STUDY REGARDING THE WATER POLLUTION IN ROMANIA AND SPAIN★

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Drinking water is a common concern for people all over the world. It is more and more obvious the relation between the drinking water contamination and the generating or supporting factors of some diseases like cancer, congenital malformations, acute and chronic poisoning. Whether or not drinking water is safe for our health depends on which impurities are present and in what amounts. This paper is intended to be a comparative study concerning water pollution with metals in Romania and Spain.

Key words: water, possible metals, concentrations.

INTRODUCTION

Nowadays, the relationship between water quality and quantity, on one hand, and health states, on the other hand, constitutes an acute public health issue. Water is never in a pure status, it contains always minerals and microorganisms originating from rocks, ground, and air. Human activities can contaminate water with various substances. But water should be clean in order to ensure a good health. Actually, some minerals present in water can have benefic consequences. For example it is already proved the fact that small quantities of calcium or magnesium in the drinking water contribute to the fulfillment of the human body needs of calcium and magnesium [1].

Fluoride, the natural one and the drink water additives as well, can prevent dental caries. Worldwide, sickness associated with contaminated drinking water has been intensely researched, due to the causal relationship with diseases such as cancer, congenital malformations and endocrine disturbances, in addition to acute and chronic toxicity. Whether or not drinking water is safe for our health depends on which impurities are present and in what amounts [1–3].

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POSSIBLE METALS THAT CAN BE PRESENT IN WATER AND HEALTH EFFCTS

Table 1

Health effects of metal- contaminated drinking water

Metal	Health effects of excessive ingestion	Water contamination source
Chromium (50 ppb)	Allergic dermatitis.	– industrial waste spills (steel and paper) – erosion of natural deposits
Copper (2 ppm)	– short term exposure: gastrointestinal disturbances – long term exposure: liver and kidney lesions	– corrosion of pipes in residential buildings – erosion of natural deposits.
Fluoride (1,5 ppm)	– fragility of bones – fluorosis (mottling of teeth) – mental retardation, anorexy, weight loss	– industrial waste spills (fertilizers, aluminum) – erosion of natural deposits
Iron (0,3 ppm)	– toxic in excess – nausea, vomiting, diarrhea, intestinal lesions	– corrosion of systems for drinking water supply
Manganese (0,5 ppm)	– toxic in excess – water contamination affects the nervous and respiratory systems.	– erosion of natural deposits – industrial water spills
Molybdenum (70 ppb)	– in high amounts: gout- like symptoms (increased serum uric acid, joint pain)	– erosion of natural deposits – industrial water spills
Nickel (20 ppb)	– allergenic and carcinogenic – dizziness, nausea, cough – nervous system and lung symptoms.	– industrial water spills
Selenium (10 ppb)	– skin annex damage – cardiovascular symptoms	– erosion of natural deposits – industrial spills (oil refineries)
Iodine	– hyperthyroidism	– erosion of natural deposits – sea water contamination of drinking water
Zinc (3 ppm)	– cough, vomiting, diarrhea – lethal when amount ingested exceeds 1 gr	– erosion of natural deposits
Arsenic (10 ppb)	– skin lesions (including malignant tumors) – increased risk for lung, kidney, liver, prostate neoplasms and leukemia – cardiovascular, immunologic, neurologic and endocrine disturbances	– erosion of natural deposits – industrial water spills (glass and electronics)

Table 1 (continued)

Metal	Health effects of excessive ingestion	Water contamination source
Aluminum (200 ppb)	– ingestion of high amounts has been correlated with development of Alzheimer´s disease [5].	– aluminum sulfate (water purification)
Barium (300 ppb)	– increased blood pressure	– erosion of natural deposits – oil refineries spills
Beryllium (0,2 ppb)	– intestinal lesions	– industrial spills (refineries; electronics, defense industry)
Cadmium (3 ppb)	– red blood cells toxicity	– erosion of natural deposits – corrosion of galvanized pipes – oil refineries spills
Lead (10 ppb)	– children (small amounts): decreased attention, IQ; hyperactivity, impaired growth – adults: kidney disturbances, hypertension [5]	– erosion of natural deposits – corrosion of drinking water pipes
Mercury (1 ppb)	– kidney lesions	– erosion of natural deposits – industrial water spills

METAL CONCENTRATIONS IN DRINKING WATER IN ROMANIA AND SPAIN

Fig. 1 illustrates the concentrations of arsenic in drinking water in several Romanian urban centers (1998; [2]), as communicated by the Public Health and Hygiene Institute.

