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Municipality of Cluj-Napoca – The Quality of Wastewaters. Note 2. Monitoring Turbidity

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Abstract

The results of turbidity monitoring, from municipal wastewater collected from the Cluj – Napoca channels network. Monitoring was performed during one year and five months. The water samples were harvested from three distinct areas of the same municipal collection channel (Canalul Morii – Mărăşti quarter, Canalul Morii - Parcul Mare and Pârâul Popii – inside of the University of Agricultural Sciences and Veterinary Medicine Cluj – Napoca). The samples were instumentally analyzed (nefelometry) and statistical processed with STATISTICA v. 7.0. During entire experimental time interval, values that did not exceed the established limits for water turbidity were recorded. An average of 1.47 Nefelometric Units of Turbidity (NFU) with a minim of 0.54 Nefelometric Units of Turbidity and a maxim of 3.03 Nefelometric Units of Turbidity.

Keywords: suspended particles, turbidity measurement equipment, nefelometry

1. Introduction

Besides temperature, pH, conductivity, disolved oxygen, or colibacili, the water turbidity represents one of the main parameters used in monitoring water quality at national level [2, 3, 11].

The solid suspended or coloidal particles produce turbidity. The general definition of turbidity takes into consideration that total suspensions are made up of the assembly of the solid insoluble components from a considered water quantity, which can be separated using laboratory methods (filtration, centrifugation, sedimentation). It is gravimetrically in mg/L, or volumetrically, mL/L, expressed [1, 5, 6]. The value of the total suspensions is very important in characterization of the natural waters.

Function of size and specific weigth, the particles are separated as precipitates or are floating on the water. The gravimetric suspensions include the totality of the soluble and insoluble substances, that can naturally sediment during a specific time interval. The percent of the gravimetric suspensions of total suspensions is an index that leads to the correct design and use of the devices destined to sand or other impurities removal, or other installations destined for their separation [7, 8].

The suspensions and coloidal substances from water represnt the totality of the substances dispersed in water, with particle diameter sized between 1 and 10 μm. Characterized by surface electric properties, thay had high stability, which makes tham not naturally sedimentable. The elimination of the colidal substances from water imposed the chemical treatment with destabilization reagents with the aim of their coagulation and precipitation [1].

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The relationship between the substances in suspension (gravimetric property) and turbidity (optic property) determines the so called ”coefficient of finess” of the suspensions. For the same water source, the finess coefficient takes values located between well established limits within an annual hydrologic cycle [2, 6].

2. Material and Method

The laboratory analyzes were conducted in the Laboratory of the Montoring of the Environmental Quality from the Faculty of Agriculture of the University of Agricultural Sciences and Veterinary Medicine Cluj – Napoca, during January 2009 – May 2010. The turbidity analyzes were performed on water samples harvested from the following locations of the Cluj – Napoca wastewater network collection: Canalul Morii in Mărăşti quarter, Canalul Morii in Parcul Mare of Cluj – Napoca and Pârâul Popii inside from the University of Agricultural Sciences and Veterinary Medicine Cluj – Napoca. The sample were harvested from the same points nominated at the above mentioned locations according to present standards and norms [9]. The preserved samples were placed in refrigerator at de 6° - 10°C until they were analyzed, at 12 hours from sample harvesting. The quantitative analyze of turbidity was performed in laboratory with turbidimeter [1, 5], which is the main component of the turbidimetric equipment TURB 355 IR (fig. 1).

Figure 1. The turbidimetric equipment TURB 355 IR

The turbitity analyzing using turbidimeter is based on Tyndall effect. According to this phenomenon, the turbid water became bright if a light fascicle crosses the water, because the suspended particles have capacity of laterally difuse part of the light beams [1, 5, 6].

We used an equipment that contains a 355 IR turbidimeter, calibration solutions and samples to be analyzed (fig. 2). In the beginning, the device is calibrated using the standard solutions NTU = 0 and NTU = 10, using the same tank. The water to be analyzed is introduced in a clean tank, up to 0.5 cm from superior edge of the tank.

Before closing the tank, it is shaked in order to eliminate the possible presence of the air particles. The tank exterior is then wiped in order to eliminate the possible fat or dust traces (at the bottom of the tank, especially), and placed in the turbidimeter (colorimeter) with the sign from the tank cover oriented towards display direction.

