

Jars of nam pla, or fish sauce, ready for transport. Thailand.

Concrete troughs for making nam pla, a salty, protein-rich liquid.



FISH sauces are widely used in South-East Asia, being known as nuoc-mam in Indo-China, nam-pla in Thailand and patis in the Philippines. They have long been valued as condiments for improving the flavour of monotonous diets based on rice, and are also considered nourishing by the peoples of these regions.

Their nutritive value is confirmed by chemical analysis, which shows them to contain useful amounts of amino-acids. These compounds are the units from which protein, the main material forming the muscles and organs of the human body, is built. The body can make its own proteins from amino-acids produced by digestion of proteins supplied in the diet, but for efficient use these aminoacids must be present in the right proportions. Rice and other cereals contain proteins which are relatively deficient in the amino-acids lysine and tryptophane, and are therefore used much better if other foods correct these deficiencies.

Fish is rich in lysine, and is thus an excellent supplement, even in small amounts, to a mainly cereal diet. The preparation of fish sauces is likely to retain the lysine and other valuable amino-acids of the fish. Analyses made at the 'Institut Pasteur', Saigon, have shown that nuoc-mam contains trypto-

* Dr. McKee is Food Technologist to the South Pacific Commission.

Fish Sauces And Pastes Are

Palatable And Nourishing

Popular in South East Asia for flavouring monotonous diets based on rice, fish sauces and pastes offer a simple way of reinforcing protein-deficient diets such as are often found in the South Pacific. Their manufacture, which is simple, provides an excellent way of utilising supplies of fish that otherwise would be wasted. How they are made is described in the article below.

By H. S. McKEE*

phane, lysine and many other aminoacids.

Fish sauces also add vitamin B_{12} to the diet. The human requirement for this important vitamin is very small, but if it is not satisfied the blood-forming process is disturbed and a serious anaemia results. It is absent from rice and from most other plant products, though its presence has been reported in leguminous pulses. Nuoc-mam from Indo-china has been analysed for vitamin B_{12} in recent years, the samples analysed being made from several different sorts of fish. The content of vitamin B₁₂ varied considerably according to the species of fish used, but all samples were good sources of the vitamin. The amino-acids and vitamin B_{12} of fish sauces can fill serious gaps in the nutritive value of diets consisting mainly

of rice. These sauces also supply essential minerals, especially calcium and phosphorus. The contribution of fish sauces to the diet is only limited by their high salt content, which causes them to be mixed with large amounts of other foods.

Preparation of Fish Sauces

The manufacture of fish sauces offers a valuable outlet for fish which may be difficult to use in other ways. Fish is often wasted in important fishing areas, either because of gluts when the catch exceeds the capacity of the local market or because the fish caught is unacceptable for direct human consumption. Some fish are avoided by consumers for traditional reasons or because they are considered unpalatable; others are too small and bony to be used.

The utilization of such fish poses difficult problems. It can be converted into fish meal, a product used mainly as fertilizer or as stock food rather than for human consumption. The large-scale manufacture of fish meal also needs complex and expensive equipment, which can only be used profitably if regular supplies of fish are available for a large part of the year. For similar reasons canning and the manufacture of fish oils require steady supplies of fish, and are of little use in handling sudden gluts.

Drying in the sun involves less equipment than the methods already mentioned, but is in many regions hindered by weather conditions for part or all of the year. Small-scale artificial drying of cooked fish is practicable, but the product requires moisture-proof containers, preferably metal, if it is to be kept for more than a few weeks in warm damp climates. Mr. H. van Pel, fisheries officer of the South Pacific Commission, has recently shown that dried fish flakes of good quality can be made from cooked fish by very simple means.

The manufacture of fish sauces from sea or fresh-water fish requires only simple equipment and can, if necessary, handle large amounts of raw material at a time. The essential piece of equipment is a vat in which the salted fish is left to be reduced by bacteria and by its own digestive ferments to a semiliquid state. On the domestic scale, earthenware jars of a few gallons capacity (20 to 50 litres) can be used. Commercial production in Indochina uses wooden vats which hold up to about 1,000 gallons (5 cubic metres) and the National Institute of Fisheries Research of Cambodia (Institut National des Recherches Piscicoles au Cambodge) has used reinforced concrete vats with a capacity of 3,300 gallons (15 cubic metres). Concrete vats must be coated internally with some salt-resistant material.

The salted fish is put whole in the vats; it is neither cleaned nor scaled. Very little labour is therefore needed, the main operation being transport between the fishing vessel and the vat. The fish remains untouched in the vat for several months; the solid residue is then washed with brine to extract breakdown products of protein, and other substances of nutritive value. The residue (*nuoc-xat*) can be used as a fertilizer. The washing can be done with a motordriven pump made of a salt-resistant alloy.

