

## Safety of ceramic objects in contact with foodstuffs

Corina A. Zugravu<sup>\*1</sup>, G. Cilinca<sup>2</sup>, M. Parvu<sup>3</sup>, D. Patrascu<sup>1</sup>, A. Stoian<sup>1</sup>

<sup>1</sup>University of Medicine and Pharmacy "Carol Davila", 8, Bdul Eroilor Sanitari, Bucharest, Romania,

<sup>2</sup>National Institute of Public Health, 1-3, Dr. Leonte str. Bucharest, Romania

<sup>3</sup>Faculty "Spiru Haret", 1-3 Masina de Paine str., Bucharest, Romania

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### Abstract

The main safety problem regarding ceramic materials in contact with aliments is the release of lead and cadmium. Hence, a strict and efficient control is needed, in order to protect consumer against the eventual dangers caused by the use of glazing, enamel and decorations on surfaces which come in direct relation with foodstuffs. Lead is a heavy metal used in pigments, coatings and stabilizers. It has soluble salts, so it passes easily in acidic solutions. Cadmium's salts are used usually as pigments. In 2009, 160 ceramic samples were analyzed in Romania, in order to evaluate the heavy metal release in acidic solutions. The determination method was the atomic absorption spectrometry. Whatever the origin of the materials (EU/non-EU countries), the release of heavy metals was far under the maximal limits (as stated by law), so that all the ceramic objects were considered appropriate for use in contact with foodstuff.

**Keywords:** lead, cadmium, ceramic objects, material in contact

### 1. Introduction

The main characteristic of materials coming in contact with foodstuff has to be the stability, in order to preserve the quality and the safety of food. In conformity with the Governmental Decision nr. 1197/2002, materials in contact are allowed to release constituents only in a maximal very small amount, stated by the law in force [6]. The release of lead and cadmium by ceramic articles needs efficient measures of control, because the consumer has to be sure that he is protected against the eventual dangers brought by the bad formulated coatings and decorations, applied or burned on the surfaces of the ceramic articles used to serve, prepare or preserve food and drinks. On the other hand, the legislative differences between countries regarding ceramic objects can be a hindrance from the point of view of the international trade with this kind of products. Cadmium is one of the metallic elements of most concern in the food and environment of man.

Cadmium is widely distributed [2] and is found in most foodstuffs in the range of 0.005-0.1 mg/kg [5]. Cadmium sulphide and cadmium selenide have been used as red, yellow and orange color pigments in plastics and various types of paint [5]. Cadmium stearate was previously used as a stabilizer in plastics [5]. Cadmium can also be used as pigments in certain enamels in food contact materials. Leachable cadmium in enamel pottery and glazes may be a source of contamination. Cadmium is unique among the metals because of its combination of toxicity in low dosages, long biologic half-life (about 30 years in humans), its low rate of excretion from the body, and the fact that it is stored predominantly in the soft tissues (liver and kidney) [1].

Lead is present in the environment in the form of metallic lead, inorganic ions and salts and organo-metallic compounds [2]. Previously, lead pigments were often used in ceramic glazes [1].

However, because lead pigments are toxic, their use is now restricted. In EU, release is now regulated by Directive 84/500/EEC which sets strict limits for the release of lead from materials and articles made of ceramics [4]. Only imported products from some countries and handicraft still need particular attention. White lead is the most important lead pigment [1]. Also, crystal glass typically contains 24% lead.

In the present paper, we present the results regarding the evaluation of lead and cadmium in acidic extracts obtained from ceramic objects manufactured in Romania and abroad.

It has to be stressed out that DG SANCO (Directorate General for Health and Consumer Affairs of the European Commission ) asks all the European Union Member States to communicate to the Commission Services information regarding the control of the lead and cadmium migration from ceramic objects coming in contact with foodstuff [3].

## 2. Materials and methods

In 2009 each county Public Health Direction tested 10 samples of ceramic objects. There have been analyzed parts of the objects theoretically or practically in direct contact with foodstuff (inner surface of plates and edges of cups or mugs).

The used methods for lead are the atomic absorption spectroscopy (most sensitive method) and the anodic decomposition voltmetry. Cadmium can be evaluated by using the atomic absorption spectroscopy, using the direct aspiration in flame or the oven spectrometric technique.

In the present study, though, the evaluation of metals in acidic extracts obtained from ceramic objects were carried out by atomic absorption spectrometry .

The limits taken in consideration are the following [6,7]:

- For the first category, plates and other objects that cannot be filled, with the maximal depth of 25 mm: 0,8 mg/dm<sup>2</sup> for lead and 0,07 mg/dm<sup>2</sup> for cadmium.
- For the second category, objects that can be filled, with a volume smaller than 3 liters: 4,0 mg /l for lead and 0,3 mg /l for cadmium.

- For the third category, cooking pots and package and storage items with the capacity greater then 3 liters: 1,5 mg/l for lead and 0,1 mg/l for cadmium.