Figure 2. The display of the turbidimetric device TURB 355 IR

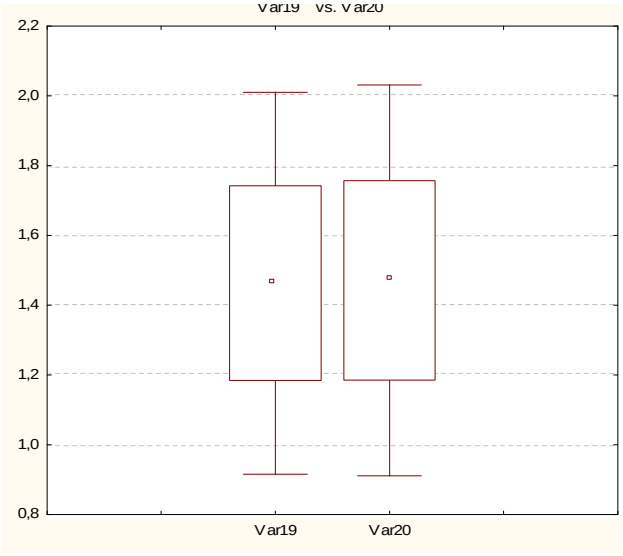
3. Results and Discussions

The turbidity of the water samples analyzed during experimental period, January 2009 – May 2010, respectively, were very uniform (similar values of averages) with values of 0.58 NTU recorded in samples harvested from Canalul Morii - Mărăşti quarter; 0,86 – 0.88 NTU for samples harvested from Canalul Morii - Parcul Mare and 2.93 – 2.97 NTU for samples harvested from Pârâul Popii located within USAMV (table 1). The biggest values obtained for turbidity, 3.03 NTU respectively, was recorded in water samples from Canalul Morii – Mărăşti quarter during July - December 2009, and the smallest, 0.54 NTU respectively, the same in Canalul Morii – Mărăşti quarter, but also in Canalul Morii - Parcul Mare (table 1). During entire analyzed time interval, a turbidity index of 1.46 NTU was recorded. The minim average value was of 0.54 NTU recorded during July – December 2009 and January – May 2010, in water collected from Canalul Morii - Mărăşti quarter, and during the same time interval in water collected from Canalul Morii - Parcul Mare. The maxim value of turbidity was of 3.03 NTU and recorded during the first analyzed time interval, January – June 2009, respectivel, in water samples harvested from Canalul Morii - Mărăşti quarter (table1). All these values were smaller compared to the maxim admitted level (< 5 NTU) even for turbidity of drinking water [10].

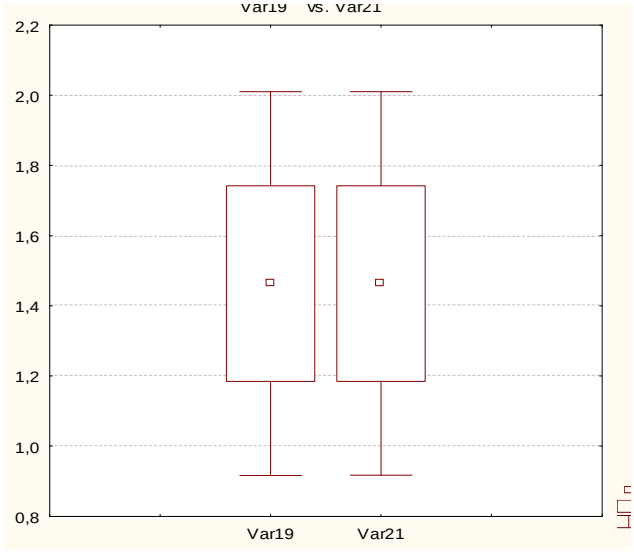
Table 1. Average and dispersion parameters of the turbidity of wastewater samples, harvested from three different areas located in Cluj – Napoca, quantified during three experimental time intervals (NTU)

