

Bokashi

fermentation starter

for recycling food waste

Home Use Instructions

The bokashi* is usually a dry organic material that can be made with different ingredients for different uses. The following is one standard ingredients used to make bokashi (U.S. version).
 Ingredients: Wheat Bran**, Blackstrap Molasses, EM•1 Microbial Inoculant†, Water (ingredients are mixed, fermented and dried). Keep dry. The bokashi can be made at home or garden, or provided by a garden, or it can be purchased ready-to-use.

* For more about bokashi and other uses, see page 5.

** Other organic materials can be used instead of wheat bran to house the microorganisms, including rice bran, dried leaves, dry coffee husk/chaff, dried brewery waste, saw dust/wood shavings (walnut, teak, pine —other kinds of wood may be difficult to properly ferment into bokashi), etc.

† In the U.S., EM•1 Microbial Inoculant or EM•1 Waste Treatment can be used to make bokashi.

The **bokashi method of recycling food waste** is a two-step process of converting all types of food waste back into the soil.

Step 1: "pickle" or ferment the food waste to prepare it for **Step 2:** adding to soil.

The method uses bokashi to sprinkle on food waste in an air-tight container in order so that the food waste will ferment instead of rot.

Note. You do not need to use bokashi if you ferment only fruit and vegetable food scraps. However, it may take time to ferment, and it may not be consistent. By adding bokashi, you can more consistently get the food waste to ferment and to ferment more quickly, and also all food waste can then be recycled, including meats, dairy, bones, etc.

Two weeks to ferment, two weeks in soil, then plant.

Instructions:

Step 1. Pickling Food Waste (airtight container and bokashi)

Use airtight container (any size for your kitchen).

Start by adding a hand full of bokashi at the bottom of empty container.

Each time you add food waste, **sprinkle bokashi** lightly covering it.

Okay to open and close the bucket 3 or more times a day.

Keep lid closed airtight at room temperature.

Optimal ratio is 1:33, 1 lb bokashi can treat about 33 lbs of food waste.

If lots of food waste at once, slowly add food waste while sprinkling bokashi.

Add more bokashi if adding more meat or if adding already spoiling food waste.

Add all food waste, including meats, dairy, bones, sea shells, egg shells, bread, citrus, etc., and especially oils (olive oil, cooking oil), salad dressings and sauces.

Instead of rinsing plate under the faucet, use paper napkin (or utensil) to **wipe sauces and dressing from plate** into your bokashi bucket with the paper napkin (some paper is fine as long as bucket does not become too dry, see page on Tips & Tricks).

Also, add **leftover juices, milk, soda, wine, beer**, etc. Avoid water or adding too much coffee (stick to adding only leftover coffee or tea if it has cream and/or sugar). To balance out the liquid, add used paper napkins, brown paper bag (after tearing some of it up), and non-waxed paper plates.

Press down with a paper plate (which you can leave in there) to make more room and squeeze out some air.

When container is full, allow at least 2 weeks to ferment (“pickle”) at room temperature.

If below room temperature, it will ferment, but more slowly. Prevent freezing or getting too hot (above 120°F, 49°C).

As long as container sits airtight, can leave it fermenting for many months until you are ready to use it.

Step 2. Adding To Soil (Using fermented food waste as a soil amendment)

After 2 weeks (or longer), the fermented food waste (FFW), will still look like food waste.

It may be discolored and soft/mushy, but should smell fermented (vinegary, slight alcohol, etc.)

However, the fermentation process will have prepared the food waste for the next step: adding to soil.

Note. Any alcohol will likely be less than 1%, which evaporates quickly when taken out of the bokashi bucket. Any further production will very likely stop right away since conditions would be changed, especially when mixed in soil.

In the fermentation process, the microbes will release the nutrients from the food waste making them not only available, but also absorbable by the plants [bioavailability]. The microbe-rich bokashi bucket will also produce antioxidants and organic acids (helps preserve the food waste and deal with pathogens), as well as, produce a wide variety of enzymes to help break down the fibers, cellulose, lignin, chitin (what makes sea shells hard), etc.

