

UTILISATION OF TRASH FISH

I. PREPARATION OF FISH FLAKE

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The paper deals with the investigations carried out on the preparation of odourless fish-starch flakes using partially deodourised trash fish meat and different sources of starch like corn, tapioca, maida and blackgram.

It has been found that the products using corn and tapioca are better compared to those prepared using other two starches, the product from corn being the best. The product has a protein content of about 20% and has been found to have a storage life of 4 months at 37°C.

INTRODUCTION

Trash fishes form a sizable fraction of our marine fish landings. In the year 1966, trash fishes like cat-fish (*Trachysurus spp.*), ribbon-fish (*Trichurus spp.*), leather jacket (*Chorinemus spp.*), sole (*Cynoglossus spp.*), silver bellis (*Leiognathus spp.*), sciaenids and other miscellaneous fish constituted 1,44,037 m. tons out of our total landings of 8, 89 651 m. tons (private communication). Some of the larger varieties of these are utilised by the curing industry, but the smaller and cheaper varieties are mainly utilized for the production of fish meal intended for cattle and poultry feed. Attempts have also been made with some success for the production of fish protein concentrate which can be utilised for human consumption as well. It may, however, be

pointed out that not much work has been reported as to how best the FPC can be incorporated in the daily diet of human beings. So it was felt that a modified and ready compounded food material based on starch and fish which can be easily prepared for the table would go a long way in solving the protein deficiency of our population.

Some work has been done in India on protein rich food materials based on starch and fish. Bhatia *et al.*, (1959) have reported the production of fish macaroni based on fish and wheat semolina or a mixture of these two with tapioca flour. Moorjani *et al.*, (1964) have reported about "Fricola", a fish enriched farinaceous product. Krishnaswamy *et al.*, (1965) have worked out a formula of a ready-to-serve fish paste and fish-potato flakes.

Assellbergs and Chan (1962) and Assellbergs (1962) have outlined the manufacture of fish potato flakes.

The present work describes a method of production of fish flakes using cheap variety of trash fish (deodourised after cooking) and starch which can be consumed after simple frying in oil. The suitability of starch from different sources was studied and comparison of the properties of flakes prepared out of different starches was made.

MATERIALS AND METHODS

Mixed trash fishes comprising mostly of cat-fish, Jew fish and Kilimeen obtained from Cochin were dressed and cooked in twice the weight of water for 30 minutes. After cooking, the meat was separated from the bones by handpicking. It was then deodourised by the method of Sen and Rao (1966). The meat was cooked in equal amount of water at pH 5.5 adjusted by the addition of ortho-phosphoric acid and pressed in canvas bag. The pressed meat was again dispersed in hot water at pH 5.5 and allowed to boil for a few minutes. Pressing out and boiling was repeated once more and the meat deodourised thus was pressed again and used for the preparation of fish flakes.

The meat after deodourisation was homogenised with the following varieties of starch viz; corn, tapioca, and blackgram in the proportion,

Deodourised fish meat	1kg.
Starch	1.25kg.
Water	2.50-2.75kg.
Salt	40g

Homogenisation was done in a waring blender. It was then poured in flat aluminium trays previously smeared with an edible oil (to prevent sticking) to a thickness of 1mm. The trays were then passed

through a steam chamber on a belt conveyor at a speed of 1 m per minute. The cooking took 20 minutes and the cooked film after cooling to room temperature was cut with a sharp knife to give flakes of of 2.5×2.5 cm. size.

The flakes were spread on trays and dried in a tunnel drier at a temperature of 70°C . The drying time was found to be $1\frac{3}{4}$ hours at this temperature and $4\frac{1}{2}$ hours at 50°C .