Location of sample harvesting	Date	n	$\overline{X}$	±	$s_{\overline{X}}$	Minim	Maxim
Canalul Morii – Mărăşti quarter	01- 06.2009	5	0.58	±	0.004	0.57	2.98
	07 - 12.2009	5	0.58	±	0.01	0.54	3.03
	01 - 05.2010	5	0.58	±	0.01	0.54	2.95
Canaul Morii – Parcul Mare	01- 06.2009	5	0.88	±	0.01	0.57	0.59
	07 - 12.2009	5	0.86	±	0.02	0.54	0.61
	01 - 05.2010	5	0.88	±	0.01	0.54	0.62
Pârâul Popii – USAMV	01- 06.2009	5	2.93	±	0.01	0.86	0.89
	07 - 12.2009	5	2.97	±	0.02	0.79	0.89
	01 - 05.2010	5	2.93	±	0.01	0.85	0.91
Canalul Morii – Mărăşti quarter	January 2009 – May 2010	15	1.46	±	0.28	2.91	2.98
Canalul Morii – Parcul Mare	January 2009 – May 2010	15	1.47	±	0.29	2.93	3.03
Pârâul Popii - USAMV	January 2009 – May 2010	15	1.46	±	0.28	2.91	2.95
Total	January 2009 – May 2010	45	1.46	±	0.16	2.91	3.03

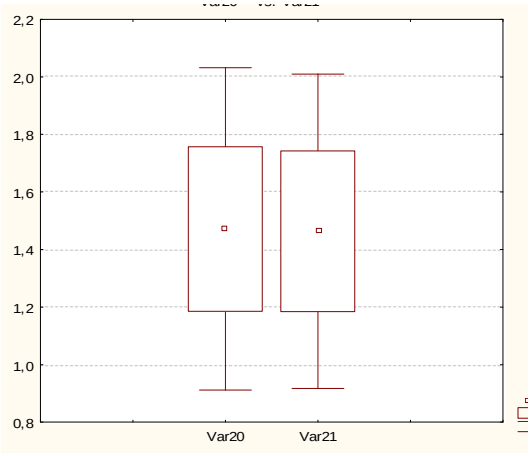
The degree of dispersion of the average values is illustrated using "Boxplot" diagrams (fig. 3) that provide an appropriate support for rapid comparison of the studied groups [4].



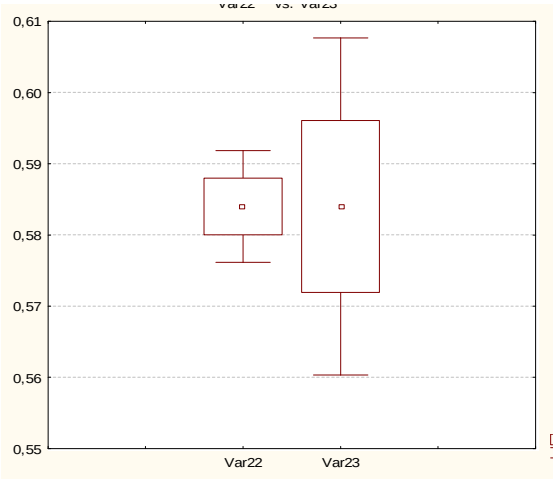
a. $X_{CMM\ 01-\ 06.2009} - X_{CMPM\ 01-\ 06.2009}$ ($p = 0.989^{ns}$)



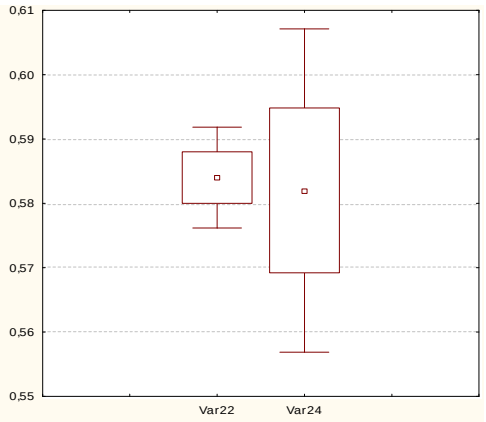
b. $X_{CMM\ 01-\ 06.2009} - X_{PP\ 01-\ 06.2009}$ ($p = 0.885^{ns}$)



