

bokashi composting

the bokashi method
of
recycling food waste

recyclefoodwaste.org

bokashi method

Step 1.

**Ferment the
food waste**

Step 2.

Add to soil

originally not food waste

Originally, a **farming method** (*fermentation farming / bokashi farming*)

Fermenting organic matter
(**plant matter**, post-harvest residue)

bokashi = *fermented organic matter*

Microorganisms same/similar in fermenting foods & beverages
(*throughout the world, ancient past? **silage**—in farming still today*)

Lacto-fermentation / lactic acid fermentation
(lactic acid bacteria: pickles, sauerkraut, kimchi)

Yeast-fermentation / alcoholic fermentation
(brewing beer, wine; baking bread)

Lactic-yeast fermentation (sourdough breads, kombucha/SCOBY; **bokashi**)

Fermenting instead of composting

bokashi and composting

bokashi (*fermenting*) is **opposite** of composting

Think in terms of fermenting foods [to eat]
preserves the food waste
instead of breaking it down (or decomposing it)

Where composting is about the decomposition process

A different **microbial path** to cycle organic matter
standalone process (ferment, then add to soil)
or integrated with composting (ferment, then add to compost)

Microbial paths: decomposition (aerobic); fermentation (anaerobic)

fermentation

fermentation – where microbes break down complex molecules into simpler ones.

sauerkraut

kimchee

Different kinds of fermentation

yogurt

lactic-yeast fermentation (incl. bokashi)

kefir

methane fermentation (anaerobic digesters)

cheese

bokashi ≠ methane fermentation

dark chocolate

We've been **fermenting foods** and **beverages** since ancient times to **feed our bodies**.

vanilla extract

bread

Farmers may have fermented plant/crop waste in the past to feed their soil and plants.

hard salami

mead

With bokashi, we're **fermenting food waste** to **feed the soil** and **plants**.

wine

beer

What is bokashi?



100 metric ton bokashi,
banana plantation,
Costa Rica

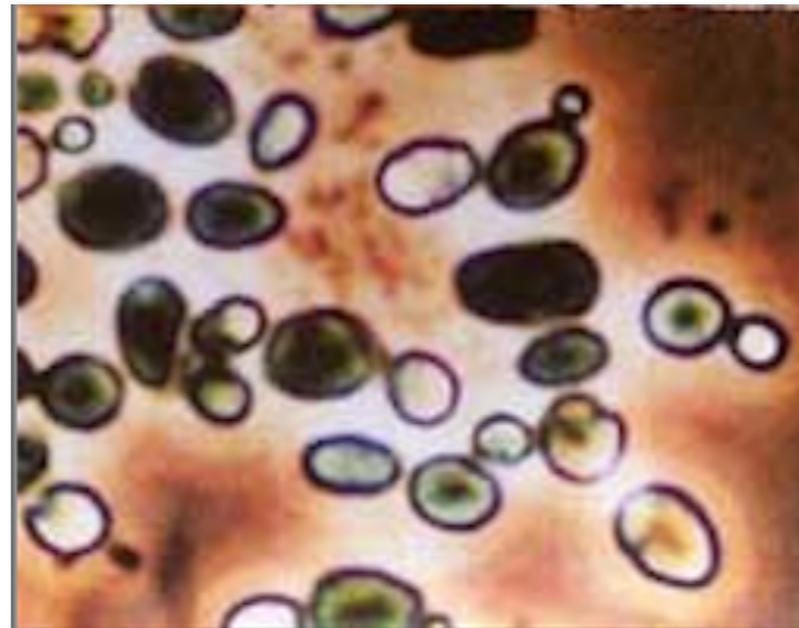
- Japanese term,
fermented organic matter
- Since mid-1700s (?)
- Possibly in most, if not all, past farming cultures throughout the world
- bokashi (fermented plant matter) made with pristine forest/mountain valley soils as fermentation starter
- with EM (Effective Microorganisms), 1982 (Teruo Higa), easier to make bokashi