RESULTS AND DISCUSSION

The degree of deodourisation of the meat at different stages was measured in terms of 95% alcohol extractive matter after drying to a moisture content of Ca 8%. The quantities of alcohol extractive matter were 14.17%, 8.92%, 3.15% and 1.87% after each successive cooking and pressing. Even though losses of lipid matter, soluble protein and non-protein substances during cooking and pressing might be the major cause of decrease in alcohol extractive matter, the odour bearing compounds being highly steam volatile are also eliminated along with the above compounds. The deodourised meat after drying had a moisture content of 7.82%, total nitrogen: 14.46%, non-protein nitrogen: 2.62%, water soluble nitrogen: 3.16% and free alpha-amino nitrogen: 0.31%.

The drying rate of the flakes in the case of preparation using corn starch is shown in fig. I.

As might be expected, the drying rate curve was steeper at 70°C than at 50°C . Since the product was not affected in any way by drying at 70°C , this temperature can very well be applied for drying since drying time was reduced to 39% of that at 50°C .

The product using corn starch was analysed after drying and the results are:

Fig. 1. DRYING RATE OF FISHFLAKE

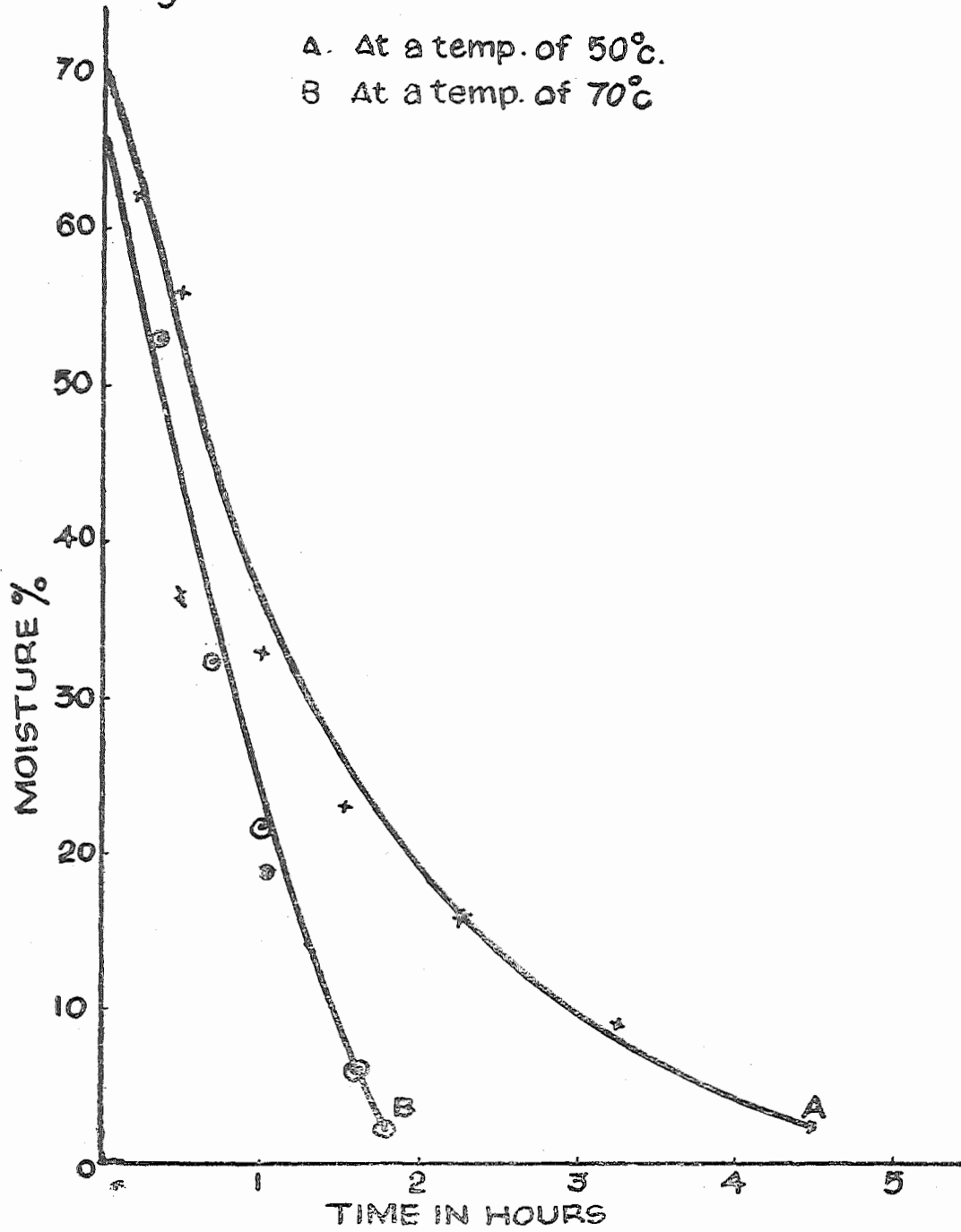


fig. 11. ERH STUDIES

A. TAPIOCA - FISH FLAKE

B. CORN - FISH FLAKE

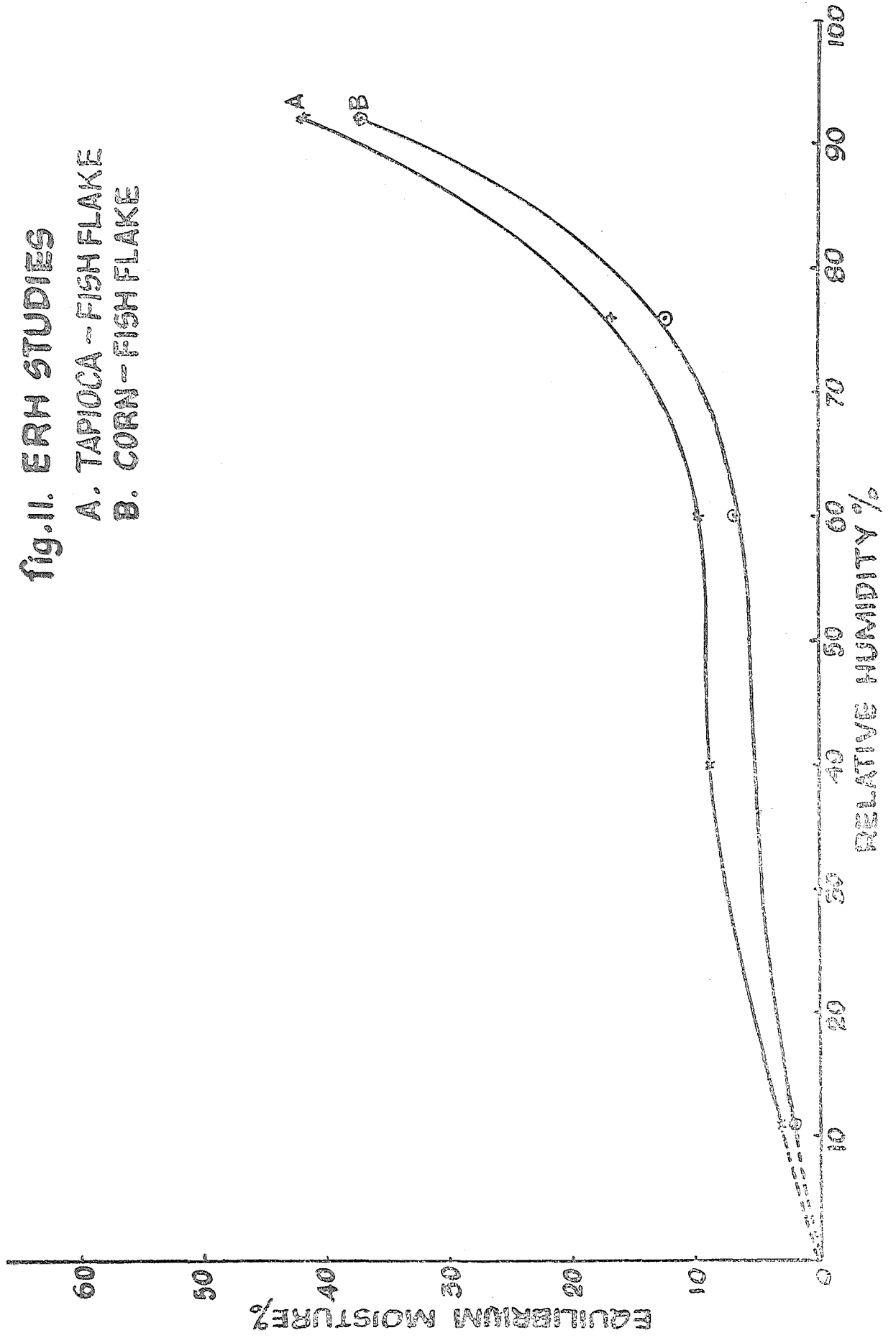


fig-III. B.E.T. PLOT FOR
A. Corn - Fish Flake
B. Tapioca - Fish Flake

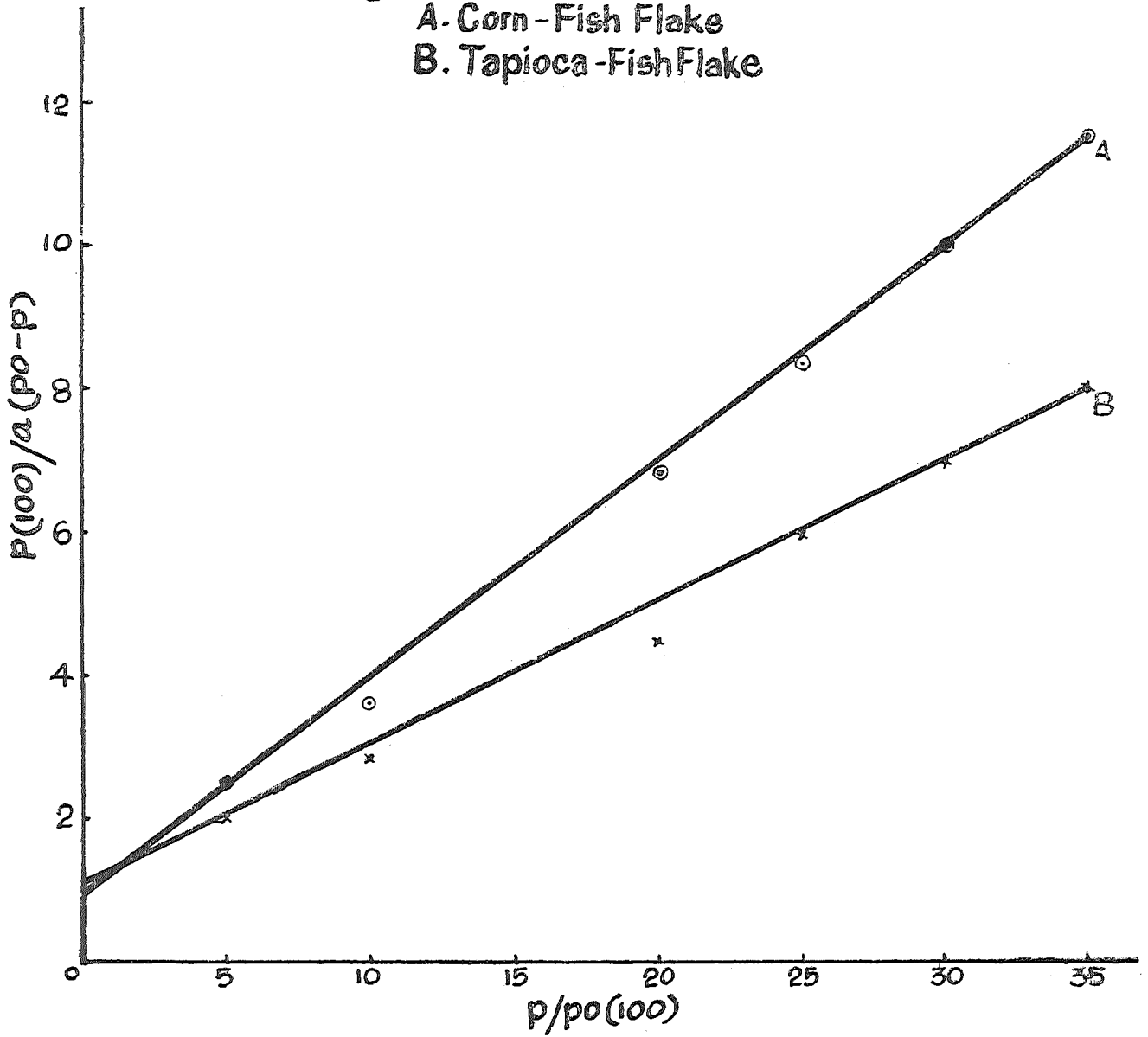


TABLE I

Starch used.	dried flakes No./5gm	% increase in wt. during frying.	%increase in volume	Colour on frying	I	II
Maida	14	8.5	79.2	brown	Poor	F-P
Corn	14	32.3	100.4	No colour change original pale yellow	Good	Good
Tapioca	14	28.0	91.0	No colour change original pale brown	Fair	F-P
Black-gram	24	7.5	47.4	charred appearance	Poor	Poor

I : Taste
II : Overall quality

TABLE II

	Intercept $100/a_1c$	Slope $\frac{c-1}{a_1c}$	Optimum moisture on Dry Wt. Basis, a_1
Tapioca Product	1.13	0.1919	4.92%
Corn Product	1.00	0.2917	3.31%

TABLE III