The capacity of a fish sauce plant is limited only by the size of the vats. It can therefore receive its raw material in large batches, even taking a year's requirements in a few days. Fish to which one-fifth of its weight of salt has been added soon after catching can be held for several days before going into the vats. Fish sauces, if correctly prepared, keep for several years; they are more stable than any other fish product except canned fish.

Fermented Fish Pastes in S.E. Asia

These products include *hagoong* in the Philippines, *prahoc* in Indo-China and *trassi* in Indonesia. They are widely used as condiments for rice. The quantities eaten in a single meal are rather small, but taken regularly they must help to supplement the rice diet in essential amino-acids, together with calcium, phosphorus and other minerals.

Bagoong is made from small fish, intimately mixed with one part of salt to three parts of fish, or two parts of salt to seven parts of fish. The salted fish is left undisturbed for three months in earthenware jars and is then ready for use. The bagoong contains about 32%of solids; half of this is protein or aminoacids, the rest being largely salt.

The manufacture of prahoc is more complicated. The heads are cut off the fish, which is cleaned and scaled before being mixed with coarse salt (one part of salt to five parts of fish). The salted fish is put on mats to dry in the sun for two days. The sun-dried material is then pounded to a paste in wooden mortars. The paste is put in earthenware jars, which are not sealed but are covered to keep out flies, and are exposed in the sun. The paste remains in the jars for a month or more. During this time a salty liquid separates from the paste, and is used as *nuoc-mam*. The *prahoc* is considered to be ready for use when no more liquid appears.

The main centre for the manufacture of *trassi* in Indonesia is the fishing port of Bagan Si Api Api on the east coast of Sumatra, from which substantial quantities are exported to Java.

Trassi can be made either from fish (*trassi ikan*) or from small shrimps (*trassi udang*). The fish is salted (one part of salt to ten parts of fish) in the boats and is spread out to dry in the sun for a few days when they return to port; it usually has at this stage a very strong unpleasant smell which disappears later. The sun-dried material is pounded into a paste, often with the addition of more salt. The process of making *trassi* from shrimps at Bagan Si Api Api is generally similar to that used

with fish. Indonesian *trassi* is usually bright red; the colour is due to synthetic dyes. The final product is often mixed with spices. Tapioca (cassava) flour may also be added.

Small red shrimps are used in the preparation of *trassi udang* in the Merauke District on the south coast of Netherlands New Guinea. Production reached 269,000 kg. (263 long tons) in 1949, a considerable increase over the best pre-war year, but fell to 7,000 kg. (7 long tons) in 1953. Almost all the production was exported to Indonesia until this market was closed for political reasons. Only small amounts of trassi have been sold in New Guinea, though if used within the territory it would be a useful supplement, especially for protein and calcium, in the diet of the people.

The shrimps are spread on sacks in the sun until half dry. They are then mixed with one-sixth their weight of salt, and the mixture broken up as finely as possible in a vessel made from a hollowed-out tree trunk. Sometimes feet (carefully cleaned) are used in this process. The resulting mass is left to ferment for two or three days in a large heap, and then spread out again to dry. Rice meal is probably added before the final drying. *Trassi* is prepared at Merauke only by Javanese and Chinese; Papuans are involved only as hired labour,

Conclusions

Fermented fish sauces and fish pastes are used widely in South-East Asia. where they render rice diets both more palatable and more nourishing. They provide a cheap and relatively simple means of preserving most of the food value of fresh fish without expensive equipment.

They have been made at Merauke in Netherlands New Guinea and on a very small scale at Arama in New Caledonia. Their manufacture should also be possible in other places of the South Pacific, especially those where an Asiatic population would provide a ready market.

If these fish products should prove acceptable to the indigenous peoples, they would be a nutritionally valuable supplement to diets based either on rice, bread or starchy roots.

FISH SAUCES PROVE POPULAR IN AFRICA Encouraging Results From Acceptability Trials

IN the foregoing article describing the preparation and use of fish sauces in South-East Asia, it is suggested that they might well be useful in other parts of the world where the people's diet supplies little animal protein.

In Africa, the average diet in many parts appears deficient in protein, especially animal protein. Fish sauces are not used, but offer an obvious possibility of improving the position. Recently the Food and Agriculture Organization of the United Nations requested the Food and Nutrition section of the Research Institute of the French Cameroons to study the acceptability of such products by Africans. The results of this study have been described by Masseyeff, Cambon and Bergeret in the issue for April 1955 of the French journal Encyclopèdie Mensuelle d'Outre-Mer.

The products used were prepared