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Photocolorimetric determination of ammonia (easily hydrolyzable nitrogen) in pork meat during storage

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Abstract

In this study we evaluated the variation of easily hydrolyzable nitrogen, in pork meat during storage through photocolorimeter measurements using Nessler reagent by measuring the variation in color intensity on ammonia formed in pork meat with Nessler reagent , study results were compared with the legal limit allowed by Romanian legislation

Keywords: easily hydrolysable nitrogen, refrigerated meat, ammonia

1. Introduction

The meat composition includes a host of chemical compounds in muscles, they include free fatty acids, glycerol, triglycerides, phospholipids, non-protein nitrogenous components such as DNA, RNA, ammonia, amine groups, and vitamins, also There are glycogen granules and ATP .

In meat and meat products during storage at refrigerated temperatures can develop a highly toxic substances such as ammonia, hydrogen sulfide, peroxidase, putrescine, and cadaverine formed by decarboxylation of amino acids in meat as a consequence of the process autolytic decomposition process in meat [2-7].

Qualities measurements of chemical or physico-chemical properties, which are directly relevant to food quality, are found less frequently for process control in the meat industry [1].

To assess the quality and freshness of meat during storage was determined ammonia (easily hydrolyzable nitrogen) with Nessler reagent [9-11]. Method consists in measure the quantity of nitrogen present in the form of dissolved ammonia and ammonium ions. The test involves dosing in the reaction medium with Nessler's reagent (solution of potassium tetraiodomercurate) Photocolorimetric method [6-9].

The products were purchased from the slaughter house immediately after slaughter and stored for 10 days at 4^0C.

2. Materials and method

2.1. Sample Preparation.

Meat for analysis was minced twice after that was weighed 10 grams (10,000 mg) of the analytical balance and placed in a 100 volumetric flask and

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brought to volume with bidistilate water closed and with a lid to shake and leave to rest for 10 minutes.

*The method principle.*Ammonia in aqueous extract of meat sample form with solution of potassium:

$$NH_4^+ + 2[HgI_4]^{2-} + 4OH^- \rightarrow HgO{\cdot}Hg(NH_2)I + 7I^- + 3H_2O$$

2.2. Reagents

Bidistilate water without ammonia.*Nessler reagent* (tetraiodomercurate bipotasic solution in potassium hydroxide): 5 g potassium iodide dissolved in 5 cm^3 of hot water in an Erlenmeyer flask. Add hot saturated solution of mercuric chloride until the precipitate formed is no longer dissolved. After cooling the solution separate, decant a 100 cm^3 volumetric flask. Add 15 g potassium hydroxide dissolved in 30 cm^3 water and bring to volume with water. Add 0.5 cm^3 saturated solution of mercuric chloride, allow to make the solution above the precipitate and separated by decantation, pass in a clean and kept in the dark.

Alkaline mixture: 10 g sodium carbonate and 10 g sodium hydroxide dissolved in few ml of bidistilate water in a 100 ml volumetric flask and completed to volume with bidistilate water;

Standard stocks solution of ammonia is obtained by weighing the analytical balance 1000 mg ammonium chloride dissolved in a 100 volumetric flask, bring to volume with bidistilate water after a dilution is made by taking 1 ml of this solution and introducing it into a 1000 ml volumetric flask and bringing to volume with bidistilate water so that the solution finally have a concentration of 0.01 mg / l ammonium chloride.

Seignette salt (potassium sodium tartrate): 392g salt Seignette $NaKC_4H_4O6$ · 4:20 dissolve in 784 ml 20% NaOH solution. Mix well and after two hours may be used without shaking the bottle.

2.3. Description of working procedures

100 ml aqueous meat extract were placed in a cylinder with a stopper and add 1 ml alkaline mixture and shaken. It was the supernatant 10 ml, was added 2 ml Seignette salt and 2 ml Nessler reagent was shaken and left to stand 10 minutes later which was centrifuged at 3500 rpm for 10 min with a rotating centrifuge ROTANTA model 460 then read color intensity in WTW photocolorimeter SpectroFlex model 6100 to 425 nm in 1 mm cuvette. Extinction values of the sample was interpolated from a standard curve which was performed after the scheme of Table no 1[11].

