

**bokashi composting**

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

# microbes

**microorganisms = microbes =  
microscopic organisms**

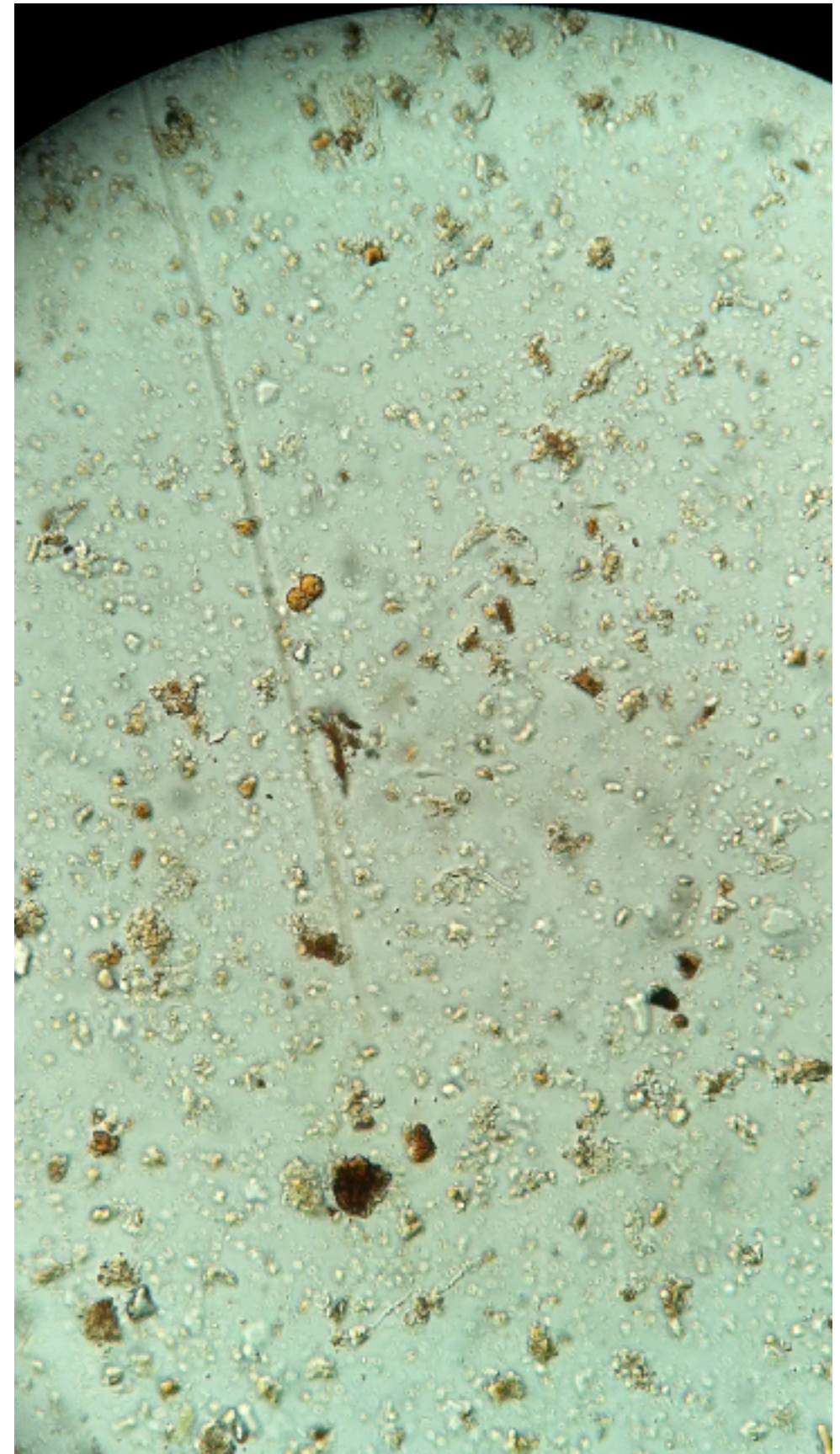
archaea, bacteria, fungi, algae, protozoa,  
microscopic plants, microscopic animals

pathogens – disease causing by toxins or cell damage  
*bacterial, fungal, viral, parasitic, prionic (protein)*

**Microbes are everywhere**

**Necessary for all of life**

They terraformed our planet.







# fermentation

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

Different kinds of fermentation

lactic-yeast fermentation

methane fermentation (anaerobic digesters)

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

Now we're **fermenting food waste** to **feed the soil** and **plants**.