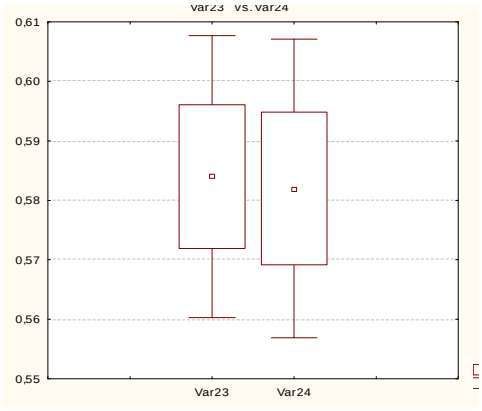
c. $X_{CMPM\ 01\text{-}\ 06.2009} - X_{PP\ 01\text{-}\ 06.2009}$ ($p = 0.912^{ns}$)



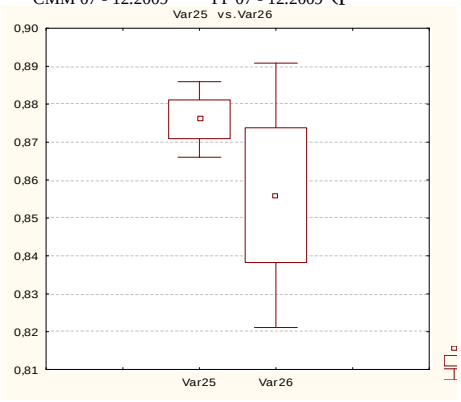
d. $X_{CMM\ 07\ -\ 12.2009} - X_{CMPM\ 07\ -\ 12.2009}$ ($p = 0.311^{ns}$)



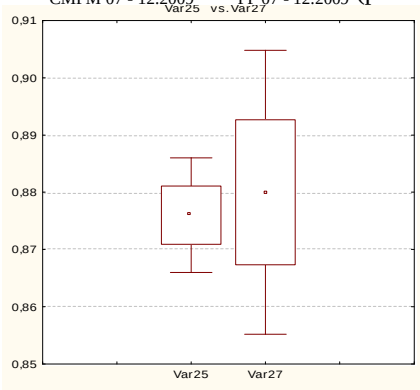
e. $X_{CMM\ 07\ -\ 12.2009} - X_{PP\ 07\ -\ 12.2009}$ ($p = 0.777^{ns}$)



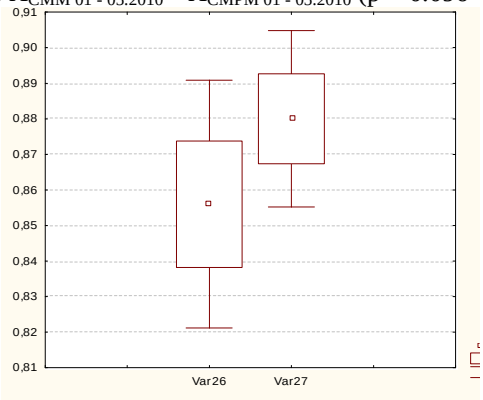
f. $X_{CMPM\ 07\ -\ 12.2009} - X_{PP\ 07\ -\ 12.2009}$ ($p = 0.303^{ns}$)



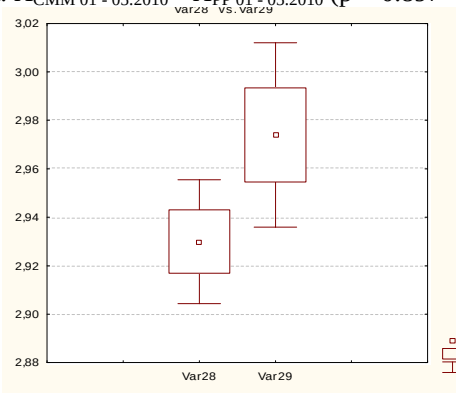
g. $X_{CMM\ 01\ -\ 05.2010} - X_{CMPM\ 01\ -\ 05.2010}$ ($p = 0.096^{ns}$)



