 and bokashi has also helped in awareness and practices in fermentation, homemade probiotics, and environmental restoration by communities.

EM-1 is used to make various kinds of ferments: Activated EM, EM-5 foliar spray, bokashi, fermented drinks (non-alcoholic and alcoholic), fermented foods (in Germany, an edible form of bokashi is made as a probiotic cereal using oats and nuts), etc.