Chromium ingestion over the admissible limit leads to allergic phenomena. Cadmium, on the other hand, is responsible for hepatic perturbations, anemia and hypocalcemia. Fig. 2 illustrates the chromium and cadmium concentrations in drinking water in Romanian urban centers for the year 1998 [2], as per the Public Health and Hygiene Institute.

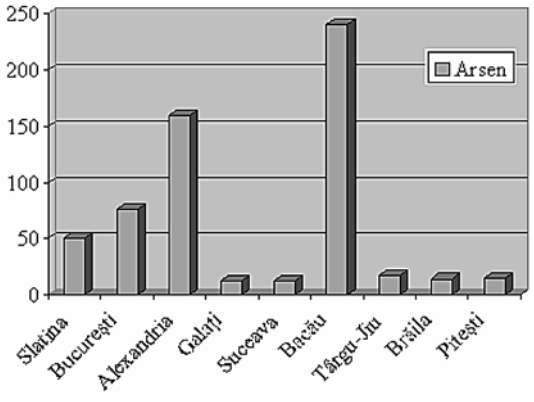

Fig. 1 – Arsenic concentrations in drinking water in Romanian urban centers (maximal concentration allowed is 50×10^{-6}/l).

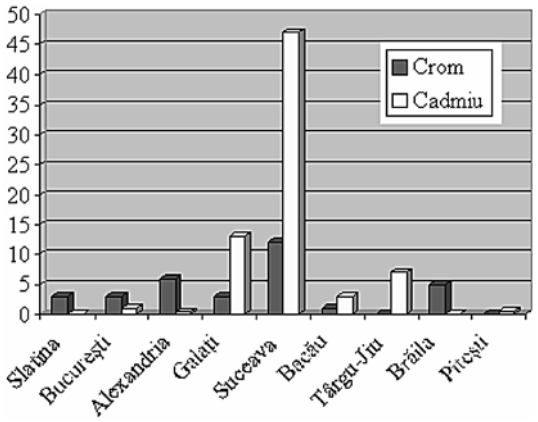

Fig. 2 – Concentrations of cadmium and chromium in drinking water in Romania.

The maximum admissible concentrations of chromium and cadmium in Romania are $50 \cdot 10^{-6}$g /l and $5 \cdot 10^{-6}$ g/l respectively.

Table 2 shows the copper concentrations in river Olt, as determined with atomic absorption method over a period of 5 months, before and after crossing the city of Râmnicu-Vâlcea [3–4].

Table 2

Copper concentrations in the water of river Olt

Data point (measurement)	1	2	3	4	5
Before/after Rm.Vâlcea	0,05/0,04	0,06/0,08	0,01/0,07	0,02/0,04	0,02/0,04

Table 3

Comparative view of drinking water quality norms in various regions of the world (inorganic contaminants)

Element	Units	UE	EPA	SPAIN
Aluminum	mg/L	0.2	0.2	0.2
Arsenic	mg/L	0.01	0.01	0.01
Cadmium	mg/L	0.005	0.005	0.005
Copper	mg/L	2	1.3	2
Chromium	mg/L	0.05	0.1	0.05
Lead	mg/L	0.01	0.015	0.025
Zinc	mg/L	NS	5	NS

NS: not specified

Tabel 4

Average, medium, maximum and minimum concentration of chemical elements obtained from 92 water probes in Spain on the consumer point

Element	Average	Max.	Min.	ST	R.D. 140/2003
Li	1,42	2,55	1,00	0,32	
Be	< 0,01	< 0,01	< 0,01	n.d.	
Cr	0,55	10,24	< 0,01	1,45	50 ppb
Co	0,01	0,31	< 0,01	0,03	
Ni	0,58	18,49	< 0,01	2,26	20 ppb
Cu	39,75	611,00	< 0,01	79,29	2,0 ppm
Zn	44,27	401,84	< 0,01	67,62	3 ppm
As	0,51	0,84	0,27	0,16	10 ppb
Se	0,85	2,10	< 0,01	0,55	10 ppb
Rb	1,11	1,73	0,67	0,30	
Sr	95,07	129,22	61,59	24,48	
Mo	0,17	0,50	< 0,01	0,15	
Cd	0,07	1,18	< 0,01	0,20	5,0 ppb
Cs	< 0,01	< 0,01	< 0,01	n.d.	
Ba	14,55	21,15	8,98	3,13	0,3 ppm
Ta	< 0,01	< 0,01	< 0,01	n.d.	
Pb	0,52	9,65	< 0,01	1,34	25 ppb
Bi	< 0,01	< 0,01	< 0,01	n.d.	
Th	< 0,01	< 0,01	< 0,01	n.d.	
U	0,10	0,66	< 0,01	0,12	