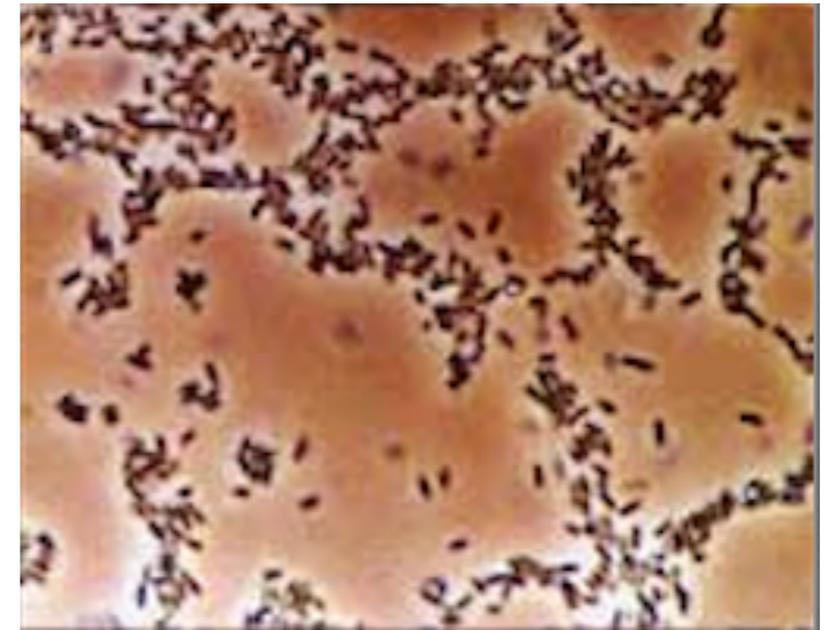
Effective Microorganisms

EM, EM-1

Combination of
3 groups of
microbes



yeast



lactic acid bacteria



phototrophic bacteria

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]

microbes

**microorganisms = microbes =
microscopic organisms**

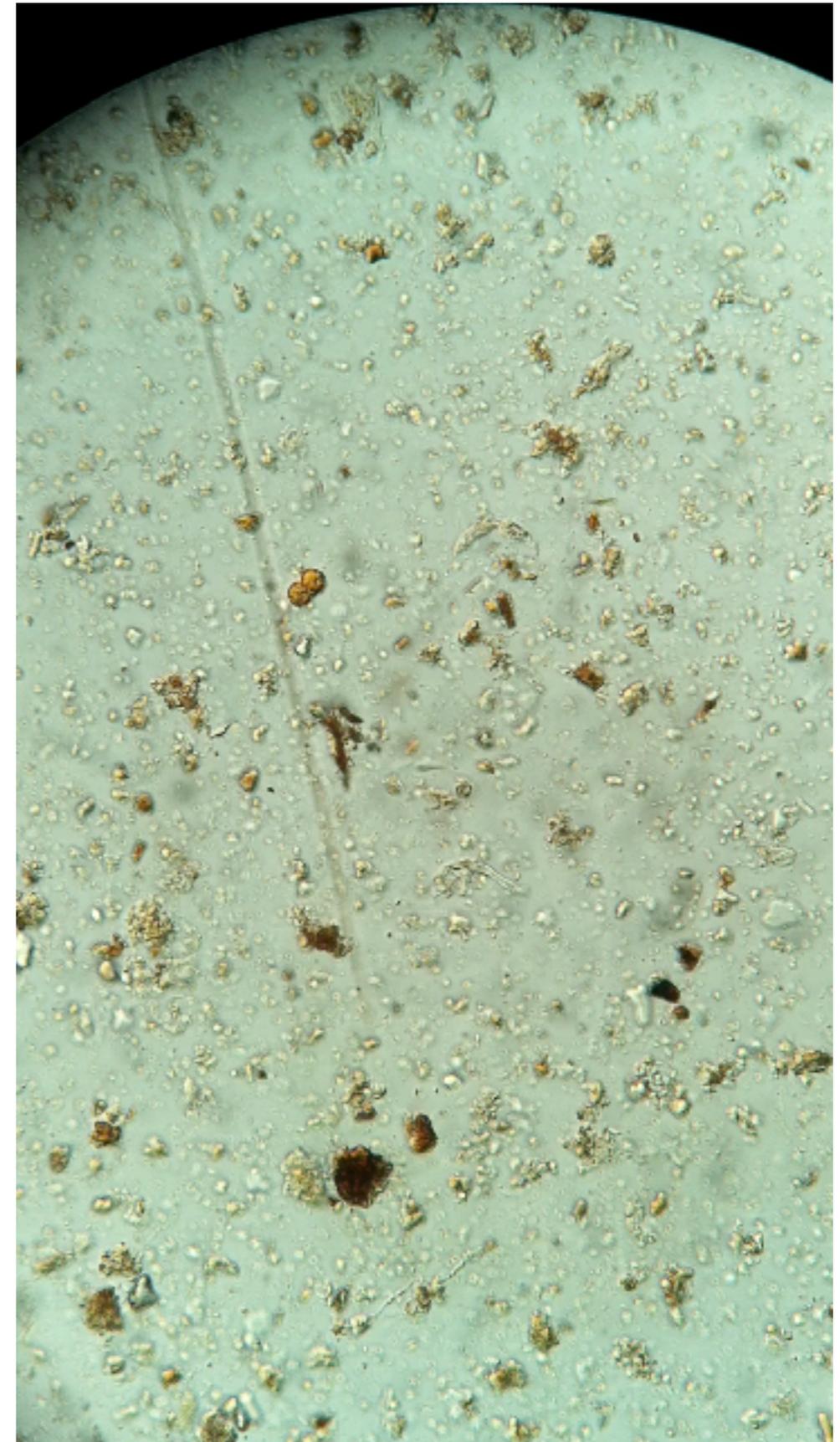
archaea, bacteria, fungi, algae, protozoa,
microscopic plants, microscopic animals

