

AAS AND TDS MEASUREMENTS FOR WATER QUALITIES  
ANALYSIS

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**Abstract:** *Water quality is affected by the many substances water contacts during its movement through the hydrologic cycle. Water dissolves a wide variety of minerals, nutrients, and other substances from soils, rocks, and the atmosphere, and carries them in solution. The rapid increase of pollution in Dambovita County, due to the industrial processes, thermal power station and domestic sewage, modify the quality of water along the county.*

*In this paper are presented the results of atomic absorption spectrometry (AAS) and total dissolved solids (TDS) measurements of water samples from two affluent of Arges River and underground waters from the same zone of Dambovita County, Romania.*

*All samples of water were collected in successive three weeks and were measured with a GBC Avanta Atomic Absorption Spectrometer (AAS) from Valahia University of Targoviste laboratory. The TDS measurements were performed at the sampling sites by means of HACH CO150 conductometer, three weeks running.*

*The obtained results reveal an evident seasonal dynamic of quality of Arges River along the Dambovita County.*

*Keywords: AAS, TDS, pollution, water quality*

## 1 Introduction

In Dambovita zone, the significant impact of the extract of petroleum and natural gases activities for environment is the salting phenomenon and pollution with petroleum of the surface and subterranean waters and of the soil.

The most impurities from the potable water are dissolved anorganics salts. So, TDS parameter is relevant. The potable water sources which contain big concentrations of anorganics salts (over 1000 mg/l) are improper because the anorganics salts. These types of waters are improper for agriculture because of the negative effect on the plants [1].

In this paper are presented the analysis of some surface and underground waters from the River basin of Arges – Vedeia, which is a zone that is affected by the activities of oil extraction.

The analysis techniques that are used in our studies of the pollution of waters with heavy metals have been: determination of the electric conductivity and TDS and atomic absorption spectrometry, all this analysis have been effectuated in the research laboratories of University Valahia of Targoviste.

## 2 Experimental determinations

The water probes from Potop River have been collected from the same place at an interval of one week. In figure 1 are shown the collecting points of water probes.

In the monitoring action of the zones affected by the oil extraction, we sampling underground water probes from 4 fountains from the same zone – a zone with a big impact of SC PETROM, deposits Ludesti – Hulubesti.

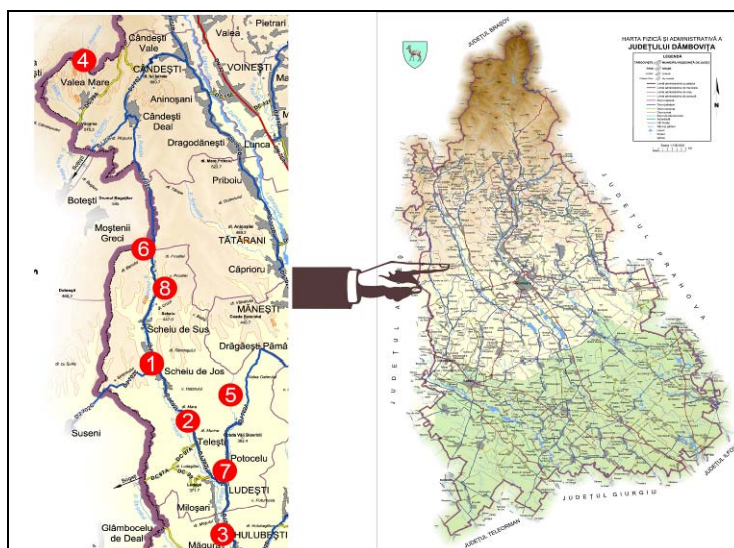


Figure 1. Collecting points of water samples

### 2.1 The determination of TDS in water samples

Determination of TDS of water samples have been realize at the sampling places with the portable conductometer HACH CO150, with the conductometric cell have platinum electrodes. The experimental results have been correlated with the heavy metals concentration that was determinate in the water probes.