## 3. Results and discussions

During the year 2009, 160 samples have been analyzed, from which 56,87% originated in Romania (91), 33,75% in China (54), 1,8% in Brazil (3) and 3,74% in EU countries (12).

Figure 1. presents the specific origin of the tested samples.

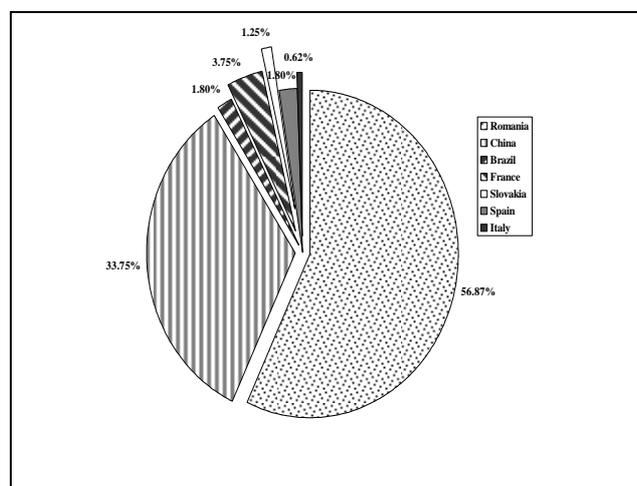


Figure 1. The origin of the evaluated samples

In table 1 are presented the values of migration of lead and cadmium (mg/l) for different samples evaluated in different counties of Romania.

It can be seen that the 160 samples tested for lead are under the limits specified for objects with under 3 liters capacity of filling.

In table 2 are presented the average values of the cadmium and lead migration from ceramic objects in contact with food.

These values are specific ones, since the manufacturers/ retailers for each object are usually very different.

The level of lead released by ceramic objects:

- for items originating in Brazil and China (non-EU countries), the value is between 0,002 and 0,098 mg/l, far under the limit established by law(4,0 mg/l).The lead from EU objects has non significant levels.

**Table 1.** Lead and Cadmium migration values

Nr. crt	County	Nr. samples	Country of origin	Lead (mg/l)	Cadmium (mg/l)
1	Bistrita	10	Romania	0,000123	0
2	Brasov	3	Romania	0,0322	0,00329
		2	Slovakia	0,001175	0,0001
		5	China	0,00368	0,000452
3	Braila	1	Romania	0,000418	0,000096
		3	China	0,000624	0,000262
4	Cluj	8	Romania	0,000335	0,000057
		2	China	0,00056	0,000065
5	Constanta	5	Romania	0,00147	0,001472
		4	China	0,00281	0,00195
		1	Brasilia	0,098	0,0002
6	Dambovita	10	China	0,0223	0,00571
7	Harghita	10	Romania	0,000034	0,0000022
8	Hunedoara	5	China	0,037	absent
		2	France	0,03	absent
		3	Romania	0,04	absent
9	Iasi	5	Romania	0,94	0,04
		2	Spain	nd	nd
		1	Italy	2,8	nd
		2	China	nd	nd
10	Maramures	10	Romania	0,232	0,005
11	Mures	10	Romania	0,088	0,004
12	Prahova	10	China	0,0158	0,00028
13	Satu Mare	5	Romania	0,169	0,0088
		5	China	0,0158	0,00028
14	Salaj	10	Romania	1,067	nd
15	Sibiu	1	Spain	absent	absent
		1	Brasilia	absent	absent
		2	Romania	absent	absent
		2	China	0,013	0,0018
		4	France	0,001	0,0005
16	Valcea	3	Romania	<0,01	<0,002
		6	China	<0,01	<0,002
		1	Brasilia	<0,01	<0,002
17	Vrancea	6	Romania	0,65	0,06

nd = non-detectable

**Table 2.** Average lead and cadmium migration (mg/l) for ceramic objects

Country of origin	Nr. of samples	lead average value (mg/l)	cadmium average value (mg/l)	%
Romania	91	0,0353	0,00134	56,87
China	54	0,002	2,00E-04	33,75
Brazil	3	0,098	0,0002	1,8
France	6	0,0051	8,33E-05	3,75
Slovakia	2	0,00058	0,00005	1,25
Spain	3	0	0	1,87
Italy	1	2,8	0	0,62
<b>Total</b>	160			

The level of cadmium released by ceramic objects:

- cadmium released by Brazilian and Chinese objects has an average maximal 0.0002 mg/l, far under the legal limit (0,3 mg/l). Cadmium released by EU-originating objects has a non-significant value, under the detection limit.

#### 4. Conclusions

Ceramic objects coming in contact with food and found on the Romanian market are safe from the point of view of toxic heavy metals (lead and cadmium) release.

All the 160 samples evaluated on the Romanian territory in 2009 comply with the laws in force and carry no health hazards for the consumers. In future, the surveillance of this kind of objects has to continue, as stated at the level of the specific work group of the EU and has to take under consideration more samples, in order to avoid the use of presumably dangerous materials, releasing lead and cadmium above the admitted limits in foodstuff and drinks.

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