N/A.= undetermined

Tabel 5

Average, maximum and minimum concentration of elements present in drinkining water measured during 3 months (march-may) in Spain

Element	March			April			May		
	Media	Max	Min	Media	Max	Min	Media	Max	Min
Li	1,14	1,20	1,00	1,16	1,57	1,00	1,17	1,66	1,06
Be	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Cr	1,61	7,43	< 0,01	0,74	10,24	0,08	0,34	0,89	0,06
Co	0,02	0,04	< 0,01	0,01	0,05	< 0,01	0,01	0,05	< 0,01
Ni	< 0,01	< 0,01	< 0,01	0,42	5,40	< 0,01	0,01	0,16	< 0,01
Cu	77,34	374,01	6,09	20,32	107,70	< 0,01	43,16	122,79	3,12
Zn	46,98	195,53	0,51	29,24	121,54	< 0,01	42,66	276,14	3,33
Ga	0,19	0,22	0,16	0,22	0,25	0,19	0,20	0,23	0,18

Table 5 (continued)

Element	March			April			May		
	Media	Max	Min	Media	Max	Min	Media	Max	Min
Ge	0,13	0,19	0,06	0,20	0,42	0,06	0,09	0,23	< 0,01
As	0,38	0,42	0,30	0,36	0,44	0,27	0,38	0,45	0,30
Se	0,51	0,92	0,25	0,68	1,37	< 0,01	0,28	0,65	< 0,01
Sr	66,44	68,17	61,59	72,21	81,84	69,11	75,89	88,51	71,80
Y	0,01	0,03	< 0,01	< 0,01	0,01	< 0,01	< 0,01	< 0,01	< 0,01
Zr	0,06	0,18	< 0,01	0,41	4,98	0,05	0,18	0,64	< 0,01
Mo	0,06	0,22	< 0,01	0,05	0,26	< 0,01	0,03	0,09	< 0,01
Cd	< 0,01	< 0,01	< 0,01	0,20	1,18	< 0,01	0,08	0,23	< 0,01
Cs	< 0,01	< 0,01	< 0,01	< 0,01	0,01	< 0,01	< 0,01	< 0,01	< 0,01
Ba	9,77	10,31	8,98	12,95	14,87	10,71	12,10	14,32	11,41
Ta	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Pb	0,43	2,16	< 0,01	0,02	0,32	< 0,01	0,71	4,37	< 0,01
Bi	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Th	< 0,01	0,01	< 0,01	< 0,01	0,01	< 0,01	< 0,01	< 0,01	< 0,01
U	< 0,01	< 0,01	< 0,01	< 0,01	0,06	< 0,01	< 0,01	0,06	< 0,01

Tabel 6

Average, maximum and minimum concentration of elements present in drinkining water measured during 2 months (august–october) in Spain

Element	August			October		
	Media	Max	Min	Media	Max	Min
Li	1,73	2,55	1,57	1,73	2,06	1,59
Be	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Cr	0,57	4,15	0,06	0,09	0,35	< 0,01
Co	0,01	0,11	< 0,01	0,01	0,31	< 0,01
Ni	0,72	8,05	< 0,01	1,32	18,49	< 0,01
Cu	55,01	611,00	3,22	23,21	138,64	1,74
Zn	42,86	401,84	1,58	58,15	349,10	0,75
Ga	0,47	0,57	0,44	0,52	0,60	0,48
Ge	0,11	0,14	0,08	0,08	0,10	0,06
As	0,63	0,84	0,51	0,70	0,79	0,64
Se	1,01	1,63	0,03	1,51	2,10	0,93
Sr	117,68	129,22	110,46	123,40	128,89	118,40
Y	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Zr	0,11	0,57	0,01	0,08	0,43	< 0,01
Mo	0,34	0,50	0,24	0,29	0,44	0,23

Table 6 (continued)

Element	August			October		
	Media	Max	Min	Media	Max	Min
Cd	< 0,01	0,08	< 0,01	0,03	0,10	< 0,01
Cs	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Ba	16,16	18,45	14,90	18,67	21,15	17,83
Ta	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Pb	0,84	9,65	< 0,01	0,54	5,71	< 0,01
Bi	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
Th	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01	< 0,01
U	0,16	0,26	0,05	0,25	0,66	0,18

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