

# Tempe

## An Indonesian fermented food

**TEMPE (or tempeh) is a solid fermented soya bean 'cake' which is widely consumed as a meat substitute in Indonesia. It forms an important part of the diet of many Indonesians, and may supply much of the total dietary protein. In recent years, especially in the USA, there has been interest in developing tempe as an 'alternative' protein source.**

### Materials

*Rhizopus oligosporus* culture (from Murphy and Sons Ltd, Murphy House, Wheathampstead, St Albans, Herts, AL4 8BY. Tel: + 44 158 283 2161)  
Incubation facilities (25–30°C)  
Wine vinegar  
Dry soya beans, 500 g  
Plastic bags eg. 18 x 23 cm (the resealable type is convenient)  
Adhesive tape (if resealable bags have not been used)  
Paper kitchen towels  
Darning needle  
Plastic bucket for soaking the beans  
Large saucepan for cooking the beans  
Large spoon  
Kitchen sieve  
Large kitchen bowl  
Large clean tray eg. baking tray

### Practical details

- Place the beans in a plastic bucket, and add enough water to provide a least 5 cm depth above the beans. Allow the beans to soak for 8–16 hours. (The soaking time can be reduced if desired by simmering the beans for 20 minutes, then allowing them to stand for 2 hours).
- Pour off the water and dehull the beans by vigorously rubbing them between the palms of the hands. Add fresh water to the bucket, and stir the contents gently so that the hulls rise to the surface. Decant the surface water and floating hulls. Repeat this process until most of the hulls have been removed. (100% dehulling is unnecessary, but a fairly high percentage must be removed for successful fermentation).
- Put the dehulled beans into a saucepan, then add enough water to cover them to a depth of at least 5 cm. Add 2 tablespoons of vinegar, then boil the beans in an uncovered pan for 45 minutes.
- Immediately put the beans into a sieve to allow the water to drain away. Transfer the beans to a clean baking tray or similar container covered with paper towels. Spread the beans evenly, and allow them to cool. Stir the beans occasionally and pat them with a paper towel to remove excess liquid. The surface

of the beans should be dry without an obvious film of moisture.

- When the temperature of the beans has fallen to 35–40°C quickly transfer them to a clean bowl. Add one teaspoonful of the *Rhizopus* culture and mix the whole mass with a clean spoon. Do not allow the beans to cool excessively.
- Place the inoculated beans in new (and therefore almost sterile) plastic bags and flatten the contents out to form a 'cake' about 2 cm thick. The area of the cake is not important, but the thickness is, to permit adequate aeration. Fold the opening of the bag over tightly up to the edge of the beans. Seal the bags with adhesive tape, then pierce them at 2 cm intervals over the surface using a hot (but not red hot) needle.
- Place the filled bags in an incubator or a warm, dark place at 28–30°C. Do not lay the bags on top of one another as this will restrict aeration. Incubation at temperatures above 40°C or below 25°C will not produce good tempe. Between 28–30°C the process will take up to 48 hours to complete.

### Safety

#### Hygiene

Although sterile conditions are not required for the successful preparation of tempe, scrupulous hygiene should be observed throughout. Tempe intended for consumption should only be prepared in a food preparation area, not in a laboratory.

#### Incubation

Incubators used for growing other cultures should not be used. If the tempe is incubated at 25°C or lower, this could allow the growth of *Aspergillus flavus* or other mycotoxin producers: incubation temperatures of 37°C should also be avoided. Adequate ventilation during incubation is essential since the fermentation generates heat.

#### Bacterial contamination

Patches without fungal mycelium, a wet appearance, or an unpleasant smell or sweet flavour indicate that bacterial contamination has occurred. If the mycelium is any colour other than white or grey (yellow or red patches may be caused by heavy sporulation) it is unsafe to eat. Contaminated tempe should be disposed of, either by autoclaving or by submerging it in a bowl of freshly diluted clear phenolic disinfectant solution for 24 hours before disposal.

#### Storage

Finished tempe can be stored for up to 4 days in a domestic refrigerator; but if it is stacked inside the 'fridge, the fungus can continue to grow and generate heat. It is best to steam tempe for 5 minutes before freezing it.

