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# METHANOL POISONING RISK OF ASPARTANIC CONTAINING-COOLING DRINKS CONSUMERS

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**Abstract.** Methanol, the chemical compound with very noxious effects on human organism, is included in food-stuffs and pharmaceutical products. Thus, the risk of poisoning by methanol exists by the consumption of products with sugar substituted by aspartame (food additive E951) because it occurs promptly by aspartame hydrolysis in physiological condition. Considering the above reasons, we have proposed the methanol dosage in the distillate of cooling beverages from the light group (including aspartame) and the results correlation with their aspartame concentrations. The chromatografic method was used in order to separate the aspartame and the distillation for methanol separation. Both for methanol and aspartame dosage, spectrophotometric methods were utilized. The aspartame and methanol concentrations determined in our study are higher than those reported by the international organizations such as Food & Drugs Administration and Nutrasweet (FDA) and this is why the authors consider the necessity of population warning about the health risks associated with the current ingestion of aspartame containing - products. Taking into account that aspartame is quite cheap and it has a sweetening power of 200 times higher than sugar, its use persists in over than 9000 products, despite the 92 neurological, ophthalmic and immunological symptoms reported by FDA in 1993.
**Key words: methanol, aspartame, sweetening food additive**

**Rezumat.** Metanolul, compus chimic cu efecte deosebit de nocive asupra organismului uman, este conținut în unele alimente şi produse farmaceutice. Astfel, prin consumarea produselor în care zahărul este înlocuit cu aspartam (aditiv alimentar cu rol dulcorant E951), există riscul intoxicării cu metanolul care se eliberează în organism în condiții fiziologice, prin hidroliza aspartamului. Ținând seama de aceste considerente, ne-am propus dozarea metanolului din distilatul băuturilor răcoritoare din gama *light* (care conțin aspartam) şi corelarea rezultatelor cu concentrația aspartamului. În scopul separării aspartamului s-a utilizat metoda cromatografică, iar pentru separarea metanolului s-a utilizat distilarea. Atât pentru metanol cât şi pentru aspartam dozarea s-a realizat prin metoda spectrofotometrică. Concentrațiile de aspartam şi metanol determinate de către noi sunt mult mai mari decât cele raportate de organismele internaționale (Food & Drugs Administration şi Nutrasweet), fapt pentru care considerăm necesară avertizarea populației asupra riscului de îmbolnăvire în cazul ingestiei curente a produselor cu conținut de aspartam. Având în vedere că aspartamul este ieftin şi cu putere edulcorantă de 200 ori mai mare decât a zahărului, el continuă să fie utilizat şi astăzi ca îndulcitor în peste 9.000 de produse în ciuda celor peste 92 de simptome neurologice, oftalmologice şi imunologice raportate de FDA în 1993.
**Cuvinte cheie: metanol, aspartam, aditiv alimentar, edulcorant**

INTRODUCTION

The methanol ("wood alcohol") is used as raw material in the industry for formaldehyde and methyl ester production. It has a poisoning effect and for this reason it's forbidden to be inhaled, gulped and to be absorbed through the skin (1). A less known fact is that the methanol is directly or indirectly contained by some foods and drinks. A such example are the drugs which transform promptly about 10% of their quantity in methanol in physiological conditions (2,3). Methyl alcohol is catalytically oxidized at 30°C, resulting formaldehyde and formic acid. Like cyanide and arsenic, formaldehyde is known as carcinogenic agent whether it is used for a long time.

MATERIALS AND METHODS

Cooling drinks analyzed: Coca-Cola lights, Prigat-Orange, Prigat-Grapefuit, Pepsi-lights.

Separation of the aspartame was achieved by chromatographic method using chromatographic plates 20x20 cm.

Sample concentration was determined by spectrophotometric method: absorbance was measured with Spekol spectrophotometer and concentration was calculated on the basis of calibration plot traced like function E = f (c) using various concentrations of reference standards of aspartame with purity of 85.71% (4,5).

The distillate of the cooling beverages was used for methanol dosage. Methanol was oxidised with $KMnO_4$ (kalium permanganate) to produce formaldehyde that was spectrophotometrically determined using Schiff reagent. Determinations were achieved using a spectrophotometer VSU-2 (6).

The cooling drinks pH was measured using pH-multiparameter analyzer Consort 833.