### 2.2 The analysis of water probes with the atomic absorption spectrometer

To determine the concentrations of Fe, Zn and Cd we used the atomic absorption spectrometry method [2].

We use the calibration method for determination of elemental concentration in sample: some sample solutions at known concentrations (three or more) are measured for draw the calibration curve of concentration like a function of absorbance. The absorbance of one sample unknown is determinate by extrapolation in the calibration curve. The standard sample is prepared so his concentration will include the concentration value of the unknown sample

The samples have been analyzed with the atomic absorption spectrometer with flame AVANTA GBC from the University Valahia of Targoviste. This system is used to elemental analysis of a variety samples (solids, liquids). It can determinate almost all chemical elements. It has the measurements limit at 1 ppm.

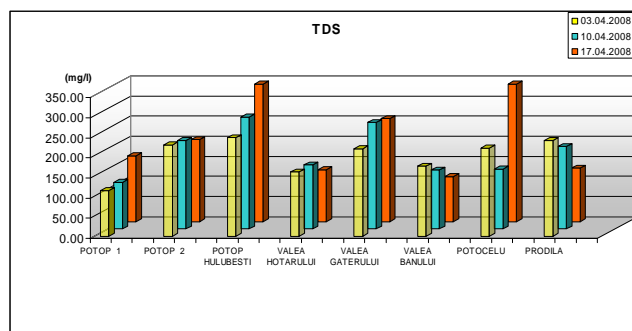
The water samples have been kept in polypropylene bottle, filtrated by filter paper and the level of pH has been increase at 4 – 5 with  $\text{HNO}_3$ .

### 3. Results and discussion

The results that have been obtained by TDS measurements of the surface water samples are shown in table 1 and of the underground water samples are shown in table 2.

**Table 1. Values of TDS in surface water probes, TDS (mg/L)**

Sample location	TDS(mg/L), 03.04.2008	Average 1	TDS(mg/L), 10.04.2008	Average 2	TDS(mg/L), 17.04.2008	Average 3
<b>Potop 1</b>	137.00	113.67	117.00	116.00	164.00	164.00
	112.00		116.00		164.00	
	92.00		115.00		164.00	
<b>Potop 2</b>	279.00	226.67	218.00	219.67	205.00	204.00
	202.00		220.00		203.00	
	199.00		221.00		204.00	
<b>Potop Hulubesti</b>	236.00	245.33	278.00	278.67	343.00	342.67
	250.00		280.00		344.00	
	250.00		278.00		341.00	
<b>Valea Hotarului</b>	163.00	159.67	160.00	159.00	129.00	129.00
	174.00		158.00		129.00	
	142.00		159.00		129.00	
<b>Valea Gaterului</b>	188.00	217.67	250.00	264.67	259.00	256.33
	200.00		275.00		256.00	
	265.00		269.00		254.00	
<b>Valea Banului</b>	175.00	174.33	146.00	146.33	112.00	112.00
	175.00		147.00		112.00	
	173.00		146.00		112.00	
<b>Potocelu</b>	233.00	218.67	159.00	149.33	344.00	342.33
	213.00		138.00		342.00	
	210.00		151.00		341.00	
<b>Prodila</b>	208.00	237.67	205.00	204.67	132.00	133.33
	252.00		206.00		134.00	
	253.00		203.00		134.00	



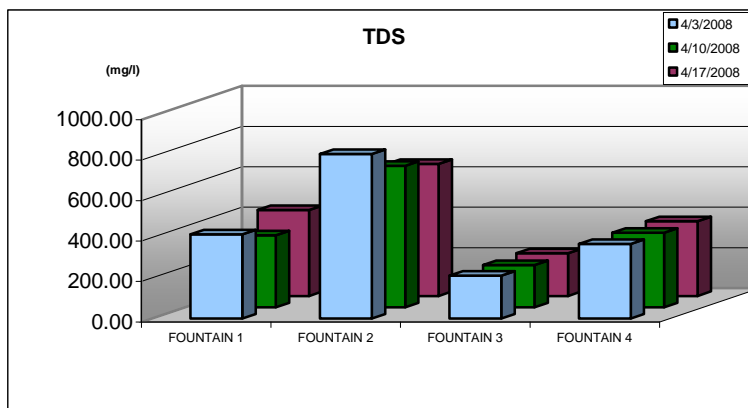
**Figure 2. TDS variation in surface water probes**

From the obtained dates it can be seen that in the Potop Hulubesti collecting point have been obtained the biggest values of TDS.

