Annals of the University of Oradea, Fascicle: Ecotoxicology, Animal Husbandry and Food Science and Technology, Vol. XVIII/B 2019
Analele Universitatii din Oradea, Fascicula: Ecotoxicologie, Zootehnie si Tehnologii de Industrie Alimentara, Vol.XVIII/B 2019

DETERMINATION OF ANTIOXIDANT PROTECTION SUBSTANCES IN FOOD BY LABORATORY METHODS

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Abstract

Because a substantial percentage of food borne diseases outbreaks are caused by home preopared food, is very important to determine their knowledge and food safety correlated with preparation practices. The occupational reactions in the food industry are also related with the knowledge about non-food, food derived or food related sensitizing materials (allergenic materials associated with food processing, manufacturing, transport, trade, transport, retail).

Key words: food safety knowledge, preparation practices, ocupational reactions, alergens.

INTRODUCTION

The demographic conditions and the lifestyle have changed significantly in the last 30 years all over the world and in Romania especially in the last 10 years. They influenced the assortments of food products available to the buyers, as well as the way they were prepared at home. It is known that a food can be valuable not only for its caloric power.

It has long been demonstrated that a "caloric" diet can be devitalized by aging, processing, storage, fermentation or cooking. Protective nutrition is broadly reducing in nature and generally exhibits antilipoperoxidative action, associated with the ability to inhibit lipooxygenase. In the case of phenolic compounds, the reducing activity increases with the number of hydroxyls in the lateral cycle.

Protective feeding, as an oxide-reducing system, plays a role in the mechanism of hydrogen transfer. Through this action, it intervenes through different metabolic, respiratory, cellular processes. So far, there has been no agreement on how to express a food in reducing activity units. Under current conditions, the need for active substances is more important than the excess energy supply.

MATERIAL AND METHODS

There are no known effective methods for rapidly determining the presence of antioxidant (reducing) protective substances in foods. All the protective foods studied contain a certain group of substances permanently, which condition the physico-chemical, biological properties, including antimicrobials. For example, a number of compounds with antioxidant properties (polyphenols, vitamins: B, C, E, K, amino acids with sulfur) are among the permanent components present in the protection diet of vegetarians. A rapid method has been developed to determine the reducing capacity of protective foods by oxidizing them with potassium permanganate. The reaction with potassium permanganate allows a qualitative characterization of the protective products from foods containing antioxidants.

The oxidation rate is expressed in time (in seconds), during which a 0,1N potassium permanganate solution is bleached, in an environment containing the product to be investigated.

$$MnO_4^- + 5e^- + 8H^+ \rightarrow Mn^{+2} + 4H_2O$$

Food protective factors (antioxidants), in aqueous alcoholic environment, etc., discolor the 0.1N potassium permanganate solution. The property of the food protection factors to oxidize condition the antioxidant properties of food protection.

Determination of the oxidation rate of the food

0,1 g food, finely chopped, weighed accurately, put into a 50 ml flask, adding 10 ml distilled water at 20 ^oC, 40 ^oC, 70 ^oC, 90 ^oC, depending on the temperature at which we want to achieve extraction. After one hour, filter paper is filtered. Take 2 ml of the filtered solution with the pipette, place in a 50 ml beaker, add 20 ml of 20% sulfuric acid solution. After one minute, a drop (0,04 ml) of 0.1N potassium permanganate solution is introduced into the acidified solution and a stopwatch is followed by the disappearance of the pink color of the solution. The analysis is performed at the solution temperature of 18 - 20 °C. The working method is repeated by different dilutions 1:10; 1:20; 1:30.

They are foods that act as a protector (that is, they discolor the 0,1N KMnO4 potassium permanganate solution) and at higher dilutions (shown in Table 1).

