

bokashi method

of recycling
food waste

recyclefoodwaste.org

bokashi method

bokashi = fermented organic matter

Ferment organic waste

Direct use of microbes (e.g., EM-1)

Connection with ancient times? (“fermentation farming”)



Making bokashi with students, Apr. 2015

⇒

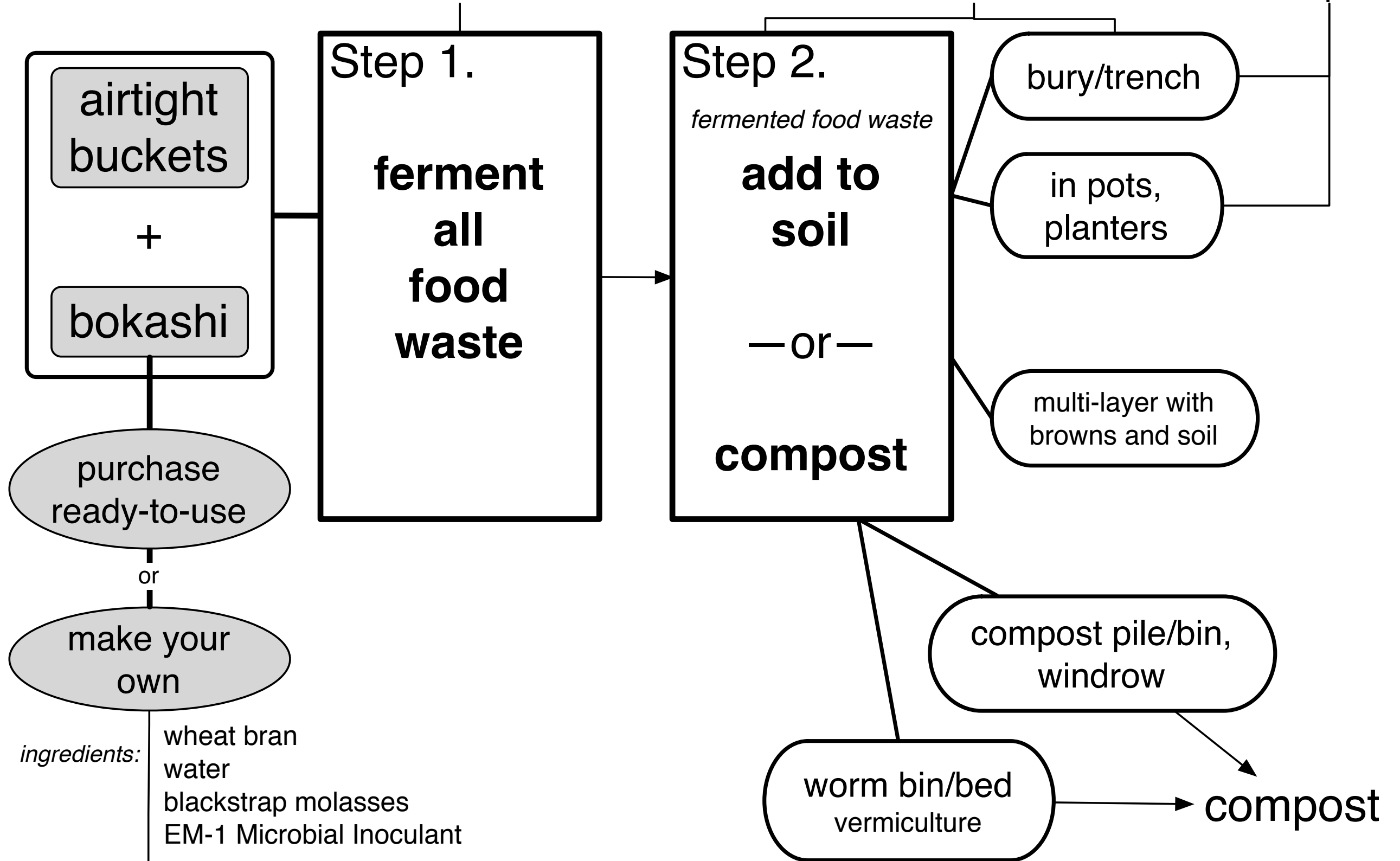
microbe rich

nutrients+metabolites

organic matter content

The bokashi method of recycling food waste

2 weeks to ferment → 2 weeks in soil → then plant.



bokashi method

Step 1.

