bokashi

recyclefoodwaste.org

Bokashi Brief

bokashi = fermented organic matter

microbial inoculant and/or fermentation starter

- Different bokashi methods

- Different bokashi types

- Focus: bokashi composting
  [or bokashi method of recycling food waste]

But this will be an overview beyond bokashi composting

bokashi types

by ingredients

fermentation starter

microbial inoculant [+ nutrients + organic matter]

bokashi mudballs / EM mudballs

probiotic feed

prebiotic starter

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

bokashi farming

bokashi gardening

bokashi composting

bokashi bioremediation

bokashi personal care

bokashi composting

Not composting

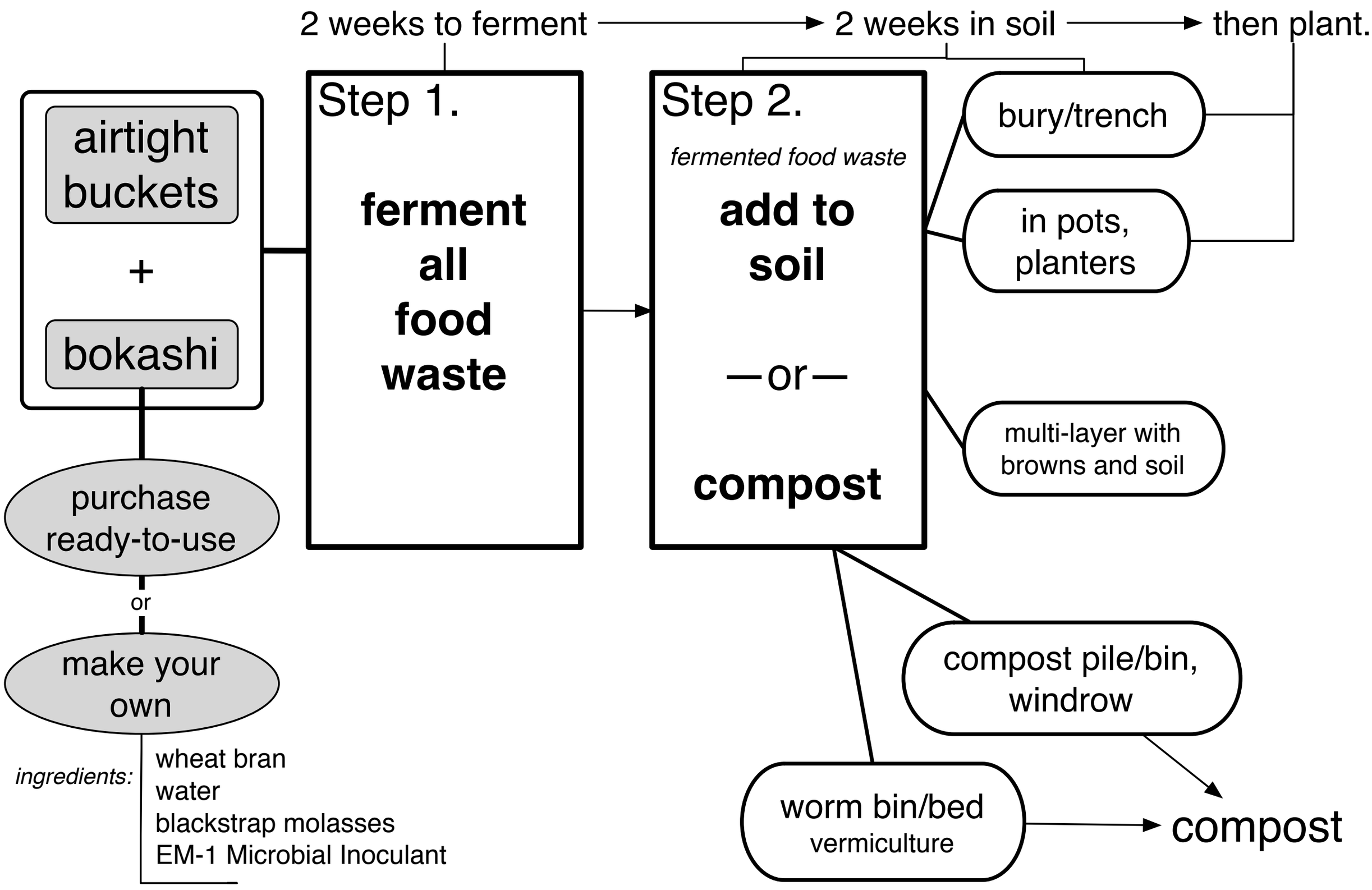
Can be integrated with composting methods

2-Step process

Originally, not about food waste/composting

Originally, bokashi farming

The bokashi method
of recycling food waste



How to make bokashi

blackstrap molasses

1% to water

mix to ~30% moisture

(1 cup water/lb)

EM•1

1% to water

pack airtight to ferment

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

organic material

wheat bran

after 2 weeks, ready to use

"wheat bran bokashi"

Other organic matter
to make bokashi

- rice bran (farm, feed, FFW, mudballs, spa, etc.)
- wheat bran
- coffee chaff (waste from a coffee roaster)
- cocoa husks / cacao husks (waste from chocolate factory)
- coconut coir, shredded coconut husk
- fall leaves
- wood shavings, saw dust (walnut, teak, pine, mahogany)
  [avoid maple, poplar]

bokashi composting

Step 1

‘pickle’ 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

bokashi provides

microbes

nutrients

organic matter

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 History

- Since mid-1700s (?)