How To Use The Fermented Food Waste (FFW)

- You can use some of your FFW for your pots and planters at home (see below). Otherwise, you can bring your bokashi bucket to a compost site that will accept it.
- The fermentation will have made the food waste soft making it easy to turn it into a paste by mashing it with a shovel or trowel (3-5 minutes of mashing is enough). This will help the FFW to break down faster (in 2-4 weeks) in the soil. It also helps to mix in soil, leaves, garden clippings, or wood chips/shavings.
- The fermented food waste can be used in many different ways:

- Buried in a pit or trench in yard, garden, etc.; at least 1 foot away from existing plants and 3 feet away from shrubs and trees (avoid close contact with roots); cover with 4-6 inches of soil; can bury deep and add more of your next batch of FFW on top of the previous batch—can do so almost immediately.
 - Sandwiched between soil in pots and planters (or mixed 1 part FFW, 2 parts soil/potting mix, and covered with a couple of inches of soil)
- After burying or mixing in soil, allow 2 weeks before planting. Or allow at least 1 month before digging up to spread amended soil to other areas, for example, where plants already exists, or to nourish areas where burying/trenching is difficult.
- Added to inside a worm bin (vermicompost). Mash into a paste before feeding earthworms.
- Added to inside a compost pile (less turning, may help break down the compost pile quicker).
- Mixed in to a closed vessel, such as an Urban Tumbler. (Will not need to be turned as much, and in cooler seasons, will become a worm composting vessel.)
- If you cannot use your fermented food waste (some or all), then make sure that your local community garden or community compost site will accept it (there may be, or start a local 'home bokashi bucket program,' with a community garden).

Bokashi Tips & Tricks

*The more vegetable scraps and especially fruit scraps mixed in, the better.
The microbes love the leftover sauces and salad dressings. Certain paper also helps.*

Speed of Fermentation

- The ideal temperature for bokashi is between 80°F ~ 100°F (25°C~40°C) —temperatures rounded for simplicity— fermentation can then take place within 7 to 10 days.
- At room temperature, between 60°F ~ 80°F (15°C~25°C), fermentation can take place within 2 weeks.
- The longer the bokashi bucket is let sit (airtight) regardless of whether ideal temperature or room temperature, the more thorough the fermentation. Fermentation will continue until there's no more food for the microbes to digest. Since the bokashi fermentation is a lactic-yeast fermentation, similar to the "pickling" fermentation of pickles, sauerkraut, etc., the food waste is being naturally preserved.
- Harder materials, such as corn husks, bones, avocado pits, etc. may take longer to break down. While two weeks may be sufficient to get these materials exposed to the fermentation process, a longer fermentation process may shorten its break down period when placed in the soil.

Too Dry Bokashi Bucket

- There may not be any smell, or the smell is weak or mild indicating possible slow fermentation.
- May happen if too much dry materials, such as pasta, bread, baked goods, paper, etc.
- Need enough moisture for microbes to be active.

- Start adding liquids that would ordinarily be poured down the sink (cooking oils, spoiling milk, juices, soda, etc.)
- Generally, try to have a balance of wet (fruits, vegetables, sauces) and dry food waste mixed in.

