Fungal Problems In Dried Fish

P. R. G. VARMA

Among the methods of preservation of fish, salting and drying is the cheapest. So this method is used by the common fishermen to preserve fish. In a hot and damp climate as seen in India, dried fish spoil very quickly. The main types of spoilage of dried fish are chemical, bacteriological and fungal.

Fungi

They are present everywhere in nature-in air, soil, water etc. They form spores which can survive for long periods. These spores are carried away by different means. The contamination of fish with fungi during drying takes place mainly from air and soil. Insects and mites also carry these fungi spores in their bodies and thus contaminate the fish.

Characteristics of fungi

Fungi are plant like organisms, but they do not contain chlorophyl. They are unicellular or have tubular filaments. They usually produce spores. Since they do not contain chlorophyl they cannot produce their own food and so they live as saprophytes (if the food source is dead) or parasites (if the food source is living). Many saprophytic fungi cause spoilage of agricultural and domestic products and result in thousands of tonnes worth of damage each year. Parasitic fungi may cause major losses to crop plants. However, not all parasites are disease agents or pathogens. Fungi cause a large number of plant and animal diseases mainly because fungi can penetrate the cell walls.

Factors affecting fungal growth

1. Water activity (a_w)

Water activity is the aqueous vapour pressure of the substrate divided by the vapour pressure of pure water at the same temperature. Whereas

the majority of bacteria require a_w levels in excess of 0.95 for good growth and 0.98 for optimal growth, most moulds are able to grow at a_w levels down to 0.80 and some, the xerophilic moulds, can grow at a_w values as low as 0.65.

2. *pH value*

Most of the common moulds will tolerate a wide range of hydrogen ion concentration provided other conditions are favourable. In general, slight acidity is favourable to spore germination and rapid growth.

Extensive mould growth can occur also at neutral pH even in the presence of bacteria and the growth of bacteria following moulds is normally indicative of advanced spoilage.

3. *Nutrients in fish*

Many moulds are able to proliferate on foods deficient in essential vitamins, since they are able to synthesise their own vitamin requirements. The production of enzymes which hydrolyse macromolecules such as proteins, lipids and polysaccharides may give moulds an advantage in initiating their own growth in foods which are relatively resistant to bacterial attack.

4. *Inhibitory chemicals present*

Many naturally occurring antimicrobial compounds in foods have fungistatic activity, but they are rarely present in amounts sufficient to prevent growth of moulds.

5. *Environmental conditions*

These factors include temperature and gaseous environment during food storage. The majority of fungi associated with foods are mesophilic, psychrotrophic or psychrophilic. Certain fungi are thermophilic. Growth of moulds on foods has been reported over the temperature range of -10°C to 45°C. The gaseous environment greatly affects the growth of filamentous fungi but whilst it was thought that moulds could not grow in canned or packaged foods because of the existing vacuum, fungal

spoilage of fruits etc was observed at CO_2 levels of about 50-10 mm. Growth of some fungi has been reported at extremely low levels of oxygen, surviving in an atmosphere of 95% CO_2.

*6. **Processing factors***

a. Heating

Most spores are destroyed by heating for 5 minutes at 65°C or 1 minute at 80°C, although species of *Aspergillus* and *Penicillium* show a higher tolerance to heat. Ascospores and Sclerotia are more resistant and can withstand 90-100°C for a short time.

b. Radiation

Radiation resistance of moulds is normally similar to or less than that of vegetative bacteria. Irradiation doses of 0.05-0.20 Mrad have been found to reduce mould spoilage of various products and extend the shelf life.

*7. **Added chemical preservatives***

Chemical preservatives active against moulds include benzoates, propionates, sorbates and ethylene oxides. Sulphur dioxide, primarily used to preserve colour, is an effective preservative. Nisin is permitted in some countries to control mould growth.

Mycotoxins

Certain fungi, during their growth in food products, produce toxins. These toxins are known as mycotoxins and they mainly affect liver and subcutaneous tissue. Some of the mycotoxins produced by fungi are.

Aflatoxins, Ochratoxin, Rubratoxin, Patulin, Citrinin etc.

Fungi isolated from dried fish

Some of the fungi isolated from dried fish are *Aspergillus* spp. - *A. niger, A. flavus, A. candidus, A. amstelodami, A. chevalieri, Rhizopus, Mucor, Penicillium spp., Polypaecilum pisce.*

Spoilage of fish by fungi

1) Colour change due to fungal growth
2) Smell/flavour changes
3) Breakdown of fats (lipolysis) and protein (proteolysis)
4) Production of mycotoxins

Control of fungal spoilage

1. Chemical methods

a) Use of preservatives (use liquid dips or dusting)

The main preservatives used are calcium propionate, potassium sorbate, sodium benzoate, parabens, sulphur dioxide and sodium nitrite

b) Use of fungicides. Probably expensive to use. Broad spectrum fungicide are toxic to humans too.

c) By Gamma irradiation. The main problem is re-contamination if the product is not sealed properly. High cost of processing and packing is another problem.

2. Physical methods

By applying the following measures we can control fungi.

a. Control of storage temperature - High or low
b. Control of water activity by controlling moisture, salt and fat.
c. Keeping storage period as short as possible
d. Adopting insect control measures like fumigation. Discard insect damaged fish.
e. Applying proper curing methods viz. drying quickly after brining, avoiding contamination from soil, dust etc.