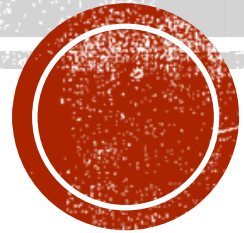
# QUALITY CHANGES AFTER DEATH IN SEAFOODS



*3. Week*

In raw fish deterioration takes two forms, microbiological and non-microbiological.

Microorganisms are present on the external surfaces (including slime) and in the gut of fish but during life are kept from invading the sterile flesh by the animals normal defences. The normal population or flora on fish consists of several groups or genera of microorganisms. On death, the microorganisms or the enzymes they secrete are free to invade or diffuse into the flesh where they react with the complex mixture of natural substances present. The numbers of microorganisms in the flesh grow slowly initially but then increase rapidly. Their microbial enzymic action results in a well defined sequence of changes in odoriferous and flavorous compounds.



In the many marine species that contain the odourless compound TMAO, one prominent reaction is its reduction to TMA which possibly in cojunction with fatty substances is alleged to smell fishy but certainly on its own is always recognised as being ammoniacal. The gradual reduction in concentration of TMAO an increase in TMA have been used as chemical measures of spoilage. Elasmobranchs contain high concentrations of urea which is microbiologically degraded to ammonia.



In addition to changes in odour and flavour the continued action of microorganisms affects the appearance and physical properties of several components of the body. The slime on skin and gills, initially watery and clear, becomes cloudy, clotted and discoloured. The skin loses its bright irridescent appearance, bloom and smooth feel and becomes dull, bleached and rough to touch. The peritoneum, the membrane which lines the visceral cavity, becomes dull and can be progressively more easily detached from the internal body wall.

Non-microbial deteriorations are of two kinds, enzymatic and non-enzymatic.

The former arise in the first place from the large number of different enzymes naturally present in the flesh. In life these are engaged in normal processes such as tissue building and muscular contraction and relaxation but on death they become involved in predominantly degradative reactions. One of these reactions is the gradual hydrolysis during the first few hours of glycogen to lactic acid, resulting when the process is complete in a fall in pH from about 7.0 to 6.0-6.8 depending on species and the condition of the fish. The decline in pH is accompanied by the natural post-mortem stiffening called *rigor mortis*.

The phenomenon of rigor just referred to is caused by another complex series of enzyme reactions lasting several hours or days depending upon temperature. Further reactions then render the flesh progressively more flaccid again. Rigor is also of some importance for raw fish quality in that fish flexed or squashed when in this condition suffer enhanced textural damage. Also, pre-rigor fish held at temperatures of 15-25 cantigrade tend to undergo a strong contraction process that can break up the flesh and so render it unacceptable in appearance or for further processing.



The most significant enzyme deteriorations are those that affect flavour. The compounds responsible for the desirable sweetish, meaty and characteristic fish flavours of different species are changed by the intrinsic flesh enzymes to more neutral-tasting compounds with the result that the fish become relatively more insipid. If this process of autolysis then contiues sufficiently far it is believed that in many species the concentration of one particular breakdown product, hypoxanthine, becomes high enough to contribute to the bitterness characteristic of unfresh fish.



Of the non-enzymatic deteriorations the most prominent is the development of rancidity. In fish this is caused by the attack of oxygen on the chemically unsaturated fatty substances contained in the flesh and other tissues. Fish in general have lipids of higher degree of unsaturation than most other foods and are therefore particularly prone to oxidative rancidity.

In some pelagic species which have high lipid contents, rancidity has been detected during spoilage.