Too Wet Bokashi Bucket

- May happen if too much food waste with lots of water content, such as eggplant, fruits (e.g., watermelon), or if you added too much liquids.
- The more watery and less oily, the more likely the liquid will oxidize (exposure to oxygen) and rot, especially if you can see the liquid pooling near the surface.
 - Oxidation happens on the surface area (both liquid and solid) where it is exposed to the air pocket when bucket lid is closed.
 - Therefore, sometimes when opening a bucket, the first smell may be somewhat foul, but after that initial smelly air clears, the bucket itself should smell fine (vinegary).
- Add dry materials to soak up the liquid, such as stale bread and paper (**used paper napkin, paper plates, paper shopping bags, corrugated cardboard, etc.**)—tear up the paper products; avoid waxy paper products.
- You can also add some oil (olive oil, cooking oil) which will float on the liquid and act as a buffer with the air preventing or delaying the oxidation and therefore smelly circumstance.
- Removing-the-liquid option, either by using a bucket with a spigot or with a cup or pouring it out.
 - The spigot option is recommended for those with experience and/or who wish to take advantage of the fermented food waste juice. The FFW juice can be used as a liquid fertilizer (1:5000 in water; 2-5 drops per quart of water) when watering plants, or to pour down drains and toilets (microbes will clean the pipes). However, a bucket with a spigot also has a separator mesh towards the bottom to separate the liquid from the solid. This creates an air gap at the bottom of the bucket. If liquids aren't remove regularly (usually after the third day of starting the bucket), the air gap can oxidize the exposed liquid and cause a foul smell. The solid part is still good, but the smell may become inconvenient.
 - A better option may be to pour or scoop out the fermented food waste juice. This way, you do not have to keep emptying the liquid (as in the spigot case).
 - If you collect the juice in a bottle (where you can squeeze out the air), you may be able to keep it for several days. If the smell of the juice starts to go bad, use it right away (pour it down the drains and toilet, if you used what you could for your plants at 1:5000, 2-5 drops/quart, dilution rate in water).

Not Enough Food For The Microbes

- To help maintain a better smelling bokashi bucket, add all of your leftover/used salad dressing, oils, sauces, vinegar, gravy, etc. to the bokashi bucket (instead of rinsing them off in your sink). What also helps are leftover drinks (juices, wine, beer, soda, etc.)
 - These are rich in sugars/carbs, salts, minerals, etc. which the microbes love to eat.

What Is Bokashi?

A Japanese term, bokashi means 'fermented organic matter.'

It is used as a fermentation starter or as a microbe and nutrient-rich carrier for various purposes, as well as, for providing organic content matter to the soil.

Uses of Bokashi

Technically, fermented food waste (FFW) can also be referred to as bokashi (fermented organic matter). Below uses of bokashi are of the non-FFW type (the ways to use FFW is in step 2 above).

Used to directly enrich soils (adding microbe-rich, nutrient-rich, organic content matter).

Example ingredients of such direct-use bokashi includes combining rice bran, fish meal and oil cake.

Added to animal feed (1% to 5% or more) as a probiotic supplement.

Added to cat litter (1-2 cups of bokashi) to help reduce odors.

Added to bath water (in a pouch with a ceramic or stone weight) to soften the water.

Treating dog waste (similar to bokashi bucket, but adding about 1-to-1 bokashi to dog poop).

Used in humanure (compost toilet) by adding bokashi instead of, or in addition to, sawdust or other fibrous organic material.

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 it may have been around since during the early Edo period (mid 1600's) in Japan. The practice of making and using some form of fermented organic matter may have also been used in other cultures throughout the world in ancient to recent past.

Bokashi was made by farmers by collecting several different kinds of organic matter (in which were the main source of the microbes), mainly 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 waste materials (cut grass, weeds, and leaves), and keep them under a covering 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.

With the discovery of EM (Effective Microorganisms), it became easier to make bokashi and make it consistently (no question on whether the collected material together comprised enough of a microbial source and diversity for proper fermentation). So the term "EM Bokashi" is also used and would mean bokashi fermented with EM.

EM, Effective Microorganisms, is a combination of naturally existing microbes, mainly lactic acid bacteria, yeast and phototrophic bacteria. The combination made it potent as a microbial inoculant for improving soil microbial health and as a fermentation starter. That combination was discovered by Teruo Higa, professor horticulture, now at Meio University.

The microbes in EM•1

EM-1 ingredients (U.S. version as of May 2010). EM-1 Microbial Inoculant (full name) 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

Lactic Acid Bacteria

L. plantarum - 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)]

Yeast

Saccharomyces cerevisiae - brewing and baking, top-fermenting yeast (ale)

[foods found in: baked breads, coffeecakes, pastries, croissants]

[beverages found in: beer, wine, mead, cider, vinegar]

Phototrophic Bacteria

Rhodopseudomonas palustris - 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]

Making Bokashi

Preparation

- a. Water - 1 cup of water per every pound of wheat bran.