Results: alcohol, antioxidants, coenzymes, bacteriocins

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

Nutrients more bioavailable

*sauerkraut*

*kimchee*

*yogurt*

*kefir*

*cheese*

*dark chocolate*

*vanilla extract*

*bread*

*hard salami*

*mead*

*wine*

*beer*



# organic matter & compost

## organic matter

once-living organisms:  
dead plants, dead organisms  
decaying or decayed (humus)  
*the forest floor*

## organic matter in soil

improves/maintains **microbial life**  
adds **nutrients**  
adds **organic matter content**

## compost

decayed organic matter

## composting

the process of decaying organic matter





# soil parts

**organic part** 1%~5%

humus/organic matter

**inorganic part** ~45%

rock/mineral particles:

clay	silt	sand
< 0.004 mm (< 0.00016 inch)	0.002 ~ 0.060 mm (0.00008 ~ 0.00236 inch)	> 0.060 mm (> 0.00236 inch)

**water** ~25%

**air** ~25%





# bokashi

- Japanese term,  
*fermented organic matter*
- Since mid-1700s (?) Throughout ancient world farming?  
(e.g., today, still silage practiced)
- fermentation starter from pristine  
forest/mountain valley soils
- with EM (Effective Microorganisms),  
1982 (Teruo Higa), easier to make  
bokashi
- mid-2000s, 25% of towns in Japan,  
some form of bokashi



100 metric ton bokashi,  
banana plantation,  
Costa Rica





# bokashi purposes

- **soil amendment**

- microbial inoculant
- nutrients
- organic matter content
- reconnect cycle of soil life



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

- **fermentation starter**

- ferment food waste
- ferment mud balls



*Cardinal Spellman High School, Bronx NY*



# Other Uses



*Barge with Activated EM treating polluted canal, Japan*



*EM Mud Balls, Lower East Side, NY  
(El Jardin del Paraiso community garden,  
La Plaza Cultural community garden)*

## COMPARISON AT GURNEY DRIVE

Mangrove Trees Grew Vigorously



16 August 2009



6 April 2010



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



# How to make bokashi



**blackstrap molasses**



**EM-1**



**organic material**  
wheat bran

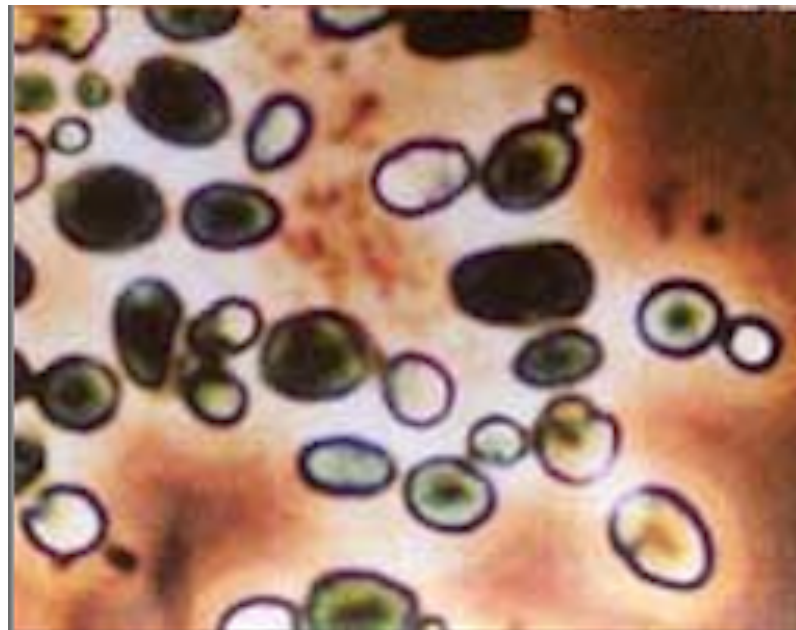




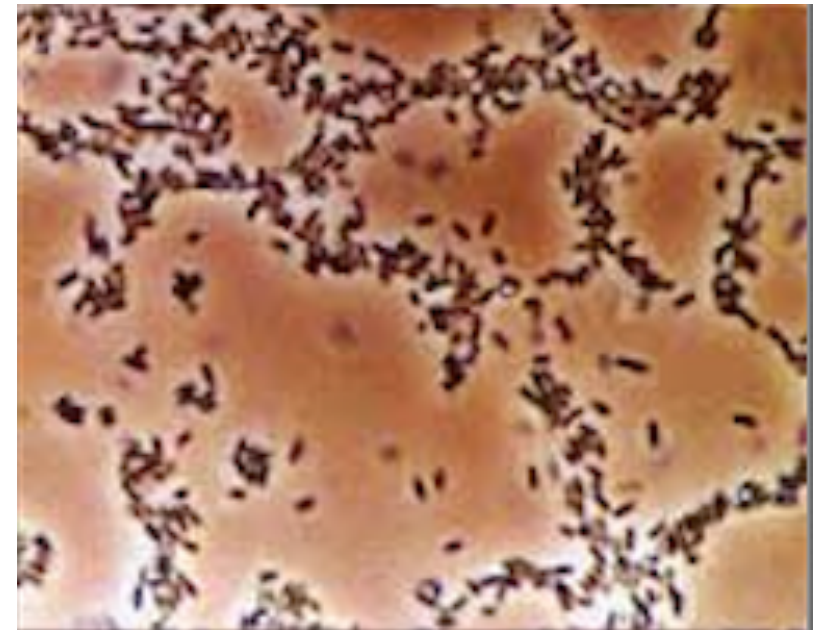
# Effective Microorganisms

## EM, EM-1

Combination of  
3 groups of  
microbes



**yeast**



**lactic acid bacteria**



**phototrophic bacteria**

## 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](http://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]



# Other bokashi materials

rice bran

coffee chaff

cocoa husk

coconut coir (shredded)

