

**bokashi method**  
of fermentation  
using Effective Microorganisms

[recyclefoodwaste.org](http://recyclefoodwaste.org)

# Effective Microorganisms

## EM, EM-1

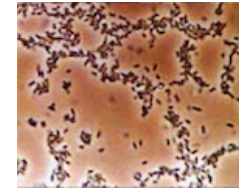
Combination of 3 groups of microbes  
with the dominant species of each group

Microbes function differently  
when combined

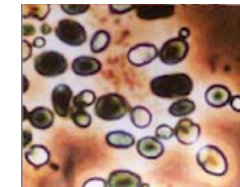
These microbes exist most anywhere,  
but are not normally found together.

When Teruo Higa discovered (1982) how effective  
this combination was, he needed to refer to this grouping  
by a name, so he called it Effective Microorganisms or EM.

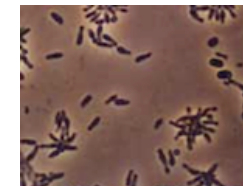
And EM-1 is the actual liquid  
containing these 3 groups of microbes.



**lactic acid bacteria**  
(various *Lactobacillus* spp.)



**yeast**  
(*Saccharomyces cerevisiae*)



**phototrophic bacteria**  
(*Rhodospseudomonas palustris*)

Images: EM Research Organization

# How to make bokashi



**blackstrap molasses**  
1% to water



**EM•1**  
1% to water



**organic material**  
wheat bran



**mix to ~30% moisture**  
(1 cup water/lb)



**pack airtight to ferment**



**after 2 weeks, ready to use**  
"wheat bran bokashi"

*St. Mary's Urban Farm, 521 W 126th St Harlem NY, Nov. 2013*

# Sprinkling the microbes



# Make bokashi

**Wheat bran** — 50 lbs

(on average, 1~2 person household, 12 lb/year)

1st mix these liquids together:

**Water** — 50 cups (3 gallons 2 cups; 12.5 qt)

(1 cup of water per lb of wheat bran)

**Blackstrap molasses** — 1/2 cup (4 fl oz)

(1% of volume of water)

**EM•1** — 1/2 cup (4 fl oz)

(1% of volume of water)

Add the liquid-mix to the wheat bran and mix thoroughly to  
~30% moisture [squeeze test: sticks together, no drip, easily falls apart]

# Other Materials

## A. As microbial host:

*(microbial inoculant, probiotic and/or fermentation starter)*

**bran** (1%\*): wheat bran, rice bran, oat bran, barley bran/barley feed, rye bran/rye feed, millet hulls (*feedipedia.org*)

**organic waste** (5%\*):

coffee chaff (husk shed when roasting raw coffee beans),

cocoa/cacao husk (chocolate factory waste),

coconut coir (shredded),

wood shavings (walnut wood, teak, pine, mahogany; *avoid maple, poplar*),

leaves (thoroughly dried, then crumbled).

## B. As direct bokashi application:

**nutrient-rich** (1%\*): rice bran + fish meal + oil cake

\* 1% or 5%, blackstrap molasses and EM•1 each to the volume of water used.

# Making Activated EM

In a 2 liter soda (PETE) bottle



Video: link at [recyclefoodwaste.org](http://recyclefoodwaste.org) "Making Activated EM (in the garden version)"

# Making the bokashi spray

Mist spray bottle: 16 fl oz clear bottle *(from sks-bottle.com)*



Video: link at [recyclefoodwaste.org](https://recyclefoodwaste.org) "Making bokashi spray"



# Spraying the microbes

Mixture:  $\frac{1}{8}$  blackstrap molasses +  $\frac{3}{8}$  Activated EM +  $\frac{4}{8}$  water



# Spraying the microbes

Spraying using a hose-end sprayer



# uses of EM

## bioremediation

break down of pollutants, chemicals, toxins—they eat our waste and secrete beneficial substances



St. Mary's Urban Farm, West Harlem, NYC

## antioxidants

*anti-rusting,  
anti-corrosion*



Experiment started 9/22/2004  
Photo taken 4/25/2011

## odor control

replace odor-(gases)-producing microbes



Washington Square Park Dog Run, New York NY

# Activated EM ingredients

Fermentation container: **2-Liter** PETE bottle (soda bottle)



Add 2 cups **water**

Add heaping tablespoon of **sea salt**; swirl bottle

Add 5% **blackstrap molasses** 100 ml; swirl bottle

Add 5% **EM-1**, 100 ml; swirl bottle

Add water to 1 inch below neck of the bottle

Squeeze out air when closing cap.