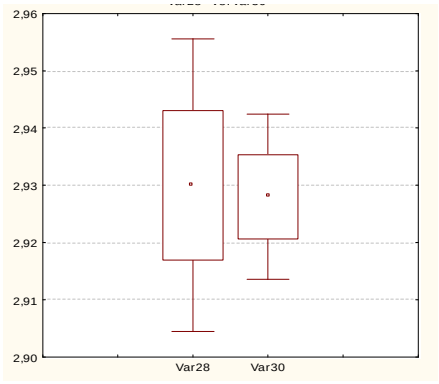
h. $X_{CMM\ 01\ -\ 05.2010} - X_{PP\ 01\ -\ 05.2010}$ ($p = 0.897^{ns}$)

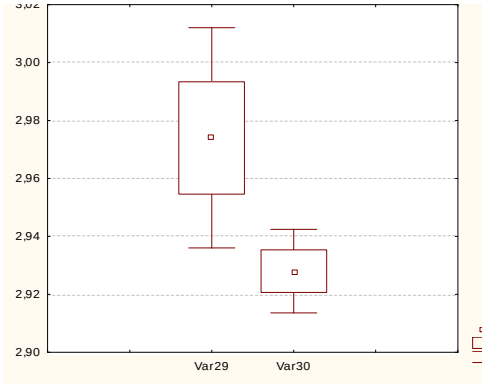


i. $X_{CMPM\ 01\ -\ 05.2010} - X_{PP\ 01\ -\ 05.2010}$ ($p = 0.057^{ns}$)



j. $X_{CMM\ 01.2009-05.2010} - X_{CMPM\ 01.2009-05.2010}$ ($p = 0.984^{ns}$)





k. $X_{CMM\ 01.2009-05.2010} - X_{PP\ 01.2009-05.2010}$ ($p = 0.984^{ns}$) l. $X_{CMPM\ 01.2009-05.2010} - X_{PP\ 01.2009-05.2010}$ ($p = 0.984^{ns}$)

CMM - Canalul Morii, Mărăşti quarter, CMPM - Canalul Morii, Parcul Mare, PP - Pârâul Popii, USAMV
ns - $p > 0.05$; * $p < 0.05$; ** - $p < 0.01$; *** - $p < 0.001$

Figure 3. Graphic illustration of the significance of differences between the average values obtained for turbidity indices of the analyzed wastewater samples

4. Conclusions

The turbidity of the wastewater collected from monitored areas, was smaller in wastewater samples harvested from Canalul Morii - Parcul Mare and Pârâul Popii - USAMV, compared to Canalul Morii - Mărăşti quarter, indicating a light smaller pollution degree of wastewater in these locations, but differences are statistcally not significant ($p > 0.05$).

The average value recorded, during entire experimental time interval and by all samples, of 1.46 NTU, with minimum 0.54 and maximum 3.03 NTU, indicates satisfactory quality of the wastewaters of the municipality of Cluj – Napoca.

References

[1] Anderson W.C., 2005, Turbidity, http://water.usgs.gov/owq/FieldManual/Chapter6/Section6.7_v2.1.pdf

[2] Berkesy L.E., C.M. Berkesy, T.T. Hasmasan, 2008, The importance of monitoring the quality parameters of surface water and ground water in order to treat them for obtaining potable water, AACL Bioflux, 1 (2), 145 - 151

[3] Citrina Daniela, 2005, Poluarea apelor, Editura Sitech, Craiova

[4] Clocotici V., 2009, Dicționar explicativ de statistică, http://profs.info.uaic.ro/~val/statistica/StatGloss.htm

[5] O'Dell J.W., 1993 Determination of turbidity by nephelometry/Methodology,http://www.epa.gov/ogwdw000 /mdbp/pdf/ turbidity/app_b.pdf

[6] Harvey D., 2000, Modern Analytical Chemistry, The McGraw – Hill Companies, USA

[7] Spellman R.F., 2008, Handbook of Water and Wastewater Treatment Plant Operations, CRC Press Taylor &Francis Group

[8] Tchobanoglous G., H.D. Stensel, 2002, Wastewater Engineering: Treatment and Reuse, Metclaf&Eddy

[9] ***, 2000, Directiva Cadru 2000/60/EC în domeniul apei

[10] ***, 2002, Legea 458/2002 privind calitatea apei potabile

[11] ***, 2005, Legea pentru aprobarea OU a Guvernului României nr. 152/2005 privind prevenirea şi controlul integrat al poluării