wood shavings

leaves

direct soil application:

rice bran + fish meal + oil cake



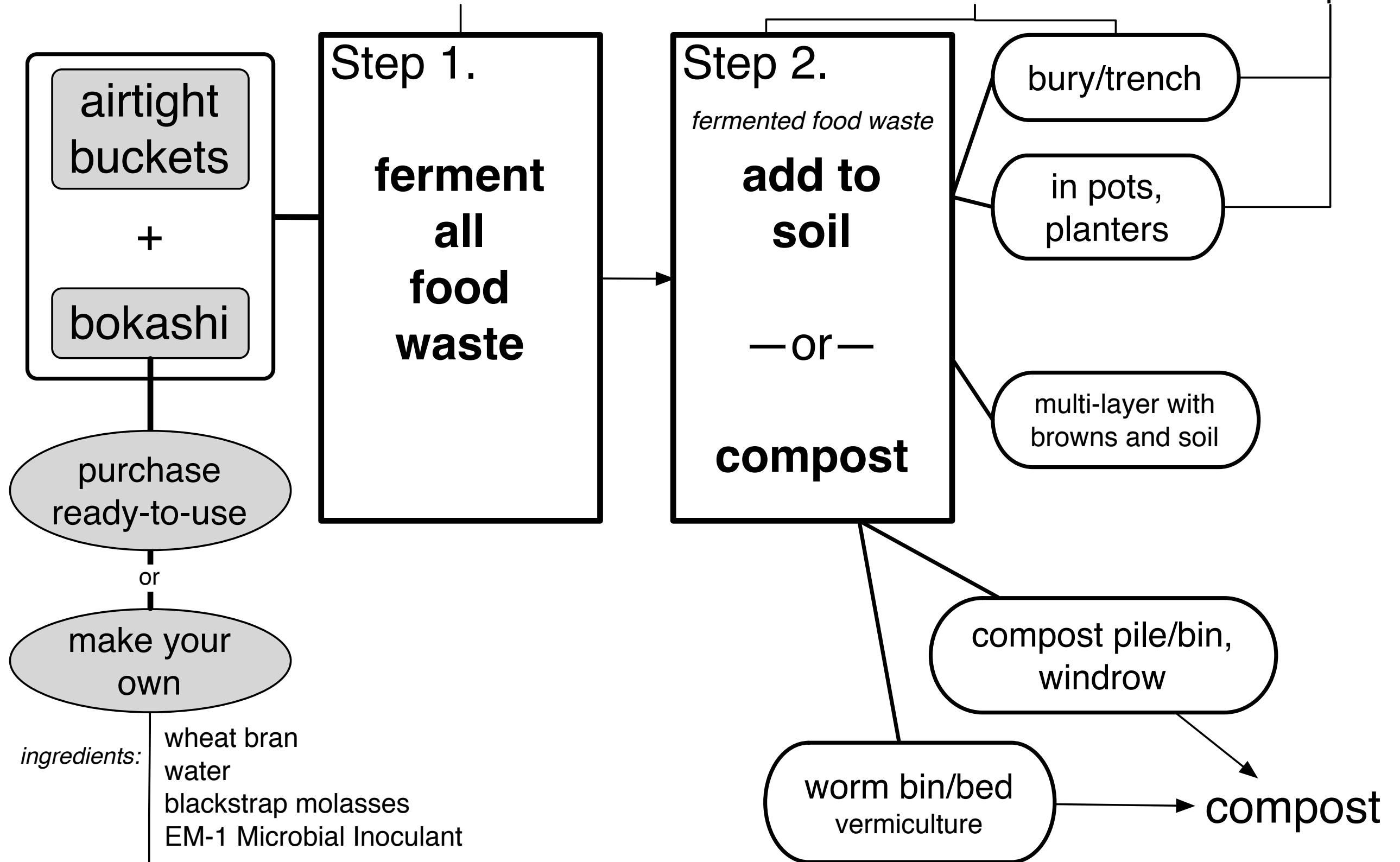
**coffee chaff**



# The bokashi method of recycling food waste

recyclefoodwaste.org

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





# 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 NY*





# bokashi methods



*Cajica City, Colombia*

**whole towns**

**with CSAs**

**volunteer-based**

**nonprofit orgs**



*Nonprofit run by seniors, composting bokashi, packaging for redistribution*

**many ways**



**at home**



**Q&A**