In figures 2, 3 are shown the diagrams of TDS in all the water samples.

**Table 2. Values of TDS for fountain water samples**

Samples	TDS(mg/L), 03.04.2008	TDS(mg/L), 10.04.2008	TDS(mg/L), 17.04.2008
<b>Fountain 1</b>	416.00	356.00	425.00
<b>Fountain 2</b>	814.00	700.00	653.00
<b>Fountain 3</b>	212.00	209.00	212.00
<b>Fountain 4</b>	369.00	368.00	370.00



**Figure 3. TDS variation in fountain water samples**

As we can see in figure 3, the high value of TDS was obtained for water sample from fountain no. 2 (814.00 mg/L), but not exceeded the maximum admissible value (1000 mg/L) [6, 7].

Standard values of surface water for class 1, 2 and 3 are presented in the Table 3 which means: class1 - very clean fresh surface water, ecosystem consumption where basic organisms can breed naturally, resources used for consumption which requires ordinary water treatment processes before use; aquatic organism of conservation, fisheries an recreation; class 2 - medium clean fresh surface water sources used for: consumption, but passing through and ordinary treatment process before use and agriculture; fairly clean fresh surface water resources used for consumption which requires special water; treatment process before use and industry [3, 4, 5].

**Table 3. Standard values of surface water for Class1, 2 and 3**

Element	Class 1 (mg/L)	Class 2 (mg/L)	Class 3 (mg/L)
Ca	1	3	3
Fe	0.3	1	1
Cu	0.05	0.05	0.05
Ni	0.1	0.1	0.1
Mn	0.1	0.3	0.8
Zn	0.03	0.03	0.03
Cd	0.003	0.003	0.003
Cr	0.5	0.5	0.5
Pb	0.05	0.05	0.05
Na	100	200	200

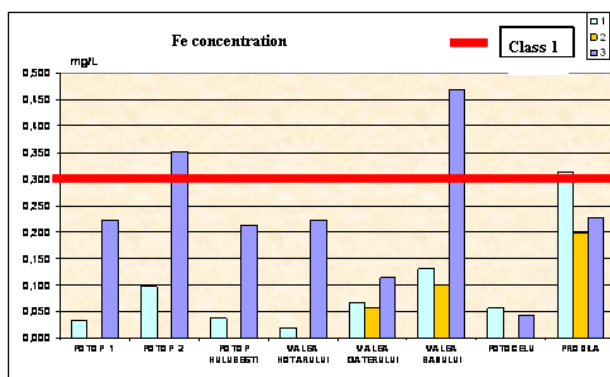
The obtained results for the concentrations of Fe, Zn and Cd in surface water and fountain water samples by the atomic absorption spectrometry are shown in tables 4 and 5. Standard error was less than 5%.

