Setting up an atomic absorption spectrometer (AAS) for determining heavy metals (Hg, Cd, Pb) in food

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Introduction

Nowadays, the concentration of heavy metals in food is very much controlled following several European regulations such as CE n°1881/2006 and n°629/2008 which define the maximum acceptable concentration of heavy metals in different types of food. The purpose of this study was to set up an AAS to meet client's request.
After setting up an analysis method for each metal, one part of the job was to use the spectrometer to analyze samples already analyzed by another laboratory, the subcontractor. Then, the results were compared to those obtained by the subcontractor.

Experimental methods

Concerning the experiments, the most important parameter is the sample preparation. To prepare the sample, a microwave was used to dissolve 0.5g of food into 6 mL of 0.22 mol/L nitric acid. The solution obtained was fed into a 50 mL flask and made up with distilled water.
Then, the method was entered in the software. Several conditions of the methods were already in it. Just the range of calibration was calculated and entered. To calculate it, the characteristic mass, and the sample absorbance was determined. Once all the parameters of the method were entered in the software, the determination of content could begin.
The results were automatically given by the software Winlab32 but the concentration unit was mg/L. Since food was used, the unit had to be mg/kg. To have the content in this unit, the standard EN NF 14084 gave the formula:

$$\text{content (mg/kg)} = \frac{\text{concentration (mg/L)} * \text{volume (mL)}}{\text{mass (g)}}$$

Results and conclusion

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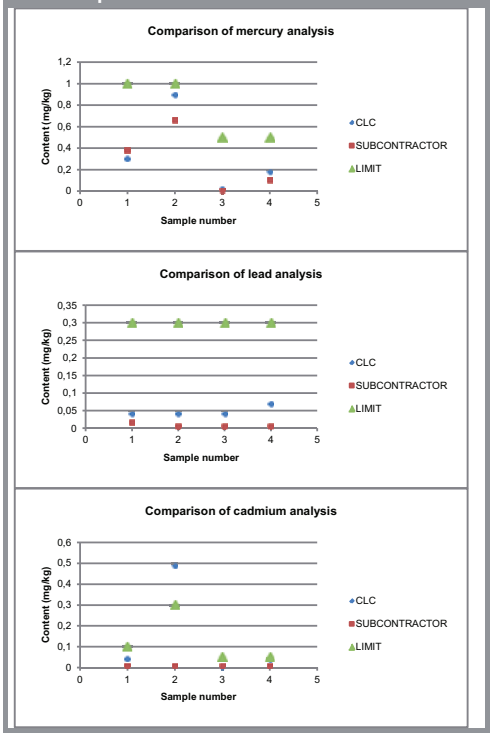
To illustrate the results, the three graphs (Fig. 1); one for each heavy metal, shows the comparison between the results of the laboratory CLC, the subcontractor and the limits. Concerning mercury, the results are a little bit different compared to the results of the subcontractor. However we can see on the graph that all the results are below than the acceptable upper limit of metal concentration in food, it is therefore the most important.
The same observations can be drawn for lead; CLC results are a little bit different but the concentrations are still within the acceptable limits.
For the cadmium, we can see with sample n°2 that the concentration is over the upper limit. It can be explained with the same reasoning; it can be possible to have a lot of metal in one part of the sample and a little in another. So in this case, we can suppose that the subcontractor's sample had less metal than the one analyzed by CLC.

Figure 1 : Comparison between the results of two laboratories; mine and the subcontractor's, and the European limits



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