Table 1

Aliments with a protective role which decolour the potassium permanganate

Material to be investigated	**Suspension (g/100ml)**	**Dilu-tion**	**Bleaching time of 0,1N $KMnO_4$ solution (sec) (oxidation index)**			
			Extraction temperature			
			20^0 C	**40^0 C**	**70^0 C**	**90^0 C**
Whole wheat flour	1	1:10	2 immediat	2,2 immediat	2,2 immediat	2,6 immediat
	1	1:20	4	4,3	4,4	4,5
White flour	1	0	8s	30s	45s	55s
	1	1:10	pink color persists	pink color persists	pink color persists	pink color persists
Palinka vol. 45%	-	0	50	-	-	-
White wine (from supermarkett)	-	0	45	-	-	-
Honey $1,8^0$ refactometric	16,6	0	1	-	-	-
Honey 2^0 refractometric	16,6	0	18	-	-	-
Alcohol vol.96%		0	56	-	-	-
		1:2	3,40s	-	-	-
		1:10	does not fade	-	-	-
White wine 7^0 refractometrice		0	3 immediat	-	-	-
		1:10	3 immediat	-	-	-
		1:20	16,5	-	-	-
		1:30	79	-	-	-
Distilled water			does not fade	-	-	-
Sugar	1	0	does not fade	-	-	-
Beef meat	1	0	does not fade	does not fade	does not fade	does not fade
	1	1:10	does not fade			

Material to be investigated	**Suspension (g/100ml)**	**Dilution**	**Bleaching time of 0,1N $KMnO_4$ solution (sec) (oxidation index)**			
			Extraction temperature			
Nettle leaves (Folium Urticae)	1	0	2,6	2,61	2,62	2,65
	1	1:10	8,6	8,55	8,7	8,7
Chamomile flowers (Flores Chamomillae)	1	0	immediat	immediat	immediat	immediat
	1	1:10	immediat	immediat	immediat	immediat
Caraway (Fructus Carvi)	1	0	2,7	2,9	3	3
	1	1:10	4,5	4,56	4,6	4,8
Marjoran	1	0	2,5	2,5	2,45	2,5

(HerbaMajoranae)	1	1:10	6,8	6,5	6,5	6,7
Rattles (Herba Hyperici)	1	0	3,2	3,12	3,13	3,5
	1	1:10	5,4	8,3	7,4	8,5
Marigold (Calendula Officinalis)	1	0	immediat	immediat	immediat	immediat
	1	1:10	immediat	immediat	immediat	immediat

Table 2

Aliments with a protective role which decolour
a potassium permanganate solution

Material to be investigated	**Suspension (g/100 ml)**	**Dilution**	**Bleaching time of 0,1N $KMnO_4$ solution (sec) (oxidation index)**			
			Extraction temperature			
			20^0C	**40^0C**	**70^0C**	**90^0C**
Pork meat	1	0	Does not fade	-	-	-
	1	1:10	Does not fade	-	-	-
Fish meat „Hake”	1	0	7	-	-	-
	1	1:10	15	-	-	-
White bread	1	0	3	-	-	-
	1	1:10	60	-	-	-
Black bread	1	0	0	-	-	-
	1	1:10	25	-	-	-
Yogurt	1	0	immediat	-	-	-
	1	1:10	immediat	-	-	-
Sweet sheep case	1	0	immediat	-	-	-
	1	1:10	20	-	-	-
Cheese „Dalia”	1	0	10	-	-	-
	1	1:10	95	-	-	-

RESULTS AND DISCUSSION

1) For all the products studied and which contain protective factors, the disappearance of pink in less than 30 seconds is characteristic.

2) The reaction rate depends on the dry matter content of the product investigated in the solution. In the case of protective food tea, the solution was instantly discolored, when the solution contained 4%, 1% finely chopped product. The disappearance of the pink color is delayed when the solution is diluted. The faster the pink color disappears (up to 30 seconds) and at different dilutions, the more protective the food.

3) The degree of activity of the extracts depended on the temperature at which the extraction was made. In general, the oxidation rate is higher for cold aqueous and alcoholic extracts than at temperatures of 400 ^{o}C, 700 ^{o}C, 900 ^{o}C. It is obvious the destructive effect of the high temperature for certain active components.