Table 1. Standard solution realization for photocolorimeter calibration

Concentration of ammonia solution	mg/l	0	0.02	0.04	0.06	0.08	0.1
standard solution	ml	0	2	4	6	8	0
Bidistilate water	ml	0	8	6	4	2	1
Seignette salt	ml	2					
Nessler reagent	ml	2					

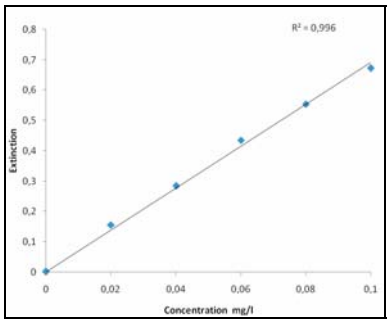

Figure 1. Calibration curve

Table 2. Results of standard solution readings at photocolorimeter

Standard solution concentrations (mg)	Abs.1*	Abs.2*	Media	RSD** %
0	0,002	0,002	0,002	0
0,02	0,156	0,155	0,155	0,454
0,04	0,287	0,282	0,284	1,242
0,06	0,436	0,434	0,435	0,325
0,08	0,553	0,555	0,554	0,255
0,1	0,671	0,673	0,672	0,210

**Absorbance; ** Relative standard deviation*

3. Results and Discussion

During the 10 days in which meat was kept at 4 0 C was taken each day 10 g sample which was analyzed for ammonia content by reaction of ammonia with Nessler reagent. The intensity of color formed following reaction similarly to the standard solution of ammonia reading. Extinction values of the sample was interpolated on the calibration curve. In the table one can see the results content increases of the ammonia in meat during the 10 days. From Table 3 we can see that the meat from of the 9th day the value exceeds the limit from 35 mg, g NH_3/100 permitted by Romanian legislation, limit stipulated in article 12 of Order 975/1998 which provides that in the pork meat the easily hydrolyzable nitrogen over 35 mg NH_3/100 g limit is unfit for human consumption through clear signs of deterioration (Order 975 1998).Variation of hydrolysable nitrogen (mg NH_3 /100g meat) during storage to de 40C can be seen in Figure 2.

Table 3. Results of experimental data

Day	Sample masses g	Abs.1*	Abs.2*	Media	RDS** %	Concentration mg NH_3 / 100 g
1	10,018	0,105	0,104	0,105	0,676	23,484
2	10,022	0,141	0,142	0,142	0,499	24,736
3	10,025	0,172	0,174	0,173	0,817	26,509
4	10,002	0,185	0,186	0,186	0,381	26,942
5	10,008	0,201	0,202	0,202	0,350	29,229
6	10,003	0,215	0,216	0,216	0,328	31,399
7	10,013	0,224	0,227	0,226	0,940	35,824
8	10,016	0,243	0,247	0,245	1,154	37,224
9	10,011	0,268	0,262	0,265	1,600	37,242
10	10,010	0,275	0,273	0,274	0,516	38,212

* *Absorbance;* ** *Relative standard deviation*

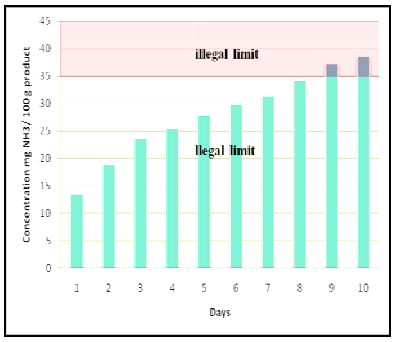

Figure 2. Variation of hydrolysable nitrogen (mg NH_3 /100g meat) during storage

4.Conclusion

The determination of ammonia (easily hydrolyzable nitrogen) in pork meat is critical for daily quality control of production and for specification in contracts.

The traditional ammonia methods (easily hydrolyzable nitrogen) see. SR 9065-7:2007 is relatively accurate, but it is, time-consuming; exposes the analyst to toxic fumes, concentrated acid, and alkali; and produces chemical wastes that must be disposed compared with Photocolorimetric method of this paper which is somewhat quicker than the traditional method SR 9065-7: 2007.

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