LECTURE NOTE

ON

FISH PROCESSING, PRESERVATION AND MARKETING (3 UNITS)

FIS 401

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FISH PROCESSING

Fish canning: - is a process involving heat treatment of fish in sealed containers made of tin plates, aluminum cans or glass, until the product has been fully sterilized.

During caning, heat treatment should be sufficient to destroy all heat sensitive bacterial and spores, in activate, the enzymes and cook the fish so that the product remains acceptable to the consumer after prolonged storage i.e. commercialized sterilization this is used in thermal processing to describe the heat treatment designed to kill substantially all microorganisms and spores which is present and cable of growing in the product.

The canned food fish is also prevented from contamination by pathogenic organisms by storing them in a virtually airtight package. If heat treatment is properly carried out canned fish may remain in storage for several years without refrigeration.

Excessive heat treatment or over processing must still be avoided, as this will adversely affect the organoleptic and nutritional quality of the fish. Traditional canned fish are obtained from small pelagic fish species such as herrings (*Clupea spp*), Sardines (*Sardinella sp*), Mackerels (*Scomberomerus sp*), Anchovies (*Engraulis sp*), Tuna (*Thunnus sp*). Bonga (*Ethmalosa sp*).

Fish intended for canning must be in first class condition and must be handle in hygienic manner to reduce microbial load on the fish. Poor quality fish will produce canned fish with offensive odour and flavour, poor texture.

Fish mince: - this can be defined as flesh separated in a communited form, from the frames, scale, bones and fins of fish. Fish mince can be prepared either mechanically by the use of flesh bone separator or non-mechanically

Mechanical preparation: - a flesh/bone (or meat/bone) separators also called Deboning machines can be used to retrieve flesh attached to bones and frames of fish and thus make them better utilized instead of discarding them as a waste. Prepared fish by removing the head, skin, bone, internal organs such as gut, kidney, liver, air bladder and blood vessel before passing it into flesh/bone separator. When this prepared fish are fed into d machine it is squeezed between the feed belts and perforated drums in such a way as to allow only flesh to pass through, while the bones and skin are collected separately. These are utilized thus maximizing the profit from the landings and fish is still made available cheaply to the consumers.

There is a non-mechanical method of preparation but if not properly handled it can result to off flavour. It involved the use of acid and end product may have rancidity or autolysis.

Minced fish is obtained from filleting leftovers to headed and gutted fish using a bone/flesh (meat-bone) separator to remove bones from the edible flesh. Fish mince is very versatile and can be used to make a variety of products such as fish portions, fish fingers, fish cakes, fish sausage and fish cheese.

Surimi is a wet concentrate of proteins of fish muscle that is mechanically deboned water-washed fish flesh. It is prepared from marine fish. Minced fish is cooled water-washed to remove fat and water soluble components. The end product is frozen and is used in the preparation of diverse fish foods such as Kamaboko, Tempura and Chikwa (Japanese Surimi based products) fish sausage fish ham, fish stick, fish balls hamburger.

Difference between minced fish and surimi is that while minced fish is the fish flesh which is separated from bones and skin (usually mechanically) surimi is prepared after minced fish have been washed in water to remove fat and wet soluble components.

SPOILAGE INICES

Bacterial and Enzymatic Spoilage

Bacteria are unicellular microscopic organisms which occur almost everywhere in nature. They are living things which often cause fish spoilage. They might have a generation time of 20minutes at 30^{o}c. in such a case, a single bacterium may give rise to 4,000 bacteria in 4hours, 16million in 8hours and one billion in 10hours. If temperature water content of the fish, osmotic pressure, pH medium, redox potential and the nutrient composition of the environment are conducive.

Bacteria Spoilage

Some bacteria are naturally present in the living fish but their multiplication and growth is limited by the general metabolic reactions of the fish (low pH of gut, anaerobic environment on the gut and its enzymes, acid in the viscera which often digest the bacteria and cause the gut condition to be favourable for their growth). When a fish dies, these metabolic actions are slowed down and micro-organisms begin to multiply. The bacteria lining the gills penetrate the flesh and the vascular system. Those lining the gut penetrate the nearby tissues through the peritorieuna. Bacteria in the slime penetrate the skin into the surrounding tissues. The powerful gut thus giving way for bacteria to enter into the tissues. These bacteria secrete digestive juices and enzymes which breakdown the tissues and cause spoilage of the fish. The end result of microbial invasion of the tissues is the loss of fresh flavour and odour of the fish replacing it with a sour and stale odour which changes to ammoniacal, putrid and faecal odour at the later stage of spoilage.

The initial elastic texture of the fish change to softer flesh with grittiness making the fish exceedingly soft flabby retaining finger identifications in the skin. The flesh of such spoilt fish is later torn from the backbone (unfit for human consumption and must be discarded, downgraded for the production of animal feed supplements).an economic loss hence minimize fish spoilage through better fish handling of fresh fish.

Enzymatic Spoilage- Enzymes are high molecular weight metabolic catalysts, protein in nature and are needed in small quantities. They operate in their native forms and become denatured when conditions become unfavourable. Temperature, acidity, substrate concentration, enzyme activation and synchronization affect enzyme activities.