2 weeks to ferment. Room temperature. When pressure (carbonation), release gas.

See video, "Making Activated EM (in the garden)," link at [recyclefoodwaste.org](http://recyclefoodwaste.org)

# uses of bokashi

*bokashi (wheat bran)  
applied directly to soil  
to treat for heavy metals  
St. Mary's Urban Farm  
521 W 126th St Harlem NY*



soil amendment

bioremediate soil

animal feed additive

**fermentation starter**



*Mudball event  
One Million Apologies to Mother Earth Event  
Penang, Malaysia 2009*

# bokashi methods

*ways to use **microbes** in **different areas***

bokashi **composting** (method of recycling food waste)

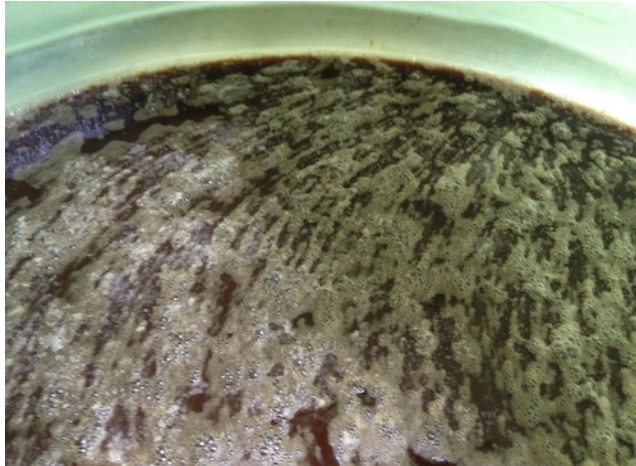
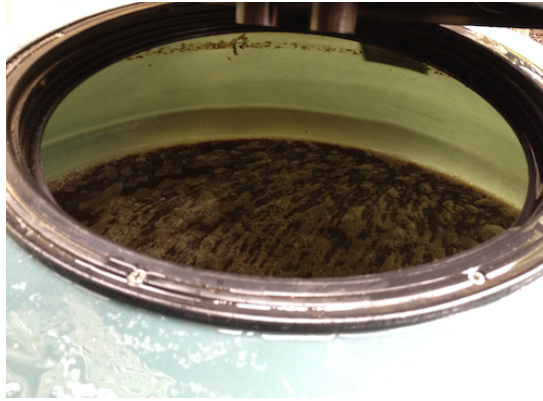
bokashi **gardening** (microbial inoculation/application methods in gardening)

bokashi **farming** (microbial inoculation/application methods in farm applications)

bokashi **bioremediation** (method of remediating soil, water with microbes)

bokashi **probiotics** (method of feeding microbes to animals)

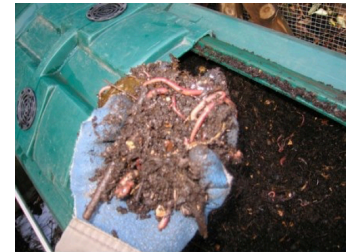
# Activated EM



# bokashi composting

Step 1

ferment food waste



Step 2

as soil amendment

*El Sol Brillante Community Garden  
and the Children's Garden  
East 12th St, Ave A & B  
East Village/Lower East Side  
New York, NY*



## Step 1. 'pickling'

fermenting food waste

**pretreats** (safer =>)

microbial pop. increase

release nutrients

metabolites:

**organic acids** (pH≈3.9)

**amino acids** (protein building block)

**enzymes** (breaks down materials)

**coenzymes, bacteriocins** (anti-pathogens)

**antioxidants** (naturally preserve)

Generally, anti-pathogenic and anti-rotting (preservation)

2 weeks - room temp.

4 weeks - <50°F (if enough mass)

all food waste

(microbial and nutrient diversity)

## Step 2. 'break down'

adding to soil or compost

as a soil amendment

microbial inoculant

organic matter content

bioavailability of more

nutrients:

**diversity** (fat, proteins, carbohydrates, vitamins, minerals)

**macronutrients** (i.e., NPK, Mg, Ca, S)

**micronutrients** (e.g., I, Fe, B, Mn, Zn)

2 weeks - warmer seasons

4 weeks - winter (successive)

90%~99% broken down