4) In the insoluble part of the investigated materials, the quantity of active substances is insignificant, only in very high suspensions a reaction of discoloration of the potassium permanganate solution 0,1 Normal can be observed.
5) In the case of fresh foods, the oxidation rate is high (the solution is immediately discolored - about 2 seconds). In the case of prolonged storage, the oxidation rate decreases, for example the protective food tea, after two years of storage it has the oxidation rate over 30 sec. (in some samples the pink color persisted even longer). Therefore, the duration of storage of certain foods under certain conditions substantially influences its properties.
6). There was no profound difference between the oxidation rate of the aplants harvested from different climatic zones. Even if the antioxidant properties differ slightly, they do not go beyond the norm. As a speed of oxidation the samples of the yellowfin (Callendula Officinalis) are insignificant: those collected in the cities area (10-11 sec.). Those collected from the unpolluted mountain area (2 sec.).
7) After the oxidation rate the quality of the product can be deduced. It is observed that the whole flour has a much greater antioxidant capacity than the white one. They have no protective effect: white sugar, alcohol, pumice, meat (the solution of potassium permanganate does not discolor or the disappearance time of pink is greater than 30 sec.).

8) The antioxidant properties of a large number of foods have been studied and verified. The most active are fresh foods but the oxidation capacity is characteristic of all samples. Although there is no single value for this index, there are certain limits of variation on the samples. If the pink color disappearance time is less than 30 sec. food can be considered protective.

CONCLUSIONS

Both in the industrial processing, as well as in the commercial environment, or in the service of mass sharing (restaurants, etc.), but also at home, we are exposed to various risk factors for more or less professional illness.

In order not to be exposed to these factors or to minimize their effect, it is important that our level of perception, understanding and defense against these risk factors is always awake and equipped with the necessary knowledge.

REFERENCES

1.Antolovich, M., Prenzler, P.D., Patsalides, E., Mc-Donald, S., &
2.Robards, K. 2002. Methods for testing antioxidant activity.
3.Analyst, 127.
4.Cadenas, E. and L. Packer, 2002. Handbook of Antioxidants. 2nd Edn., University of Southern California School of Pharmacy Los Angeles, California.
5.Donna M. Williamson, R. B. Gravani, Harry T. Lawless – Correlated Food Savety Knowledge with Home-Food-Preparation Practices-Food Technology, 1992;
6.S. B. Lehrer, C. E. O`Neil. Occupational Reactions in the Food Industry- Food Technology, 1992;
7.Halliwell, B., R. Aeschbach, J. Lo Liger and O.I. Aruoma, 1995. The characterization of antioxidant. Food Chem. Toxicol., 33:601-617.
8.Hart, F., Schmidt, R., Ray, L., Journal Materials Science, 33 (1980), 3919-3925.
9.Huang. D., Boxin, O.U. & Prior P.L., 2005. The chemistry behind antioxidant capacity assays. Journal of Agricultural and Food Chemistry, 55: 1841-1856.
10. (PDF) Methods for Determining the Antioxidant Activity: A Review. Available from: [accessed Nov 07 2019].
11. Ionel Jianu, Delia Dumbravă – Factori de protecţie alimentari, editura Mirton – Timişoara, 2001.
12. Karadag, A., B. Ozcelik and S. Saner, 2009. Review of methods to determine antioxidant capacities. Food Anal. Methods.
13. Kristoffersen, T & Gould L. A. (1960), *Journal of Dairy Science* 43, 1202;
14. Niculescu , N.,Producerea modernă a alimentelor făinoase, Ed. Ceres , Bucureşti, 1980 ;
15. Niki, Etsuo: Antioxidant activity: are we measuring it correctly? 2002; 18:524-525.
16. Niki, E.; Noguchi, N. Evaluation of antioxidant capacity. What capacity is being measured by which method? IUBMB Life 2000,50.
17. Sharpe, M. E. & Franklin, J. G. (1962), VIII *International Congress of Microbiology*, B 11.3.