Gauge of polythene bag	Moisture content of flakes after 1 month storage at 92% RH	Moisture content of flakes after 1 month storage at 12% RH
200	10.80%	4.32%
300	12.45%	4.43%
400	12.25%	4.91%

(Initial Moisture content 8.1%)

Moisture: 7.40%. Protein (N \times 6.25): 19.59%, Salt: 4.31%, Fat: 1.04% (DWB), Ash: 5.63% (DWB), Calcium (as Ca O): 450 mg % (DWB), Phosphorus: 323 mg % (DWB), Iron: 11.70 mg% (DWB) Starch: 67.66% (by difference), calorific value: 408.0 (fried sample)

Frying Characteristics

The products prepared out of different starches were fried for 30–60 seconds in refined ground nut oil at 250°C and the frying characteristics were measured in terms of intake of oil during frying, % increase in volume due to swelling, colour changes during frying and taste of the fried product. The increase in volume (due to swelling) was measured on the principle based on which the cooking quality of rice was measured by Bienveindo O. Juliano *et al.*, (1965). The displacement of kerosene by the same weight of flakes both before and after frying was measured and the difference reckoned as increase in volume. The results are given in table I.

As seen from the figures in the table, the extent of swelling was least in the case of product from black-gram even though it had minimum density as shown by the number per 5 g. Maximum swelling was in the case of product from corn followed by the tapioca product. These significant differences in qualities in the products obtained using different starches can be attributed to the differing properties of the starch used. These results indicate that corn starch is the best for preparing the flakes as regards increase in weight during frying and swelling properties as measured by increase in volume during frying. This was closely followed by tapioca starch, while the other two starches tried were less satisfactory.

It was found that after frying there was a loss of amino acids corresponding

to 11.57 mg N/100 g dry flakes, in the case of product using corn probably due to decomposition at the high temperature employed for frying.