### ADDITIONAL INFORMATION

This practical first appeared in *NCSB Newsletter* Number 1. It is an adaptation of the following undergraduate practical:

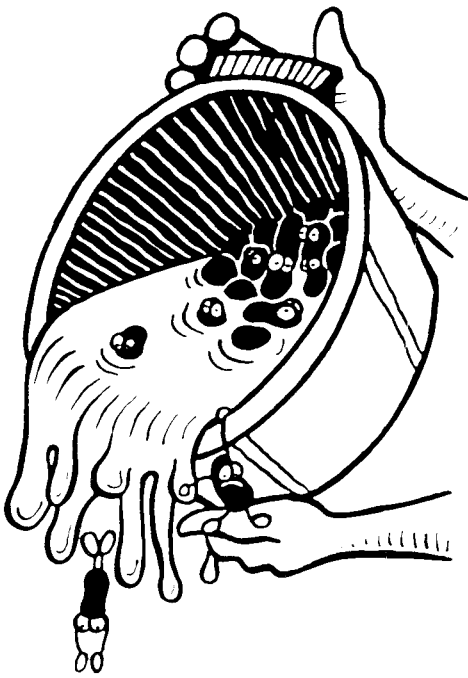
Hedger, J. N. (1982) 'Production of tempe, an Indonesian fermented food', in *Sourcebook of experiments for the teaching of microbiology*, Primrose and Wardlaw (Eds), pp. 597–602, Academic Press.

More information regarding traditional tempe production may be found in: Shurtleff, W. and Aoyagi, A. (1985) *The book of tempeh*, Harper and Row.

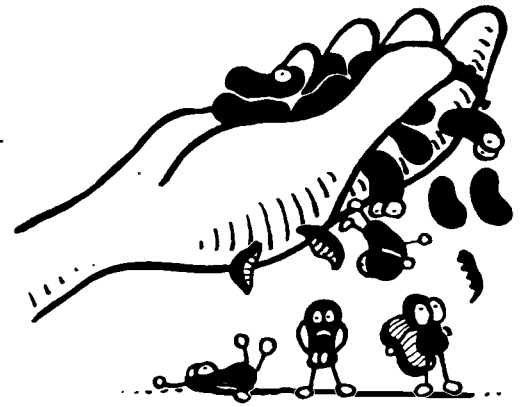


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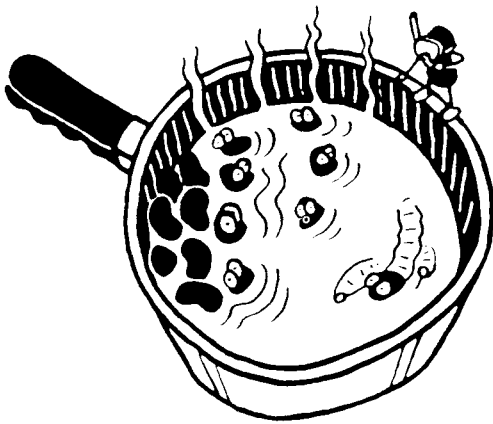
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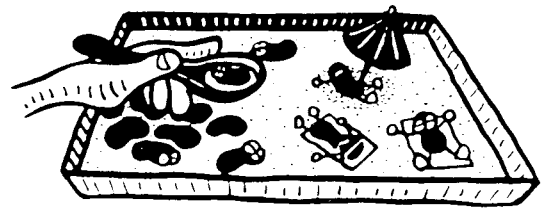
1. Soak the soya beans in water overnight.



2. Remove the bean skins by rubbing the beans between your hands.

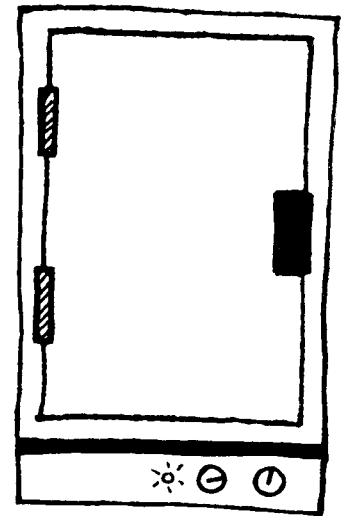
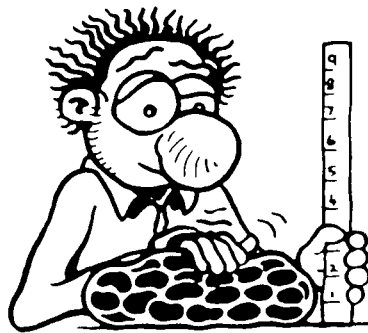


3. Boil the beans for 45 minutes. Add a little vinegar to the water.



4. Spread the beans on a tray and let them cool to 35–45°C. Sprinkle on starter culture.

5. Seal the beans inside a plastic bag in a layer 2 cm thick. Make air holes in the bag with a hot needle.



6. Incubate the beans at 28–30°C for 48 hours.



7. Check the finished tempe for contamination.

8. Impress friends at your next cocktail party.