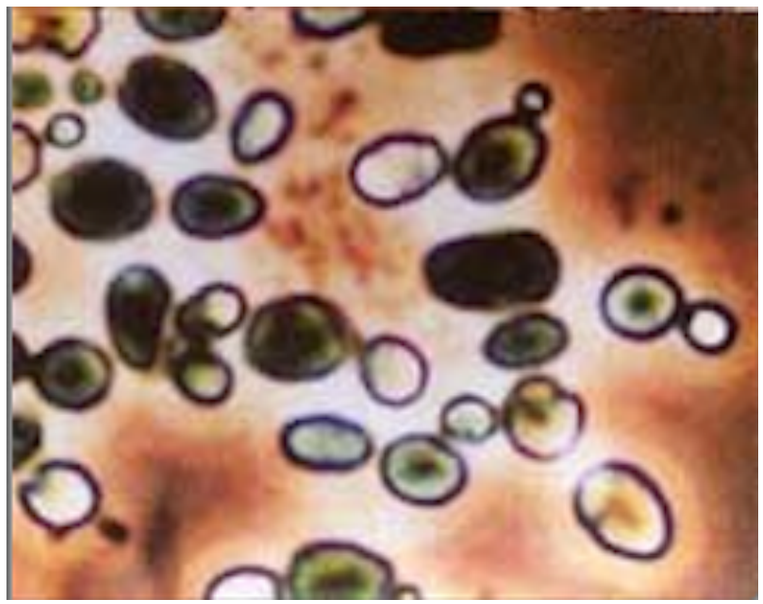
- bokashi (fermented plant matter) made with
  pristine forest/mountain valley soils
  as fermentation starter

- with EM (Effective Microorganisms), 1982 (Teruo Higa),
  easier to make bokashi

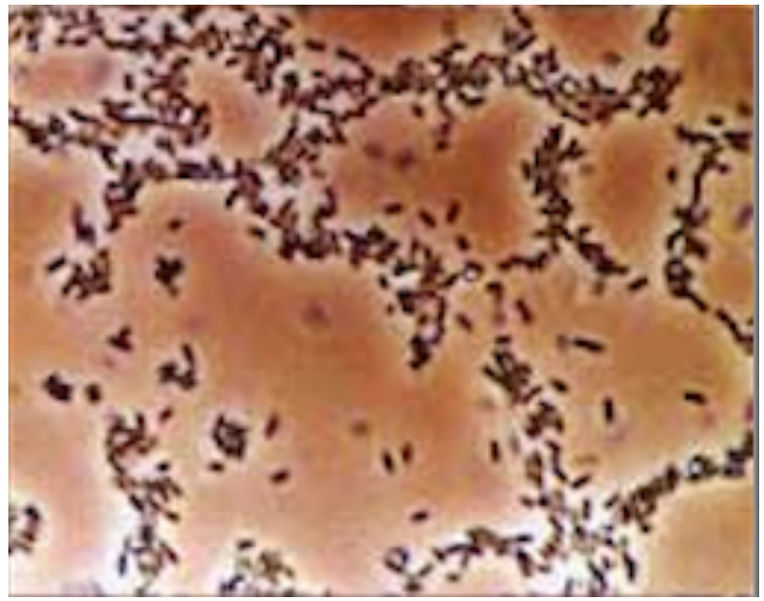
- bokashi revived and developed with EM

Effective Microorganisms
EM, EM-1

Combination of
3 groups of
microbes



yeast



lactic acid bacteria

phototrophic bacteria

When Higa needed to refer this grouping by a name,
he called them Effective Microorganisms or EM
And EM-1 is the actual liquid containing these
3 groups of microbes.

Microbes function differently
when combined

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

http://recyclefoodwaste.org/files/Microbes%20in%20EM1.pdf

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]

Activated EM

blackstrap molasses

1% to water

EM•1

1% to water

after 2 weeks, ready to use

EM-5

1. water
2. blackstrap molasses 5%
3. EM-1 Microbial Inoculant
4. apple cider vinegar 5%
5. 40% alcohol (vodka) 5%
6. garlic cloves
7. hot peppers (cayenne or hotter)

Bokashi with EM

ideal world, no need for EM

but we keep polluting and damaging life/microbial world

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soil care without chemicals

animal care without pharmaceuticals

environmental remediation: water, soil, waste

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industrial applications

health applications

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

odor control
replace odor (gases) producing microbes

Washington Square Park Dog Run, New York NY

bokashi

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