RESULTS

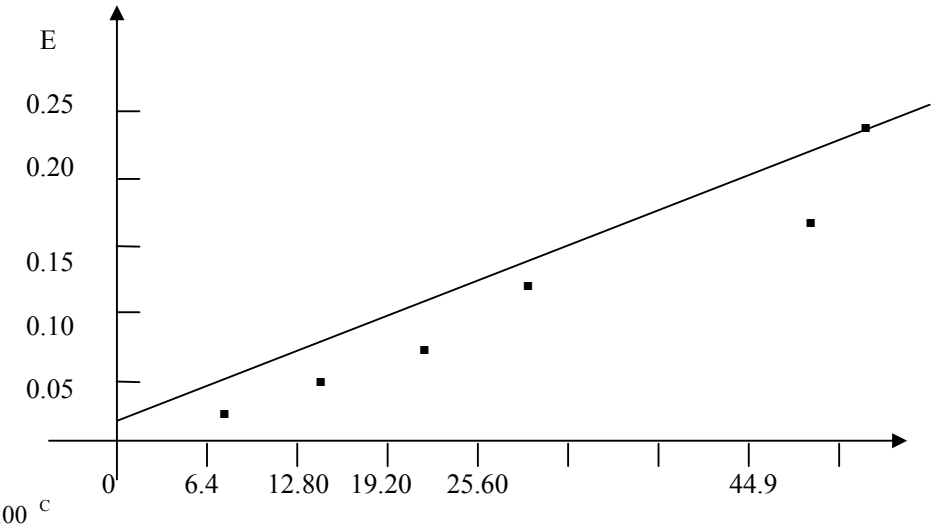
1. The quantities of aspartame determined in analyzed samples have ranged between 0.75 and 1.7 g/l and were determined related to the calibration plot E = f (c) (table 1, fig. 1).

The uprightness of dosage was verified by correspondence method with $\sqrt{S}$ = f (lgc) (7).

**Table 1. Values of aspartame according to volume of the etalon**

| V(µl) | $S_{(area)}$ | $\sqrt{S}$ | lg c | c (µg) | $E_{(absorbance)}$ |
|---|---|---|---|---|---|
| 5 | 2.04 | 1.43 | 0.81 | 6.4 | 0.025 |
| 10 | 2.47 | 1.52 | 1.11 | 12.8 | 0.035 |
| 15 | 2.60 | 1.61 | 1.28 | 19.2 | 0.075 |
| 20 | 2.80 | 1.67 | 1.41 | 25.6 | 0.120 |
| 35 | 4.60 | 2.15 | 2.15 | 44.9 | 0.175 |
| 50 | 5.04 | 2.25 | 2.25 | 64.0 | 0.225 |

V - volume of the etalon applied at the start time; S – the spots area; c – the concentration of aspartame; E – absorbance.




E – absorbance; c –aspartame concentration

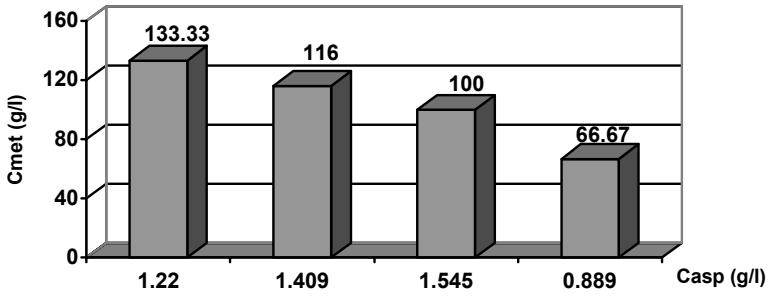
**Fig. 1 The calibration plot E = f (c)**

2. The values of pH have ranged in the interval 2.73-3.26 g/l. (Table 2).
3. The methanol concentration in the cooling drinks analyzed was situated in interval 66.67-133.33 mg/l, in conditions of the pH and temperature determined (24°C) (table 2).
4. The comparison of methanol quantities found in the analyzed samples did not show a linear dependence with the aspartame concentrations. The result of analysis has indicated that low pH favors the release of a more quantity of methanol, excepting Pepsi – light that has contained about aspartame and acetsulfam sweetener (fig. 2).

**Table 2. Aspartame concentrations in the cooling drinks**

| Tests (20µl) | $S$ *(area)* | $\sqrt{S}$ | lg c | C (µg) | $C_{Asp.\ (g/l)}$ √S=f(lgc) | E (absorbance) | $C_{Asp.\ (g/l)}$ E=f(c) | $C_{met.}$ (mg/l) | pH |
|---|---|---|---|---|---|---|---|---|---|
| Etalon | 4.72 | 2.17 | 1.55 | 35.48 | 1.774 | 0.120 | 1.89 | 166.66 | 2.5 |
| Coca-Cola light | 3.90 | 1.97 | 1.39 | 24.55 | 1.220 | 0.145 | 1.38 | 133.33 | 2.73 |
| Prigat-Grapefruit | 4.16 | 2.04 | 1.45 | 28.18 | 1.409 | 0.168 | 1.58 | 116.0 | 3.14 |
| Prigat-Orange | 4.40 | 2.10 | 1.49 | 30.90 | 1.545 | 0.119 | 1.70 | 100.0 | 3.26 |
| Pepsi-light | 3.00 | 1.76 | 1.25 | 17.78 | 0.889 | 0.080 | 0.75 | 66.67 | 2.76 |

