Japanese style of soy sauce to the American population might be proof that a traditional fermented flavor in one area can also be accepted by most of the people in another area. It might be presumed that most of the traditional protein foods could be accepted by most of the people in the world, to the extent that the qualities are superior. When we consider the development and popularization of vegetable protein foods, it might be of great importance that we have a further look at the traditional protein foods from this point of view, examine them in detail by modern scientific methods, and develop some new food technology based on these traditional products.

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Fermented Foods of Southeast Asia

F.G. WINARNO, Bogor Agricultral University, Indonesia

Toxin produced by *Pseudomonas cocovenenans* are bongkrek acid, which is colorless, and toxoflavin, which has a yellow color. Bongkrek acid is responsible for deadly food poisoning which, until recently, claimed victims in Indonesia.

A lethal dose of bongkrek acid is 2 mg/100 g body weight. This dose will kill mice within 2-5 hr, if injected intraperitoneally. Doses of 1 mg/100 g body weight will not kill mice unless the doses are repeated within 40 hr. This is an indication that the BA has cumulative action. Eating bongkrek in small amounts is also still very dangerous for human beings.

Berends et al. have succeded in showing that bongkrek acid acts as an inhibitor to oxidative phosphorylation in mitochondria. In consequence, the ATP production in mitochondria will be disturbed. If it attacks heart muscle cells, the heart will stop due to lack of ATP.

Symptoms of bongkrek poisoning in mice are the same as in human beings. In the very beginning, people suffer from hyperglycemia. Later step-by-step this changes into hypoglycemia and the victim dies due to hypoglycemia. The patient will also suffer acidosis due to rapid lactic acid production in the blood.

Toxoflavin is also dangerous. According to the literature, toxoflavin functions as an electron transport carrier, which bypasses the cytochrome system. The end product of this process is production of hydrogen peroxide which, in fact, is very toxic to the cell. However, cells having abundance of catalase apparently will survive.

Coconut presscake inoculated with *Ps cocovenenans* and incubated at room temperature for five days will become a yellow-brownish color. This was dried and extracted using petroleum ether as solvent and shaken with 2% bicarbonate. A sample kept in 2% Na bicarbonate can last a few months if refrigerated.

Some of the local governments in Central Java have banned the making and selling of tempeh bongkrek. However, since many people are so attached to this particular fermented food, and making tempeh bongkrek is the only source of their income, this particular regulation creates problems. The tempeh bongkrek-making continues underground or illegally.

Using calingcing leaves (*Oxalis sepium*) during the making of bongkrek may help in reducing toxic poisoning. Local people still have not accepted this due to the flavor produced. The future use of NaCl for inhibiting *Ps cocovenenans* has very good prospects since NaCl will certainly be part of the food in the end.

Other Fermented Foods

C.W. HESSELTINE, USDA Northern Regional Research Center, Peoria, IL USA

In my plenary paper, I did not have time to complete all I wanted to say about the Kaffir beer fermentation. It is also called Bantu beer, and there are some other names. One of the things that I think interesting is that the average cost per pack of Kaffir beer in wax-lined cardboard packages was 15 cents per liter, and for bulk beer it is 10 cents per liter. There are ca. 900 million liters of Bantu beer produced per year, and that bulk beer is declining in volume while the packaged beer that is in the cardboard packages is increasing. The price of the beer is only about half the price of milk or Coca Cola.

I should tell you about the actual production of beer in South Africa. Some plants have a capacity of 4.5 million gallons per month production. As a matter of fact, if you look at the number of breweries in South Africa, there are three large breweries with an annual production of at least 17 million imperial gallons each. There are also 16 breweries with an annual capacity of 1 to 7 million imperial gallons, and there are 50 minor producers who annually produce less than 1 million imperial gallons. Industrialization of the fermentation has only recently happened. The original work that was done in South Africa began in 1954, and in that short period of time the production has gone up tremendously as the figures would indicate.

The Bantu industry, of course, is unique in several aspects. It is a large, modern, industrial fermentation founded on tribal art. The industry also is in the hands of the local authorities and not private industry. Another interesting thing is the profits are controlled by the government, and the greatest amount of profit goes for Bantu development projects. And also it is partly privately financed in that the sorghum malt and the yeast inoculum are made by private industry and sold to the municipal breweries. In 1966, the municipal breweries bought about a quarter of a million pounds of dried yeast for pitching, that is, for inoculation. This is all private industrial work. Also, it is unique in that the government takes out of each gallon of sales 3/4 of a cent which goes back into financing research on the production of Bantu beer.

