DETERMINATION OF MERCURY CONTENT IN MILK POWDER

M. Iovtchev, T. Grigorov, D. Apostolov
Institute of Nuclear Research and Nuclear Energy
Boul. Lenin 72, 1184 Sofia, Bulgaria

INTRODUCTION

The risks for human organism connected with the increased content of mercury compounds in some foods require a systematic examination of the different components of diet.

Along with the particularly important control of the concentration of mercury in certain products (fishes, mushrooms, some animal internal organs) about which general accumulation of the element is established and a comparison with the existing norms of content is necessary, for the elucidation of the total mercury exposition, it is necessary to analyze products with comparatively low Hg concentration but with a high relative share in human nutrition (e.g. flour, milk and products from them) /1-4/.

In this respect it is interesting to examine humanized milks which during a certain period of human life - in mixed and artificial feeding of new-borns and sucklings - are the basic and almost the only possible food.

EXPERIMENTAL

Samples

Humanized full cream cow milk powder for new-borns (sample A: Bebe 0), sucklings (sample B: Bebe 1) and small children (sample C: Vitalact 2); biologically soured milk powder (sample D: Biolacton).

The samples weighing 300-500 mg are activated for 18-24 hours in a neutron flux $\Phi = 5.10^{12}$, resp. 2.10^{13} n/cm^2.sec (IRT 2000 - Sofia) in quartz ampules without preliminary lyophilization (humidity content of 4-5 %).

Method

"Wet ashing" of the samples in BETHGE's apparatus in a oxidizing mixture ($HNO_{3conc.}$: $H_2SO_{4conc.}$ = 1:2) and removal of Hg by amalgamation on Cu powder /4/. This is a modification of the method suggested by /1/.

Mercury was determined by Hg-203 energy line 279.1keV with correction for the relative share of Se-75 in the total peak area /4/. The measurements are carried out on a Ge/Li-detector (resolution 2.3keV at 1332keV of Co-60).

DISCUSSION

The mercury concentration data in milk and dairy products from the trade network, are comparatively scarce and rather discrepant. For example, values for fresh milk vary from 0.1 to 25 ppb /5-8/, for milk powder from several ppb to 180 ppb /4,9/(the data being valid for industrial developed countries).

In choosing the samples we settled upon milk powder which may be activated without preliminary treatment /4/. In such a way possible mistakes from mercury losses during lyophilization are avoided. This is a very important consideration, having in mind that for most analytical methods mercury concentration in milk powder is usualy of the order of the detection limit.

Milk being a protein rich product contains a considerable quantity of Se. At the measurement one must exclude the contribution of Se-75 in the peak area of Hg-203 at 279.1 keV. The activity correlation of the peaks of Se-75 at 279.6 keV and 264.6 keV for the chosen geometry of measurements, is 0.4.

Ag-110m, being eliminated in the amalgam, is not an obstacle to the mercury determination.

The results of the analysis are shown in Table 1 (average values from 8 determinations; Hg concentrations in ppb). The values obtained for the mercury content in the investigated humanized milk (powder) are of the same order as in most of the references /1,2,5/ and in all cases are many times lower than the admissible norm for foodstuffs - 50 ppb (Table 2).

Sample	[Hg] (ppb)	$[Hg]_{min.}$	$[Hg]_{max.}$
A	5.1 ± 2.1	3.6	7.3
B	5.8 ± 2.3	3.4	7.6
C	7.2 ± 3.1	4.3	8.7
D	6.8 ± 2.3	4.7	8.4

Table 1: Concentration of mercury in milk powder /ppb/

References	[Hg] (ppb)	$Hg_{min.}$	$Hg_{max.}$
/1/	5	1	12
/4/	10	3	29
/4/x		0.6	4
/5/x		5	8
/7/x		20	25
/8/x		0.1	1
/9/		70	180
/10/	2.5 (IAEA-A-11)		

x - Values for Hg concentrations in fresh milk

Table 2: Comparison of mercury concentrations in milk powder and in fresh milk

CONCLUSION

The results show concentrations of mercury in the analysed humanized full cream cow milk powder considerably under the recommanded by WHO values for food products.

At the measurement one must exclude the contribution of Se-75 in the peak area of Hg-203 at 279.1 keV.

The method applied gives a possibility to determine mercury by comparatively simple radiochemical procedure. This is very important in case of large number of analyses for assessment of human organism burden with this toxic element through food products.

REFERENCES

/1/. R. Schelenz, J.-E. Diehl: Z. Anal. Chem., 265 (1973) 93
/2/. R. Schelenz, J.-E. Diehl: Z. Lebensm. Unters.-Forsch., 151 (1973) 369
153 (1973) 151
/3/. G. Birke, et al.: Arch. Envir. Health, 25 (1972) 77
/4/. K. Heine, A. Wiechen: Milchwissenschaft, 27 (1972) 688
/5/. J. Ruzicka, C.G. Lamm: Talanta, 16 (1969) 157
/6/. L.J. Goldwater: Sci. American, 224 (1971) 15; cit. in /4/
/7/. B. Weigand-Eschraghie, et al.: Wiss. Veröff. Nr.1 Mercury; cit. in /4/
/8/. J.J.M. de Goeji, et al.: Symp, IAEA (1972) SM 157/8
/9/. R. E. Jerves, et al.: AED-Conf. (1970) 349-002; cit. in /4/
/10/. R. M. Parr: IAEA/RL/103, September 1983