# SOME CONSIDERATIONS CONCERNING VARIATION OF RESIDUAL OXYGEN CONTENT IN UNDERVACUUM FOOD PACKAGING

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In this work are exposed some results concerning determination of residual oxygen content in different vacuum packed preserved foods. The residual oxygen content is related with oxidegradative evolution of these products.

## Introduction

It is very known that stockage in air of packed foods is unconvenable [1]. Therefore the methods of air-removal at packaging and storage of foods in modified atmosphere-packages have been much developed in the recent years [2÷6]. New materials, which allow a food product-package compatibility (3,5) and more selective techniques for analysis of chemical and microbiological changes of food products in the period of storage, have been also promoted [4,6].

Examination of the variation in residual oxygen content of vacuum packed foods in the period of storage can be an important indicator on the evolution of degradative processes in food products.

Therefore the storage period, specific to different foods, must be limited for toxicological reasons [7,8].

In this work we propose an introductory study, based on oxygen residual content determinations, in different vacuum packed foods, grouped in two categories after the conditions of thermal storage.

In present are in practice three types of oxygen sensors: optical, electrochemical and biochemical [4].

For the determination of oxygen residual concentration we used the electrochemical $O_2$-sensor Clark type [7,8]. The oxygen (from sample) diffuses between a polytetrafluorethilene membrane and will be integral reduced to a platinum cathode (+):

$$O_2 + H_2O + 4e^- = 4OH^-$$

The reaction at the silver electrode with KCl content is as follows:

$$4Ag^+ + 4Cl^- = 4\ AgCl + 4e^-$$

This corresponds to a transfer of four electrons between the electrodes (for one molecule of $O_2$) and intensity of electrical current is proportional with oxygen content.

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## Experimental

The oxygen content has been measured with the Anatop-OXY 211, TECAN A6 made in Swiss.

The corresponding performances of this portable analyser:

Range 0÷50% vol. $O_2$,

Measuring precision: 0,1÷1% vol.,

Time of response: < 20 s between 2÷21%vol. $O_2$

Resolution: 0,1% vol. $O_2$

The listed values of $O_2$ -residual content, specified for different products, were represented in the Tables 1÷5 as average values of three measured values in the same ambient conditions.

## Results and Discussions

The food products studied in this work are distributed in two categories from point of view of thermal conditions of storage and in tree classes after the nature of food (meat, fish, chess).

Thus, in Table 1 are presented the vales of oxygen residual content for meat packaged products for which is not necessary refrigeration.

**Table 1. Residual $O_2$ content to meat packed products**

| Name of product | Compositional characteristics of product | Date limit to storage | Date of analysis | $O_2$ content at calibration (%) | $O_2$ -residual content (%) |
|---|---|---|---|---|---|
| Kronen Salami (Austrian premium) | Pork meat, fat, salt, spices, sugar,dextrose, Na-ascorbat | 27.03.2000 | 16.12.1999 | 21 | 21,2 |
| Danish Salami | Pork meat, fat, salt, amidon, sugar, spices, gluco-lactose, dyes | 14.10.2000 | 16.12.1999 | 21 | 8.8 |

In this case of two sorts of salami with the nearly compositional characteristics (with the mention that first contain Na-ascorbate as antioxidant and the second contain gluco-lactose which consume a part of oxygen) differs date limit of storage. The $O_2$-residual content is much less for Danish sort. Since test is not changed and for both products alteration is not observed, it is possible to suppose that difference of $O_2$ -residual content is due to the nature of used adjuvants (Na-ascorbate and gluco-lactose).

In the Table 2 are presented the values of $O_2$ residual content for the same type of products, which must be preserved at cold. It is observed a high content of water in the second package, correlated with a less $O_2$ content, which indicate the presence of alteration processes.

**Table 2. The value of $O_2$ -residual content to meat slided products, preserved at cold**

| Name of product | Compositional characteristics of product | Date of package | Date limit to storage | Date of analysis | $O_2$ content at calibration (%) | $O_2$ -residual content (%) |
|---|---|---|---|---|---|---|
| Apollo Salami Pitesti | Smoked slided pariser ( cow and pork meat, spices) | 26.11.1999 | 16.12.1999 | 16.12.1999 | 20,9 | 18.9 |
| Apollo Salami Pitesti | Smoked slided pariser ( cow and pork meat, spices) | 26.11.1999 | 16.12.1999 | 16.12.1999 | 21.0 | 5.5 |

Examinations of the values listed in Table 3 show the progress of alteration processes, although both the samples are analysed at the middle of validity time interval.

**Table 3. The values of $O_2$-residual content at vacuum packed meat products, preserved at cold**

| Name of product | Compositional characteristics of product | Date of package | Date limit to storage | Date of analysis | $O_2$ content at calibration (%) | $O_2$ -residual content (%) |
|---|---|---|---|---|---|---|
| Grounded meat Apollo | Pork meat, bakon, spices | 10.01.2000 | 30.01.2000 | 14.01.2000 | 21 | 7.0 |
| Grounded meat Apollo | Pork meat, bakon, spices | 10.01.2000 | 30.01.2000 | 14.01.2000 | 20.9 | 8.64 |

After the examination of data presented in Table 4 results that for this product the date of determination of $O_2$-residual content is positioned at beginning of validity time interval, showing a high content of $O_2$, e.g. absence of alteration processes.

**Table 4. Values of $O_2$-residual content at fish products, preserved at cold (maximal temperature 8°C)**

| Name of product | Compositional characteristics of product | Date of package | Date limit to storage | Date of analysis | $O_2$ content at calibration (%) | $O_2$ -residual content (%) |
|---|---|---|---|---|---|---|
| Smoked hering | Hering leaf fillets | 10.01.2000 | 10.02.2000 | 14.01.2000 | 20.0 | 20.0 |

After examination of data listed in Table 5, concerning the single product in the class of milk sort results, this is nearly to validity limit, has a high water content (40÷45%) and can observe that it is conserved very well.

**Table 5. Values of $O_2$ residual content at milk compositional product which is preserved at cold (storage temperature 2÷10°C)**

| Name of product | Compositional characteristics of product | Date of package | Date limit to storage | Date of analysis | $O_2$ content at calibration (%) | $O_2$ -residual content (%) |
|---|---|---|---|---|---|---|
| Pressed cheese Penteleu | Matured cow milk, fat(40÷45%) water(45÷50%) | - | 30.12.1999 | 16.12.1999 | 20.3 | 19.5 |

## Conclusions

After examination of the data concerning oxygen residual content determinations at different sorts of vacuum packed food products that belong to two categories of thermal conservation conditions we may conclude that the values of oxygen residual content may be used as indicator of oxidegradative changes. The values of oxygen residual content nearly at 21% vol. indicate absence of oxidative degradation.

The values of the same indicator much less than 21% vol. (calibration was made in reference with atmospheric oxygen) show presence of oxidative degradation.

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