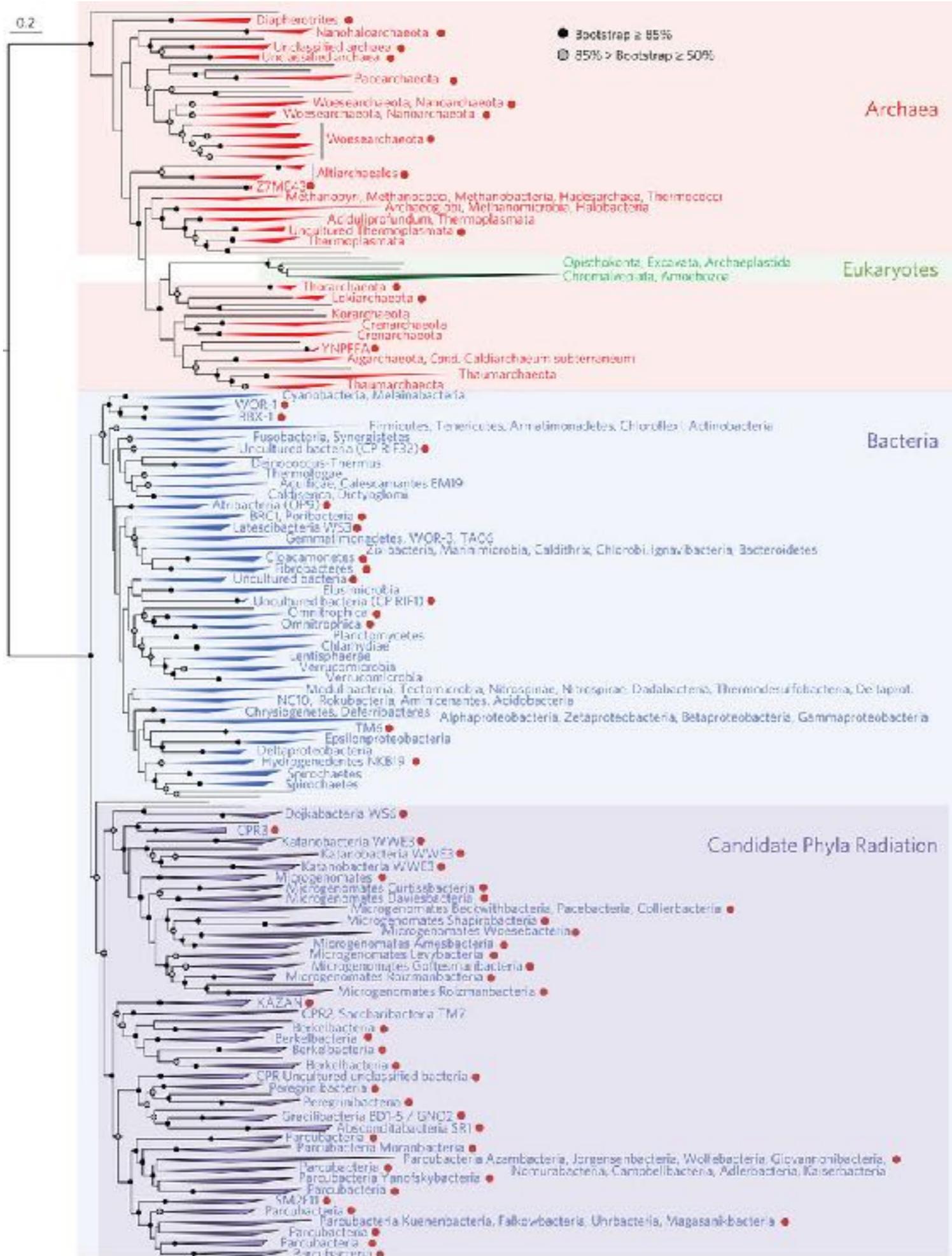
pathogens – disease causing by toxins or cell damage
bacterial, fungal, viral, parasitic, prionic (protein)
— a fraction of 1% of all microbes

Microbes are everywhere

Necessary for all of life

They terraformed our planet.





“A new view of the tree of life” [biology]

from Nature Microbiology

<https://www.nature.com/articles/nmicrobiol201648>
May 2016

Past tree of life diagrams had animals represent about half of all the species.

Now, all of the visible life (from fungi to plants to animals to humans) are on that one thick line under Eukaryotes.

The bottom third, “Candidate Phyla Radiation” (a temporary name) have all been recently discovered (ca. 2015).

How little we still know about the microbial world.

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”

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

purpose of bokashi

microbes

microbial inoculant, fermentation starter

nutrients

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

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)

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*