**Table 4. The concentration of Fe, Zn and Cd in surface water measured by AAS method, mg/L**

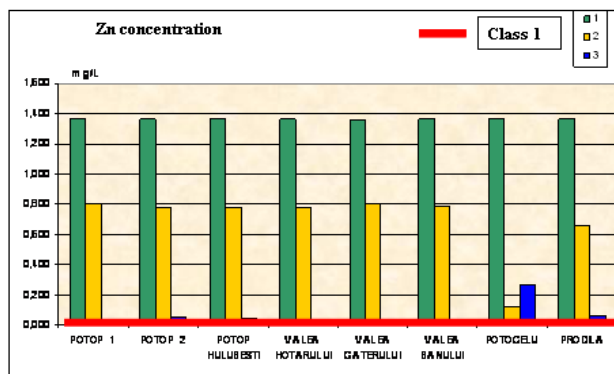
Point collection	Fe			Zn			Cd		
	1	2	3	1	2	3	1	2	3
Potop 1	0.033	0.000	0.222	1.364	0.798	0.028	0.078	0.019	0.001
Potop 2	0.097	0.000	0.352	1.367	0.782	0.051	0.078	0.025	0.007
Potop Hulubesti	0.038	0.000	0.212	1.364	0.779	0.038	0.077	0.030	0.029
Valea Hotarului	0.020	0.000	0.223	1.363	0.777	0.002	0.077	0.030	0.036
Valea Gaterului	0.068	0.056	0.113	1.357	0.801	0.022	0.079	0.006	0.005
Valea Banului	0.131	0.099	0.470	1.363	0.789	0.027	0.079	0.006	0.002
Potocelu	0.056	0.000	0.043	1.366	0.118	0.266	0.078	0.009	0.005
Prodila	0.312	0.199	0.227	1.365	0.660	0.061	0.077	0.030	0.025

1. collected date of samples: 03.04.2008;
2. collected date of samples: 10.04.2008;
3. collected date of samples: 17.04.2008.

In figures 4, 5 and 6 are shown the concentrations variation of Fe, Zn and Cd in surface water samples for a period of 3 weeks compared with the admissible value for water samples from the first class category.



**Figure 4. The variation of Fe concentration in surface water during April 2008**



**Figure 5. The variation of Zn concentration in surface water during April 2008**

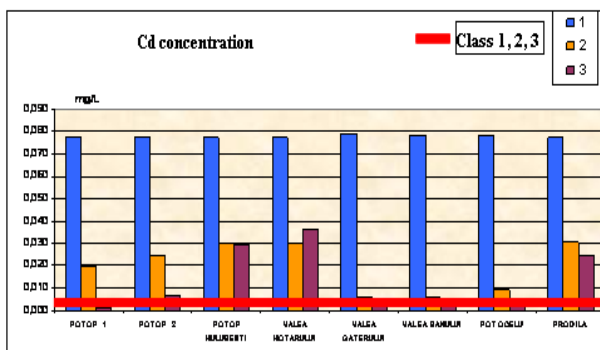


Figure 6. The variation of Cd concentration in surface water during April 2008

Table 5. The concentrations of Fe, Zn and Cd in fountains water measured by AAS method, mg/L

Samples	Fe			Zn			Cd		
	1	2	3	1	2	3	1	2	3
Fountain 1	0.037	<LD*	0.010	1.477	0.549	0.412	0.188	0.011	0.008
Fountain 2	0.042	<LD	0.031	1.367	0.063	0.072	0.188	0.012	0.007
Fountain 3	0.059	<LD	0.024	1.444	0.152	0.701	0.185	0.010	0.125
Fountain 4	0.043	<LD	0.014	1.366	0.112	0.020	0.183	0.010	0.146

\*LD – Detection Limit

- 1. collected date of samples: 03.04.2008;
- 2. collected date of samples: 10.04.2008;
- 3. collected date of samples: 17.04.2008.

In figures 7, 8 and 9 are shown the concentrations variation of Fe, Zn and Cd in fountain water samples for a period of 3 weeks compared with the admissible value for water samples from the first class category.