**Ferment ALL
food waste**

including meats, bones,
dairy, citrus, baked
goods, raw, cooked, etc.

Not compostable plastics (requires high heat
to break bond that keeps them rigid)

*Bokashi usually at ambient temp.
stays under 100°F*

Step 2.

“fermented food waste”
(FFW)

add to soil

as soil amendment

–or–

as greens if composting

bokashi method

Step 1. think in terms of
fermenting foods &
beverages [to eat]

lactic-yeast-phototrophic fermentation

culturing batch of diverse
microbes

diverse **nutrient** source

retains mass (airtight)
[carbon negative]

Step 2. can think in terms of
composting
(decomposition)

safe to bury
more quickly/readily breaks down

microbial inoculant

(boosting microbial population and
diversity)

nutrients (macro- & micronutrients)

organic matter content

bokashi and composting

bokashi

ferments / preserves

adds microorganisms

manage pathogens
with metabolites, pH

composting

manages the decomposition

creates the condition to
attract the microorganisms

manage pathogens
with heat

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

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*





3.5-gallon
bucket

5-gallon
bucket

Sprinkling the microbes



Spraying the microbes



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”

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

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.

Making Activated EM



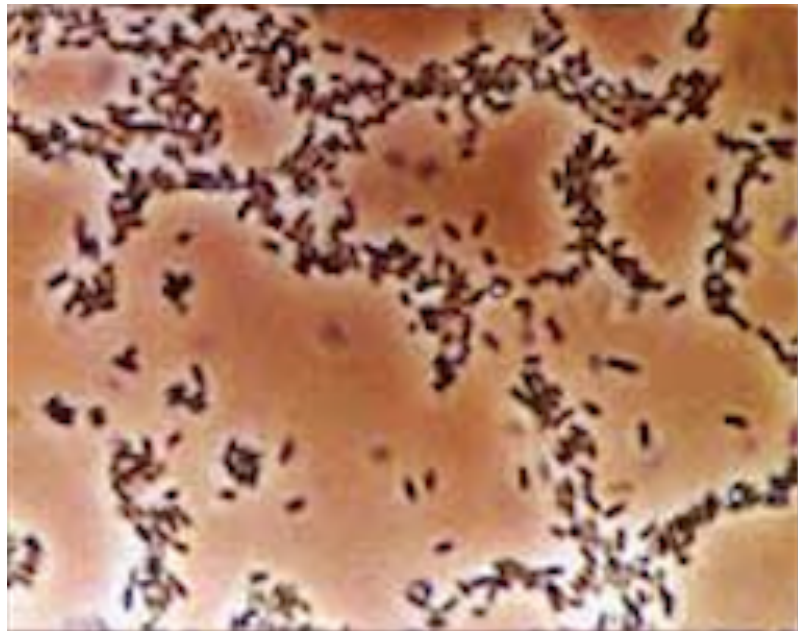
Making the bokashi spray



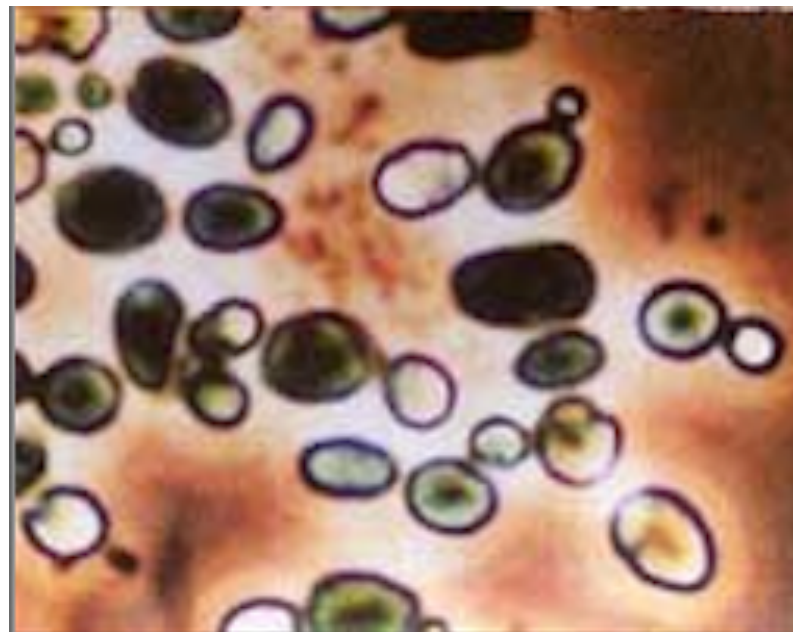
Effective Microorganisms

EM, EM-1

Combination of 3 groups of microbes



lactic acid bacteria
(various *Lactobacillus* spp.)