Enzyme spoilage is known as AUTOLYSIS i.e. self digestion. It is a process whereby enzymes against which the fish is normally protected alive, under optimal conditions for enzymatic activity, post mortem, digest the fish tissues such enzymes are present in the gut, on the skin and in the tissue. Autolysis causes off-odours, off-flavour and softening of flesh and tissues. It causes general disruption and permission of movements of enzymes and oxygen in the muscle. Such enzymes include cathepsins and proteolytic enzymes. They make the fish unpalatable, unattractive and unfit for consumption. Gutting should be carefully and thoroughly done and belly cavity thoroughly washed (Athepsin in fish is more active in fish than in meat hence autolysis is faster in fish).

The breakdown of amino acids (lysine, histidine and) into toxic compounds such as cadaverine and co_2, histamine and $co_2$and putrescine and co_2 respectively is undesirable to consumer. Shell fish spoil faster than true fish due to higher content of non- protein N-

compounds such as Arginine phosphate. Japanese allow these breakdown and use such for fish sauce and fish silage for delicacy in Japan.

Chemical Spoilage- is caused by reactions in the fat of fish, giving rise to unpleasant odours and flavours called Rancidity which is often caused by the fish oil (with unsaturated fatty acids).

Assessment of fish spoilage

Physical method- instrumental test piercing a Torrymeter on the skin of about 16 randomly selected fish and picking 1 of the result as representing the entire lot. Measure the pH also.

Subjective method- involves the use of human sense organs and not machines, chemicals or reagents. It is often called Sensory tests, may be biased but its represent the customers view e.g.

Organoleptic test – utilizing the sense of touch, smell, sight and taste for quality assessment of fish.

Sight- gill colour, presence/absence of indentation

Flavour- for degree of freshness

Texture- state of the muscles firmly held condition of the belly, or soft presence of blemishes and parasites on fish.

Visual exam – in cured fish – general appearance, degree of insect/ mould infestation intensity of smoking from appearance bulging cans, broken fishes.

Touch- texture of fish, elastic firm, soft or flabby, fragmentation in dried whole fish if fish end without breaking it is flexible

Brittle – if it breaks into small

Smell – Good and bad flavour, smoke or cooked. (use-limited because not all can smell)

Taste – Sweet, bitter, salt and sour,(salty or acidic) fermented and marinades(analytical method gives better result)

Flavour – a combination of taste and odour cause by volatile organic compounds. Mostly use objective test rather than taste panel evaluation eventhough too expensive (chromatograph which measure a flavour at a time). Thus they often train taste panel to prevent bias.

PROPER FISH HANDING A PRE – REQUITE TO GET EXCELLENT PRODUCT

In African countries generally, fish are poorly handled, some die get mixed up with sand and other contaminating debris at the handling shores. In aquaculture, the method of harvesting which usually involves the dragging of seine nets on the bottom, of a pond contaminates the fish with mud and silt. The scales skin of some fish like *Clarias* and Chrysichthys species can be badly bruised and damaged. In addition to poor handling, the fish may pass through a long chain or distribution network before reaching the ultimate consumer. The simplified distribution chin for fish in most situations is Fisherman – Whole saler – Retailer – Consumer.

Fish most remain in acceptable quality to the end of this chain. The high temperature and high relative humidity of the tropics greatly facilitates spoilage, resulting in a considerable loss of fish. To maintain good quality of fish from fisheries good handling practices must involve Keeping the fish cool; fish undamaged; fish flesh clean.

Some of the fish preservation techniques have broadly grouped into 2

A. Low temperature techniques e.g
    I. Chilling using ice-blocks/ice flakes, compact solar refrigerator, refrigerated sea water (RSW), chilled sea water (CSW).
    II. Freezing e.g blast freezing using blast refrigerator, plate freezing
    III. Cold storage using cold room.
B. High temperature techniques e.g
    I. Drying using solar fish drier e,g mud/bamboo solar drier, oil drum, solar drier, solar dome drier

II. Smoking using traditional Ghanaian mudoven, NIOMR and Kainji gas smoking kiln, Chorkor fish smoking kiln

III. Salting and Drying

1. Fish canning: -

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Bacillus stearothermophilus

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High temperature techniques and low temperature techniques

High temperature	Low temperature
This constitutes the traditional methods of fish preservation	This constitutes the modern methods of fish preservation
It takes place even at the absence of electricity	May not take place except there is electricity or source of light
Can take place even at the village level at any where	Can only be used in the town and cities where there is source of power
Low cost of operation	It is ex[pensive
Takes place under high ambient temperature	Takes place under low temperature $<40^0$C
Labour intensive	Not laborious
Temperature may not often be controlled	Temperature is often controlled
Time consuming	Time managing
Not often hygienic	Highly hygienic
Allow few quantity to be processed at a time	Large quantity can be processed at a time
Needs little or no skill	Requires skill in operation
Quality of products vary	Quality of product is uniform
Package is not often attractive	Package is very attractive
Smoking, sun drying, salting	Freezing, chilling, icing, cold room