Place water in a large enough bowl or bucket.

Examples for 10 lbs, 25 lbs and 50 lbs.

10 lbs - 10 cups of water (80 fl oz, or 2.5 quarts)

25 lbs - 25 cups of water (200 fl oz, or 6.25 qts, or 1 gal 2 qts 1 cup)

50 lbs - 50 cups of water (400 fl oz, or 12.5 qts, or 3 gal 2 cups)

- b. Measuring cup(s) or measuring spoon size.

Have ready the right size measuring cup or spoon for the molasses and EM-1.

Examples

10 cups of water - 0.8 fl oz (1.6 tablespoon, or 24 mL)

25 cups of water - 2 fl oz (4 tablespoon, or 60 mL)

50 cups of water - 4 fl oz (8 tablespoon, or 118.3 mL)

Mixing

1. Fill mixing tub to about 3/4 full with wheat bran.
2. Mix the liquid ingredients (water, molasses, EM-1):
 - 2a. Add the molasses first. Fully dissolve the molasses in the water.
Use a clean hand or hot water to help dissolve the molasses quickly.
 - 2b. Add the EM-1.
3. Slowly add the liquid mix to the wheat bran (do not add all of the liquid at once — it may be too much depending on pre-moisture content of the wheat bran).
 - 3a. Thoroughly mix the liquid and wheat bran (with clean hands).
 - 3b. Keep adding the liquid while mixing.
Avoid clumping. Look for too dry spots and too wet spots (liquid may go straight to the bottom).
Suggest using a circular pressing motion, as if wiping.
 - 3c. Moisture target of about 30%. Test by squeezing a hand full where it should easily stick into a ball, but easily fall apart when touched. If it drips when squeezed, it is too wet—add more dry wheat bran in this case.
4. Put the mixed wheat bran into an airtight bucket or double-bag in trash bags.
Press down and squeeze out the air as much as possible.
For better anaerobic (less air exposure) conditions, place a plastic sheet or plastic bag over the wheat bran before closing the bucket (not necessary if double-bagging in trash bags).

5. Label the bucket(s) or trash bags as follows:
Bokashi
Fermenting
<Today's date>
Ready: <two weeks after Today's date>
6. Keep the fermenting wheat bran (bokashi) at room temperature, airtight. Keep away from direct sun light.
7. After two weeks, the bokashi is ready to use. The bokashi could be let to continue to ferment for up to about a month before it can go bad.
So, between two to four weeks of fermenting the bran, you can start using it, as is. It will be damp and as long as you store it airtight, the undried fermented bran (the bokashi), should be good for up to a month or so.
 - a. Air dry the bokashi if not using all of the bokashi within 2-4 weeks.
Can use the bokashi as you dry it.

Drying Your Fermented Bran (the bokashi)

To prevent mold (green or black mold) from forming on the damp bokashi, and especially if it will not be all used within a month, then it should be dried.

How To Dry The Bokashi

Spread it out thinly over a flat surface (over a tarp or newspaper or cloth or shallow bins or trays).

- If drying indoors, it can take 2 - 3 days to dry completely (crunchy dry feel). If in close quarters, the smell may be strong for some people. Air flow would be good.
- If drying outdoors, in direct sunlight, dries in less than 3 hours. Otherwise, it will depend on humidity, wind flow and temperature. So, during cooler seasons when not enough sunlight, not too dry air, then it may take more than a day (in which case, make sure to put the not-yet-completely-dry bokashi in a bag or container overnight to prevent any moisture, such as the morning dew, from making it wet again.

Use trays if possible. Even if you spread it out thinly, it will go faster if every now and then you use your fingers to stir it to let it air out and dry faster.

After drying, keep in a bag or container to keep out moisture.

A very well dried bokashi can have a long shelf-life (over a year, and as long as 3 years or longer).

Keep the bokashi dry and away from moisture.

When added to food waste, the moisture in the food waste will help to activate the microbes.

You can use the bokashi as it is drying.