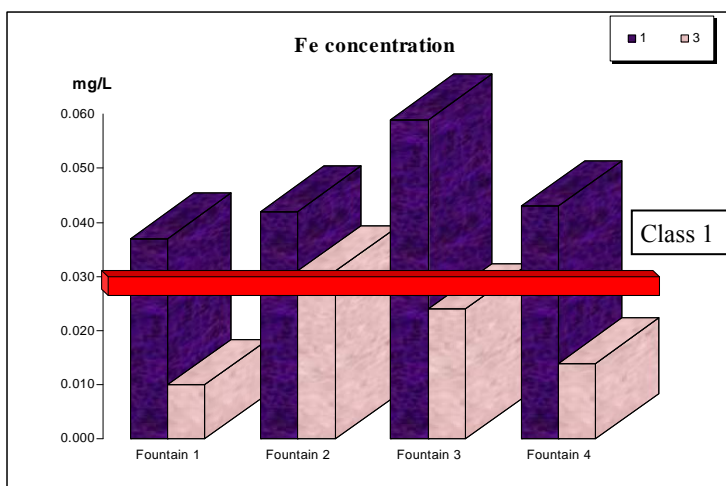
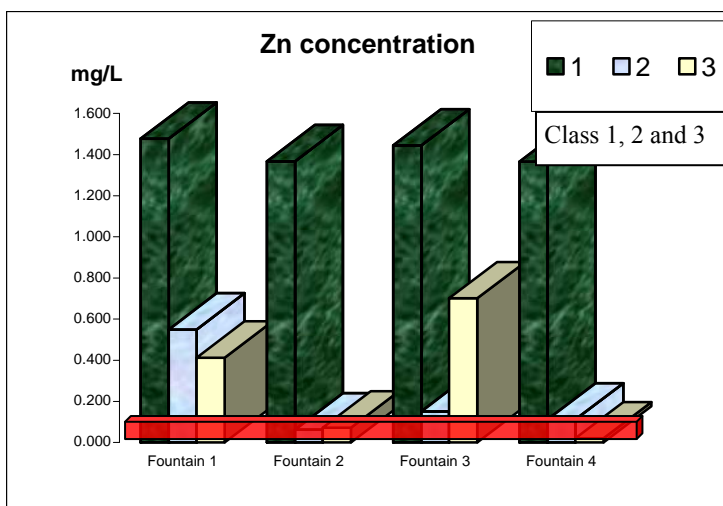
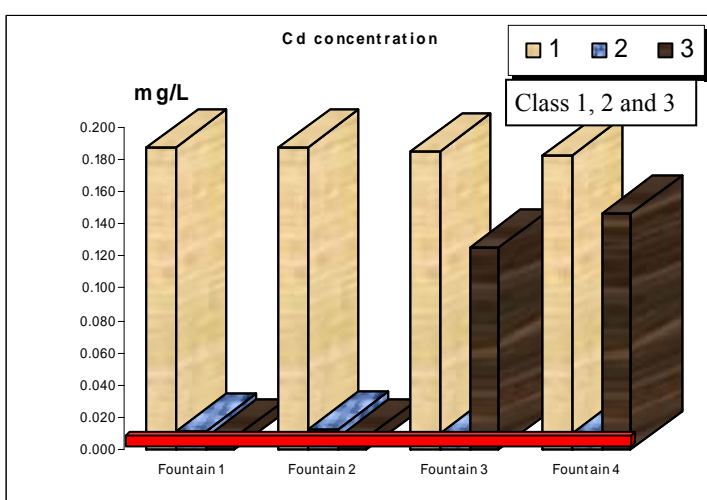


Figure 7. The variation of Fe concentration in fountain water samples during April 2008



**Figure 8. The variation of Zn concentration in fountain water samples during April 2008**



**Figure 9. The variation of Cd concentration in fountain water samples during April 2008**

From the experimental data obtained we can observe that:

- In 03.04.2008 we have obtained the maximum values for concentrations of Fe, Cd and Zn in all water fountains samples.
- All obtained values are over the standard values for quality of potable water.
- The smallest concentration values of Zn and Cd have been recorded in 17.04.2008 and are over the maximum admitted value.

#### 4. Conclusions

The big concentration of Fe in water is due to the precipitations from the third week. The water with a big concentration of Fe and Zn don't cause big problems for health but is unpleasant at taste, appearance and smell.

The rivers from the zone where are presents the activities of oil extraction, are affected by a pollution with heavy metal and by a salting phenomenon. We observe that the values of heavy metal concentration are over the maximum admissible values.

The obtained results reveal an evident seasonal dynamic of quality of Arges River along the Dambovita County.

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