

Beginners Guide to Bokashi

Bokashi Research and Education
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What is bokashi?

Bokashi is a fermented material (solid or liquid) that is used as a microbial inoculant (added to soil or water) and/or as a fermentation starter (e.g., to ferment food waste). There are various bokashi methods and ways to make and apply the bokashi in many different fields (including crop farming, gardening, livestock, water and wastewater treatment, organic waste, and bio-remediating and regenerating nature).

Bokashi and EM•1

Essentially, the bokashi method is about applying microorganisms and organic matter to soil or water. The term bokashi means **fermented organic matter**. The microorganisms used to make bokashi are a combination of microbes called EM (Effective Microorganisms). EM•1 (the liquid solution containing the microbes) is used to ferment organic matter to make bokashi (such as bokashi sprinkle [bokashi bran] and bokashi spray [Activated EM]). For the specific microbes in EM•1, see <https://bokashiresearch.org/education/bokashi-ferments/ingredients/em-1>.

Why Bokashi

The bokashi method improves soil health (including water, waterways, and the environment) by using microorganisms to ferment organic matter (food waste, plant waste), converting it into a microbe-dense biofertilizer and biostimulant.

- Microbes are multiplied by the fermentation process, becoming a probiotic for the soil.
- Microbes produce a wide variety of substances known as metabolites, including enzymes, coenzymes, bacteriocins, amino acids, organic acids, and antioxidants.
- Metabolites feed other microbes, increasing population density and diversity and protecting plants from outside stresses such as excess heat, drought, salts, and heavy metals.
- Metabolites help release nutrients from organic matter and rock particles in the soil, making them bioavailable for plants and other soil organisms (soil microbes, worms, insects).
- The bokashi process takes place at ambient to warm temperatures, which conserve the nutrients and not just the presence of but also the propagation of microorganisms.
- Biofertilizers contain living microbes that increase the availability of nutrients for plant growth.
- Biostimulants stimulate plant growth by enhancing nutrient availability, increasing tolerance against outside stresses, and improving plant quality traits (color, cooking qualities, grain size, mass, nutritional values, odor, plant height, root length, shape, size, texture, and weight).

The Purpose of Bokashi

Primarily

- To increase microbial population and diversity – by inoculation/introduction into an environment and/or by fermentation (culturing microorganisms);
- To make nutrients more available (bioavailability) – by both adding bioavailable nutrients and making nutrients that are inaccessible in the soil/environment bioavailable by microbial activities and their metabolites;
- To increase/replenish organic matter content, by returning organic waste back to the soil/environment (especially if it is taken away elsewhere) and facilitating/expediting its breakdown.

By the situation

- In the case of generally good or not-so-bad soil—to improve soil health; similarly, for soil maintenance, to sustain the soil's viability, and to recharge or replenish the soil with microbes, nutrients, and organic matter.
- In the case of generally poor, dead (sterile), or non-existent soil, rebuilding the soil, including regenerating soil (i.e., adding/increasing organic content, microbes, and nutrients).
- In the case of polluted/contaminated soil and water, to bioremediate them. See the "Microbes in EM•1" on the website for the species and then further research their environmental applications (e.g., the use of *Rhodopseudomonas palustris* as a natural detoxifier).

How is bokashi used?

Direct application (with one fermentation step)

After harvesting, the plant residue is fermented in piles and then applied back to the field to recharge the soil with microbes, nutrients, and organic matter. Other direct applications after first fermentation include fermenting nutrient-rich materials (such as a mix of rice bran, fish meal [post-fish oil extracted pulp], and oil cake [post-seed oil extracted pulp]) and then applying it directly to the soil.

In terms of bokashi as a fermentation starter (with two fermentation steps)

Where a material is first fermented (such as wheat bran, coffee chaff, or cocoa husks) and then used as a microbial carrier to ferment another material (such as food waste), the material in the first fermentation does not need to be rich in nutrients. Still, it must be fermentable in order to carry/house the necessary microorganisms to ferment some other material.

By Area of Application

- Agriculture: farming (direct applications to the soil); livestock (adding to the animal's feed).
- Gardening: amend soils in beds, pots, and planters; direct microbial treatments to soils and plants.
- Composting: organic waste, plant waste (post-harvest residue, yard waste, etc.), and food waste.
- Bioremediation: of soils, waters/waterways, and the environment.
- Wastewater: holding tanks, septic systems, and treatment plants.
- Odor management (bokashi liquid spray): dog run, landfill, post-flood putrefaction, etc.

- Cleaning methods (bokashi liquid spray): slow method, relying on microbes to eat away grime, stains, and grease at their pace.

Note on biodigesters: Bokashi can only be used in pre-treating the feedstock (for example, bokashi is used to grow plants/crops that become part of the feedstock) and/or treating/composting the post-bio digested matter; if bokashi is used in the biodigester, it can hamper or prevent the production of methane (that is, inhibit the function and growth of methanogens—the methane-producing archaea).

The bokashi method can recycle food waste back into the soil

With the bokashi method:

- You can recycle all food waste: meat, seafood, bones, dairy, raw, cooked, etc.
- Takes two weeks to ferment the food waste; however, the longer, the better.
- The fermented food waste can be buried in soil or added to a compost pile.

What you need to ferment food waste:

- Airtight container(s).
- Fermentation starter: bokashi sprinkle or bokashi spray.