Equilibrium Relative Humidity studies:

With a view to studying the storage characteristics of the product using corn and tapioca starches, equilibrium relative humidity studies were conducted as described by Iyengar *et al.*, (1965) and Strolle *et al.*, (1965).

The fish flakes were powdered so as to pass through a 40 mesh size sieve and lots of 3–4 g were placed in petri dishes and exposed to different relative humidities obtained by placing different salt solutions of different % of sulphuric acid in desiccators. The weight of each sample was checked periodically until constant weights were attained. The equilibrium moisture contents were attained in all the cases within 4 days, and were determined by drying at 100–105°C for 6 hours. The values were plotted against the corresponding relative humidities. (Fig. 2)

As seen from the figure, the equilibrium moisture contents show a steep rise beyond RH of 60%. Hence exposure of the product to an RH above 60% will cause rapid deterioration. The sample kept in 92% RH became ammoniacal after 4 days. Mold growth was noticeable in this sample after 6 days. No caking was found in any of the samples.

Optimum moisture content:

It is essential to limit the moisture content of the product to an optimum level in order to get the maximum shelf-life. Knowledge of this optimum moisture level is necessary to prescribe the maximum allowable humidity limits during packaging and storage. Salwin (1959) found that moisture content at which

certain dehydrated foods have got maximum storage life agreed closely with the moisture content representing a calculated monolayer of adsorbed water. This monolayer was calculated in the case of fish flakes from moisture sorption data by means of Brunauer, Emmett and Teller (B. E. T.) theory of multimolecular adsorption. (Strolle and Cording Jr. 1965). The optimum moisture content was calculated by transferring the isotherm obtained from equilibrium relative humidity studies (in the range of 5–35% RH) by the B. E. T. equation.

$$\frac{p}{a(p_0-p)} = \frac{1}{a_1 c} + \frac{c-1}{a_1 c} \times \frac{p}{p_0}$$

where,

$a = g$ of water/100 g dry matter corresponding to a relative vapour pressure p/p_0 , $p =$ moisture vapour pressure used in the experiment, $p_0 =$ vapour pressure of pure water at the same temperature (28°C), $c =$ a constant related to heat of absorption.

The data were plotted with $\frac{p(100)}{a(p_0-p)}$ as ordinate and $\frac{p}{p_0}(100)$ i. e., RH % as abscissa. A straight line was obtained with slope $\frac{c-1}{a_1 c}$ and intercept $\frac{100}{a_1 c}$ (Fig. 3)

From this graph, a_1 , i. e., the optimum moisture content on dry weight basis (monolayer of water adsorbed) was calculated. The values of slopes and intercepts in the case of the corn and tapioca products are given below. (Table II)

Bacteriological Examinations

The product was tested for salmonella, streptococci and coliform, all of which were found to be absent. The total plate count was 9.0×10^3 immediately after preparation and $1.2 \times 10^3/g$ after 3 months storage at 37°C. This can be attributed to

the gradual destruction of the organisms due to the unfavourably low moisture levels in the product.

Shelf-Life

The fish flakes were found to remain in good condition for several months in sealed polythene bags as found by organoleptic studies. The variation in moisture content when the fish flakes are packed in different gauge polythene bags and stored for one month at different relative humidities is shown in table III.

The results indicate that polythene bags of various gauges tried are not suitable as a packaging material for this product in so far as they are permeable to moisture vapour. Hence any commercial venture attempting to market this product should use moisture vapour proof packaging material.

Notwithstanding the slight change in colour, the product remained acceptable at the end of storage for 4 months at 37°C and had the same extent of swelling and crispness on frying as freshly prepared material. No rancidity was noticed probably because of low fat content.

CONCLUSION

Cooked and deodourised trash fish meat can be successfully utilised for the production of fish flakes containing 20% protein after mixing with carbohydrates. Of the various carbohydrates, corn and tapioca were superior to mada and black-gram, the product from corn being the best.

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