Now the question comes up of how many companies or

how many processes have been industrialized from traditional processes. The first one that I have just described is the Bantu beer, which is a very large and successful operation. Another example, of course, is the fact that the Kikkoman Shoyu Company has come into the United States and built a plant which has been in operation for some time. I would judge that their sales are very good, since I visited the plant this summer and noticed that they were expanding their facilities. Another case of development has been the mahewu (magou) fermentation which, although it is small, produces a sour maize product in South Africa, at least by one plant that I visited several years ago. I have no idea of their capacity, but I recall seeing tanks of 1,000 gallons or more capacity in use. The fourth process is tempeh fermentation in the United States. This process or this fermentation was started because of the interest by many vegetarians in using a protein source of food, and the tempeh fermentation is one that satisfies their needs. We know of at least one company which is producing tempeh. The one company we know that we have supported and helped produces a package in which the soybeans are prepared and the inoculum is enclosed. This is used for people in the home who like to make homemade bread. They can make homemade tempeh. So I think that we can conclude that at least in these four cases fermentations which are traditional ones have been industrialized in the last few years, and I think that there is considerable hope for further development of other fermentations in the future.

Fermented Products in the Philippines

MICHIO KOZAKI, Tokyo University of Agriculture, Japan

The vast area occupied by Polynesia includes the Hawaiian Islands, New Zealand, and Easter Islands. Native tribes of Polynesia used the same language with similar customs and traditions. As far as fermented foods are concerned, they all resemble each other, and therefore, I would like to illustrate with Philippine fermented foods.

This country is almost divided into Malaysian line 70%, and China line 15%. With this in mind, the culture of these places and methods of preparing foods like fermented foods have something in common with Indonesia, Malaysia, Thialand, and China.

Food fermentation is traditional, and the best way of food preservation in the Philippines, just as in the Orient. This method is still popular. Some local alcoholic beverages and indigenous fermented foods are: tuba (palm wine); tapuy (rice wine); binuburan (prefermented rice wine); and basi (sugarcane wine).

Tuba is made usually in the topical and subtropical zones as a peasant wine. The responsible organism is *Saccharomyces chevalieri*. The same general procedure of tuba-making is used in Polynesia, Southeast Asian countries, and Africa. In the Philippines peasants use tangal bark (mangrove bark) in order to avoid contamination.

Tapuy (rice wine) is the only alcoholic beverage of the Ifugao Tribe in the northern part of Luzon Island. It is used for celebration or ceremony. During fermentation the early stage includes saccharification. This is followed by alcoholic fermentation, which has been shown to be done by only yeasts. These yeasts are *Endomycopsis fibrigera* and *Saccharomyces cereviseae*. The final product contains 15 or more % alcohol.

Binuburan is characterized by its sweet taste and juiciness. This is the result of prefermentation of rice for 2-3 days, i.e., the earliest state of fermentation in tapuy making.

Basi is an Ilocano term for the ancient sugarcane wine. It tastes a little sweet-sour, and it is a good flavored alcoholic beverage. There are two types of basi made according to the purpose: one type is for "babae" (for women), which is sweet and low in alcohol content; the other one is "lalaki" (for men), which is bitter, less sweet, and higher in alcohol content. Other breweries of sugarcane wine in foreign countries distill the wine after fermentation, in which case it is called "rum." But this type of wine (basi) is never distilled.

Sugarcane juice (about 15% cane sugar) is concentrated in a big pan to half of its original volume. Samac leaves, fruits and bark are added. The concentrated juice is transferred to an earthen jar, and cooled and inoculated with Chinese yeast powder as a starter. This is allowed to ferment for 7-10 days more before adding another batch of starter (rusod). After one month of fermentation, it is covered with earthen cap and sealed with clay. Maturation is done for 6-12 months.

Dominant microorganisms in Basi have been identified as *Saccharomyces cereviseae, Saccharomyces bayanus, Endomycopsis fibrigera,* and *Endomycopsis burtonii.* On the bacteria side, the organisms are identified as *Pediococcus pentosaceus* (at its early stage of fermentation) and *Lactobacillus casei* (matured stage).

Nata is the native term applied to the thick, mucilagenous film on the surface of an acidified, liquid-containing sugar, e.g., coconut water and pineapple juice. This is considered as the most indigenous and unique fermented food in the Philippines.

Nata-making may play an important role in the coconut industry in this country because of the growing interest on its production from coconut water, which is an abundant waste product of copra manufacture.

Some papers concerning nata-making or nata microorganisms are by Dimaguila, Lapuz, and others. The main organism of the nata fermentation is *Acetobacter aceti* var. *xylinum.*