S – spots area; c – aspartame concentration in samples;
E – absorbance; $C_{Asp.}$ – aspartame concentration in g/l; $C_{met.}$- methanol concentration in mg/l




pH: 2.73 3.14 3.26 2.76

**Fig. 2 Methanol concentration of aspartame**

DISCUSSION

The comparison of the aspartame quantities found in cooling drinks (0.75-1.70 g/l) with the value recommended by FDA, a significant difference was recorded.

Aspartic acid is considered as belonging to neuroexcitotoxins category; phenylalanine is potentially toxic for those ones suffering of phenylketonuria; diketopiperazine results from phenil-alanine and it is considered a cancerigen agent. The methanol consumed in slight quantity generates ophthalmologic diseases, fatigue, mind confusions, joint pains and, in high quantity, death (2,3,8,9). FDA recommends a daily consumption of about 40 mg aspartame/kg body weight; that means about 2.8 g/day for a person of 70 kg body weight and, for a child having 20 kg, approximately 0.8 g/day. Our findings on aspartame content in cooling drinks indicated that one liter of cooling drink exceeds the maximum dose of aspartame admitted for daily consumption of a child and, also, represents a half of admitted dose for adults, not taking into account the aspartame ingestion from other food products (i.e.: one fruit yogurt includes 140 mg aspartame).

The quantities of methanol spectro-photometrical measured in our samples are situated in the interval 66.67-133.33 mg/l, much more that the admitted limit of FDA: 40-70 mg/l or 90 mg/l which represents the limit value provided by NutraSweet. Our results are confirmed by other studies reporting about 140 mg/l aspartame/l (2,3,10). Regarding the associated risk with our findings, it has to mention that NutraSweet specifies that a consumption of about 34 mg aspartame/kg/day (2.28 g for adults and 0.68 g for children) does not

produce a significant increase of methanol concentration in blood, but a higher quantity of aspartame could rise blood methanol levels. This increasing results in higher quantities of formaldehyde, as methanol metabolite, with noxious effects on eyes, nervous system, tissues. Trocho et al. have reported the accumulation of formaldehyde starting from aspartame dose about 10 mg/kg/ day (11).

## CONCLUSIONS

Usual ingestion of food and pharmaceutical products containing aspartame may signify "the imminent risk of health" for consumers by its causative and aggravating role in many diseases. As regards the methanol results of aspartame hydrolyze, the consequences may be alarming considering that poisoning with methanol produces: metabolic acidosis, diabetic reaction, retinopatia, metabolic disturbances of carbohidrates, memory affectation and symptoms like autoimmuno diseases (sclerosis in plates, systemic lupus, fibromyalgia).

## REFERENCES


1. Roberts HJ: *What's Blinding the World?* Documents on the Enhancement of Eyesight, 1995.
2. xxx: Rodie D*: The Sweet Lie*. Aspartame Consumer Safety Network, 2001.
3. xxx: FAO/WHO Expert Committee on Food Additives: *Toxicological Evaluation of Certain Food Additives.* WHO Food Additives Series. 1982, 28-32.
4. xxx: Instit. of Med.: Committee on Food Chemicals Codex: *Revised Monograph- Aspartame*, 1996, received Dec. 15.
5. Gyéresi A: *Vademecum cromatografic*. Ed. Mentor, Tg.Mures, 1997, 28-29.
6. Bota Virgil, Máthé Ioan: *Lucrări practice de chimie sanitară*. UMF. Tg.Mures, 1992, 166-7.
7. Kerese I: *Fehérjevizsgálati módszerek*. Müszaki Könyvkiadó, Budapest. 1975, 267: 278-279.
8. Davoli E et al.: *Serum Methanol Concentrations in Rats and in Men After a Single Dose of Aspartame*. Food & Chemical Toxicology. 1986, 24: 187-189.
9. Blaylock, Russell L: *Excitotoxins. The Taste That Kills*. Health Press. 1994, Santa Fe, New Mexico.
10. Roberts HJ: *Aspartame (NutraSweet): Is it safe?* Philadelphia. 1989, The Charles Press.
11. Trocho C et al.: *Formaldehyde Derived From Dietary Aspartame Vinds to Tissue Components in vivo*. Life Sciences. 1998, 63: 337.