How to ferment food waste:

- Step 1. Add a thin layer of bokashi sprinkle or spray the bokashi liquid to the bottom of the airtight container.
- Step 2. Cut the food waste into smaller pieces to help fermentation.
- Step 3. Sprinkle or spray bokashi on every handful of food waste added to the airtight container.
- Step 4. Compress the food waste in the container to squeeze out the air.
- Step 5. Keep the container airtight and at room temperature. **DO NOT ALLOW IT TO FREEZE.**

Keep adding food waste until the container is full.

When full, let ferment for at least two weeks or take the food waste to a composting site (unless you have curbside organic waste pickup).

If fermenting your food waste, then start on a second airtight container.

Why treat your food waste with bokashi, especially if you're taking it to a composting site or to be picked up:

- You can collect your food waste in a container in your kitchen at room temperature (instead of keeping it in the refrigerator).
- You can treat all food waste with bokashi.
- It's easier to dispose of expired food and keep your refrigerator clean.

How to use your fermented food waste:

- Bury/trench in soil (yard, garden bed, or landscape).
- In pots/planters, sandwich between soil.
- Feed to a home worm or compost bin.
- Add to your home compost bin/tumbler.

You can do ALL food waste with bokashi because the microbial metabolites (enzymes, coenzymes, bacteriocins, organic acids, antioxidants) naturally preserve food waste, preventing it from rotting.

What is the difference between bokashi and composting?

- Bokashi combines pretreating food waste with microbes to stimulate fermentation (bokashi fermentation = lacto-yeast-photosynthetic fermentation) without heat or turning without adding air. The fermented materials are then added to soil, worm bins, or composted. After fermentation, organic matter, microbes, and microbial metabolites are the end product.
- Compost is an aerobic decomposition of organic matter that generally involves heat and turning to add air. The goal of compost is to produce humus that contains microbes.

How is bokashi made?

Different techniques depend on the type of bokashi, the ingredients, and the scale (small or large applications). Basically,

1. a liquid microbial culture mix (EM•1) is used with a mineral-rich sugar source (blackstrap molasses – to feed the microbes), both at 1% to 5% of the amount of water.
2. When making a solid bokashi (bokashi sprinkle), the liquid mix is added to a dry material such as wheat bran, rice bran, coffee chaff, or shredded organic matter (e.g., coconut coir).
3. The amount of water depends on the material, but generally enough to moisten the material to about 30%.
4. When making a liquid bokashi (bokashi spray), the liquid mix is put in a bottle or container, preferably with an airlock.
5. For both the liquid and solid bokashi, they are fermented for two weeks in an airtight (anaerobic) condition at room temperature (68°F to 80°F).

Bokashi Spray (Activated EM)

How to Make and Use

The bokashi spray can be used to spray on food waste instead of, or in addition to, the bokashi sprinkle (e.g., wheat bran bokashi—<https://bokashiresearch.org/education/bokashi-ferments/recipes/bokashi-bran>).

The bokashi spray liquid is also known as Activated EM (AEM), which is used for various other applications. (<https://bokashiresearch.org/education/bokashi-ferments/recipes/activated-em>)

Table. Differences between bokashi spray (Activated EM) and bokashi sprinkle (wheat bran bokashi):

bokashi spray/Activated EM	bokashi sprinkle (wheat bran version)
In an airtight bottle(s) [3 Liters or 102 fl oz] with an airlock (or regular burping necessary)	in an airtight container [5 gallons]
1. water* [92 fl oz] 2. blackstrap molasses** [5.1 fl oz(1)] 3. EM•1 Microbial Inoculant*** [5.1 fl oz(1)] 4. sea salt‡ [2 tablespoons]	1. water* [12 cups or 96 fl oz] 2. blackstrap molasses** [1 fl oz(2)] 3. EM•1 Microbial Inoculant*** [1 fl oz(2)] 4. wheat bran†† [12 lbs]
Ferment for two weeks at room temperature. 8.5 fl oz (250 ml) per 5-gallon of food waste. For one year, if avg. 5-gal food waste/month, 102 fl oz (3 liters) bokashi spray per year.	Ferment for two weeks at room temperature. 1 lb per 5-gallon of food waste. For one year, if avg. 5-gal food waste/month, 12 lbs bokashi sprinkle per year.

Water: use regular tap water (filtering is unnecessary); warm water can help dissolve the blackstrap molasses more quickly.

** **Blackstrap molasses** (unsulfured): the ingredients on the bottle will say "Blackstrap Molasses"; "unsulfured" means that sulfur was not added as a preservative (which is used if the sugar cane was harvested young, i.e., prematurely, for economic reasons).

*** **EM•1 Microbial Inoculant:** other names include EM•1 Waste Treatment, EM•1 Compost Accelerator, etc.; the maker for North America is EMRO USA (emrousa.com). To prevent EM•1 from spoiling before the Best Used By/Expiration date, decant into a clean wine bottle(s) and use a wine vacuum pump and stopper.

‡ **Sea salt:** any low-cost sea salt is acceptable. While making the standard Activated EM does not require sea salt, adding sea salt (or using seawater for some applications) increases the shelf life for several months to over a year; without sea salt, AEM needs to be used within 45 to 60 days after it's fermented.

†† **Wheat bran:** if possible, use animal feed grade wheat bran from a feed supply store (e.g., Agway); they usually come in 25-lb or 50-lb bags at \$0.65-\$0.80/lb.

(1) 5.1 fl oz or 5% of the total volume of the bottle(s) [3 Liters or 102 fl oz].

(2) 1 fl oz or 1% of the amount of water [12 cups or 96 fl oz] is needed for making wheat bran bokashi; you need 1 cup of water per pound of wheat bran to wet the bran to about 30% moisture.

For further information, see bokashiresearch.org.