yeast
(*Saccharomyces cerevisiae*)



phototrophic bacteria
(*Rhodopseudomonas palustris*)

Effective Microorganisms

EM, EM-1

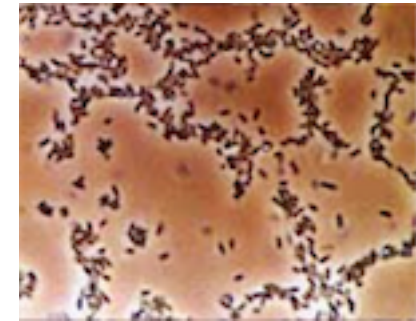
Combination of 3 groups of microbes
with the dominant species of each group

Microbes function differently
when combined

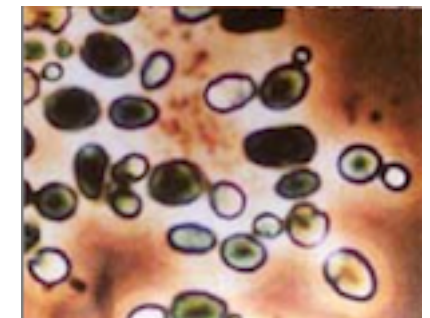
These microbes exist most anywhere,
but are not normally found together.

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.

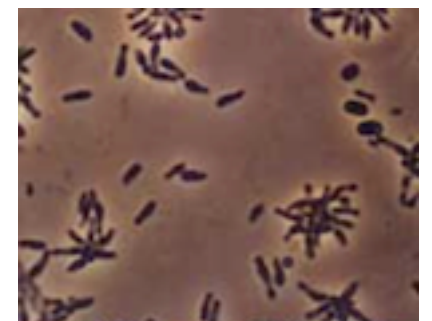
And EM-1 is the actual liquid
containing these 3 groups of microbes.



lactic acid bacteria



yeast



phototrophic bacteria

Purpose of fermentation

purpose of bokashi

microorganisms

increase population
& diversity

probiotic
(microbial inoculation)

life cycles
(break down dead matter—
composting;
feed living matter—nutrient
availability & transport)

food for other
organisms

nutrients + metabolites

release nutrients

increase bioavailability

macronutrients &
micronutrients

produce metabolites

increase microbial
functions

organic matter content

replenish the organic
component of soil
(humus)

for soil structure (flow)

soil microbiome
(prebiotic)

improve soil functions
(biodiversity, fertility, sequestration, filtration)

Use of Microbes

Direct application → different environments/conditions

Some will ...

- thrive, but **function** differently –*adaptation*
- die –*no adaptation or survival mechanism*
- go passive (slow metabolic activity or activity provide no significant source of bioactive/catalytic substances) –*survival*
- go **dormant** (zero or near-zero metabolic activity) –*survival*
- become **food** for other organisms –*food chain*

⇒ biodiversity & ecological function

purpose of bokashi

microbes

microbial inoculant, fermentation starter

nutrients

and metabolites

organic matter

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



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

fermentation starter

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)

bokashi sites, information, and contacts

volunteer/non-profit

- El Sol Brillante community garden
526 East 12th St, New York NY
elsolbrillante.org
- Children's Garden
544 East 12th St, New York NY
childrensgarden12b.org
- LUNGS — lungsnyc.org
Loisaida United Neighborhood Gardens
Represents 50 community gardens in
the Lower East Side and East Village,
Manhattan, NYC
- Sustainable Jersey City
sustainablejc.org

businesses

- EM Research Organization
emrojapan.com
(case studies, global contacts)
- TeraGanix
teraganix.com
(U.S. distributor, technical information)
- Vokasi
vokashi.com
(bokashi-treated food waste in 5-gal
bucket pickup service based in
Brooklyn NY)

recyclefoodwaste.org

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