

MINISTERIE VAN LANDBOUW  
Bestuur voor Landbouwkundig Onderzoek  
Rijkscentrum voor Landbouwkundig Onderzoek - Gent  
RIJKSSTATION VOOR ZEEVISSERIJ  
Oostende  
Directeur : P. HOVART

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**PH OF FISH MUSCLE :  
COMPARISON OF DETERMINATION METHODS (\*)**

W. VYNCKE.

Mededelingen van het Rijksstation voor Zeevisserij (C.L.O. Gent).  
Publicatie nr 172/1981.

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(\*) Paper presented at the 11th Meeting of the West-European Fish Technologists Association, Copenhagen, August 1981.

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## 1. Introduction.

The determination of the muscle-pH is one of the objective methods used to assess the freshness of fish. Although the results do not always correspond perfectly with the organoleptic judgment (which is also the case for other objective methods), pH-determinations generally provide useful additional information on the quality of fish. For most fish species pH-values exceeding 6.8-7.0 indicate fish of suspected freshness.

Furthermore, for studies involving texture of fish e.g. deepfreezing or canning, the determination of the pH of the raw material is very often important as the pH of fish flesh is directly related to firmness (1).

Several techniques are used to determine fish-pH. It can be measured directly by inserting a combined glass-calomel-electrode into the flesh. The method is simple but requires several determinations on the same fish and on 5 to 10 fish of the same batch to be reasonably accurate. Earlier experiments carried out in our laboratory showed that e.g. for cod the pH of the tail section of the fillet was on average 0.1 pH unit lower than in the head section, due to quicker spoilage in that part of the fish (2).

Most of the time, it is more convenient to measure the pH on a pooled sample of minced fish. This sample can further be used for chemical tests such as TMA, TVN etc. There is however a difference with the direct method. Comparative experiments in our laboratory on several fish species showed the pH of the minced fish to be on average 0.12 units higher than the pH measured directly in the fish (2).

The minced fish can further be homogenized with one or two parts of distilled water, a method frequently used in Europe, or sodium iodoacetate solution, a method often preferred in North-America (3).

As it appears that pH-values are influenced by the method used, we took the opportunity of routine pH-measurements to test the three indirect determination methods mentioned above. In addition, the possible usefulness of measuring pH of fish flesh with pH indicator strips used in the meat industry (4) was investigated.

## 2. Materials and methods.

- Fish : cod (*Gadus morhua*), haddock (*Gadus eglefinus*), whiting (*Merlangius merlangus*), ling (*Molva molva*), plaice (*Pleuronectes platessa*) and redfish (*Sebastes marinus*) were used depending upon the experiments carried out for other purposes in the laboratory.
- pH-determinations :
  - (A) on mince : a composite sample of fish muscle is passed twice through an electric meat grinder and thoroughly mixed with a glass rod. The pH is measured by inserting a combined glass-calomel-electrode.
  - (B) on mince with water : 10 g minced fish is homogenized with 20 ml distilled water for 1 min in a Waring blender. The pH of the slurry is measured.
  - (C) on mince with iodoacetate : same procedure as for (B) except that 90 ml 0.005 M sodium iodoacetate is used.
  - (D) with pH indicator strips : the Merck 9547 model was tested. It is a non-run plastic indicator strip with a pH range of 5.2-7.2..
- Procedure : In a first period, method A, which is normally used in our laboratory, was systematically compared with method B. The pH-range was 6.3-7.1 (method A). Thereafter, methods A and C were applied. Finally, method D was experimented. For each series, 100 measurements were made. The determinations were spread over a period of four years.

### 3. Results and discussion.

pH measurements made on mince (method A) were on average 0.02 units lower than on fish homogenized with water (method B), although individual measurements could differ up to 0.20 units, the standard deviation of the difference being 0.102. When using the statistical method of the paired comparisons however this difference appeared not to be significant.

The use of iodoacetate on the other hand lowered pH values significantly by 0.16 unit on average, but there was a good relationship between both methods. The linear regression equation was :

$$Y = 1.30 + 0.79 X$$

where Y = pH of minced fish (method A)

X = pH of fish homogenized with iodoacetate (method C)

The correlation coefficient was 0.899 and was highly significant. There was no significant difference between the fish species tested. When comparing data obtained by research workers using the iodoacetate method, the difference in pH-values should be taken into account.

pH indicator strips (method D) lacked sufficient accuracy to give reliable data notwithstanding the fact that they are of the non-run type.

### 4. Conclusion.

The three determination methods of pH on minced fish flesh gave results which can be easily correlated. However, as mince without water or iodoacetate solution can be used directly for other chemical analyses, this method is preferred in our laboratory.

pH-indicator strips of the model described were of no use with fish.

### Summary.

Three methods to determine pH were compared i. e. on minced fish (A), on minced fish homogenized with water (B), and on minced fish homogenized with 0.005 M iodoacetate solution (C).

A non-run plastic pH indicator strip was also tested. There was no significant difference between methods A and B. Method C gave values which were on average 0.16 pH-units lower. The pH-indicator strip gave unreliable results.

#### Samenvatting.

Drie methoden voor de bepaling van de pH werden vergeleken, nl. op gemalen vis (A), op gemalen vis met water gehomogeniseerd (B) en op gemalen vis met 0,005 M jodoacetaatoplossing gehomogeniseerd (C). Een niet uitlopende plastic pH-indikator strip werd eveneens uitgetest.

Er was geen significant verschil tussen methoden A en B. Methode C gaf resultaten die gemiddeld 0,16 pH-eenheden lager lagen. De pH-indikator strip gaf onbetrouwbare resultaten.

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