

# Implementation of IQ Software Pack in Wastewater Treatment Plant

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**Abstract**— The use of software monitoring technologies presented a particular interest in the last few years. Implementing such techniques can be done not only as a right course of action, but also as an intermediate stage. The efficiency of industrial wastewater treatment plants depends, at a significant level, on the quality of the water which enters the plant, established by the current normative. Failure in applying these conditions leads to a decrease in the plant's efficiency as an ensemble. The wastewaters from treatment waste from landfills are important concern because of variations in the leachate quality for entry into the treatment plant. The wrong correlation between stages of wastewater treatment who not offer a suitable solution can lead to destruction of biological stage primarily by pH (6.5-8 pH unites).

**Keywords**— wastewater treatment, organic compounds, IQ Software Pack.

## I. Introduction

When wastewater is discharged, the emissaries composition and concentration of harmful substances influence its self-cleaning ability. Physico-chemical and bacteriological indicators used to determine whether treated wastewater meets or not the waste the discharging conditions, are regulated in Romania by law. The role of wastewater treatment plant is to double monitor wastewater: both at the treatment plant entrance and at the exit. If the maximum allowable value is exceeded, the physico-chemical set indicators need careful monitoring; therefore the treatment process has to be automated. Pursued wastewater degrees corresponding to each stage of purification treatment at fixed intervals of time are not enough from the point of view of the organic loads. Such monitoring at very narrow time intervals is needed in order to prevent destabilization, protection and functioning of the biological stage with activated sludge. Considering all these, this paper aims to analyze the advantages of implementing the monitoring system which is based on the

IQ Sensor Pack software. Following the implementation of such a system is desired so that biologically treated water can be continuously discharged through the emissary mouths. The use of online monitoring systems leads to the performance of the wastewater treatment plant. Tracking indicators used in advance of the physico-chemical treatment plant leads to the establishment of the main parameters to be monitored online and gives a hint how to reconcile this decision making process on the treatment.

## II. Experimental

Conceiving IQ Software Pack system was done by Petroleum-Gas University of Ploiesti and implemented together with SC Envirotronic Bucharest. Functional units connect scheme is shown in figure 1.

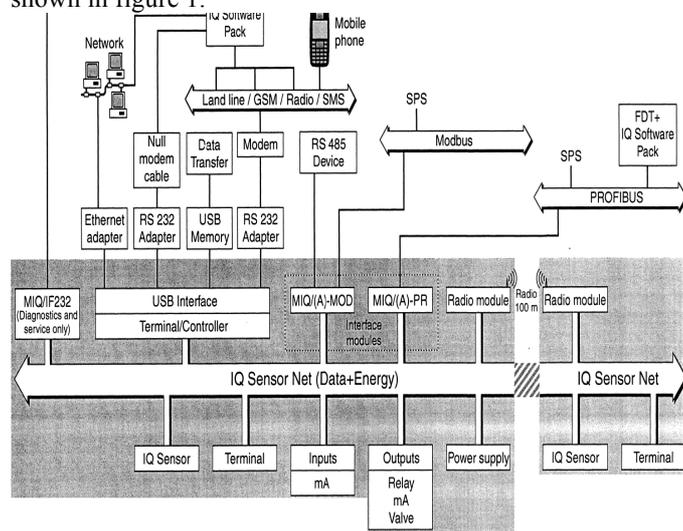


Figure 1. Functional units of IQ Software Pack

IQ Software Pack includes sensors, terminal/controller with USB interface, Ethernet adapter and modem for data transfer. As observed, the information is transported between the

controller and other modules. The Scheme implemented for the proposed system is shown in figure 2.

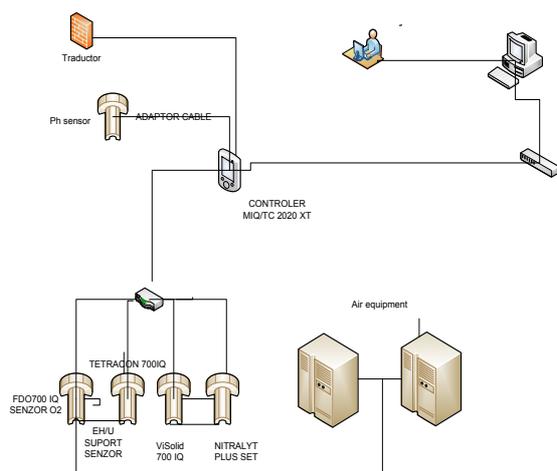


Fig. 2. Scheme IQ Software Pack implemented

Functions corresponding to this case are: alarms, recording data transmission limit values, calibration history, measuring representative values and local settings.

The wastewater leached treatment plant has both a physico-chemical and a biological unit. When the data obtained were processed it was taken into consideration system errors and random errors [1,2]. In the physico-chemical unit there was assembled the pH sensor (type) and in the biologic unit there were assembled the oxygen sensors (type), total suspended solid, nitrates/ammonium interchangeable sensors and conductivity sensors. The system accomplishes a cyclic auto test during the exploitation stage [910,11], thus identifying all the values exceeding the normal operating parameters. The messages resulted in the system are meant to inform or to indicate errors that are automatically corrected by the exit modul (MIQ). The temperature range in which the modul operates is between -20...40°C and the functioning altitude has to be of maximum 800 m above sea level. In order to adapt sensors to the temperature approximately 50 minutes are needed. The measured values are stored in a data base which is the basis of an automation system of the wastewater treatment process of the leachate. Thus, based on the measured values of the dissolved oxygen the blowers are turned on or off for the biological unit aeration. The measured values of the pH in the physico-chemical unit turns on/off the dozing system of the reactives. The values of the SS (suspended solids) indicators, conductivity, nitrates/ammonium show the biological wastewater treatment process efficiency and with the help of an internal automation routine they allow establishing the quantity of the recirculated sludge. The monitoring of the SS concentrations, nitrates/ammonium, conductivity, pH experimented for 30 days, during summer, when water temperature was approximately 24°C. The intensification of the biological wastewater treatment process was taken into account, thus performing tests specific to active sludge development, which consisted in observing

microorganisms on the optical microscope (type) and also in periodical estimation of the SVI. The dissolved oxygen concentration needed for nitrification reaction occurrence is minimum 1mg/l. The chosen operating interval for optima conditions functioning was between 2,5 and 3,8 mg/l. The device used for determining COD (chemical oxygen demand) and BOD (biochemical oxygen demand) was DR 5000.

### III. Results and discussion

The values of the physico-chemical indicators recorded and optimized by the system IQ SENSOR NET are shown in table 1. Thus adjusting pH in the phisco-chemical unit by adding suitable coagulants and flocculants allowed the good functioning of the biological unit. The elimination of the nitrogen and, implicitly of the nitrogen compounds was done by observing the report C:H:N=100:5:1. As observed, the wastewater degree varies between 10% and 80% from BOD and between 5% and 80% from COD.

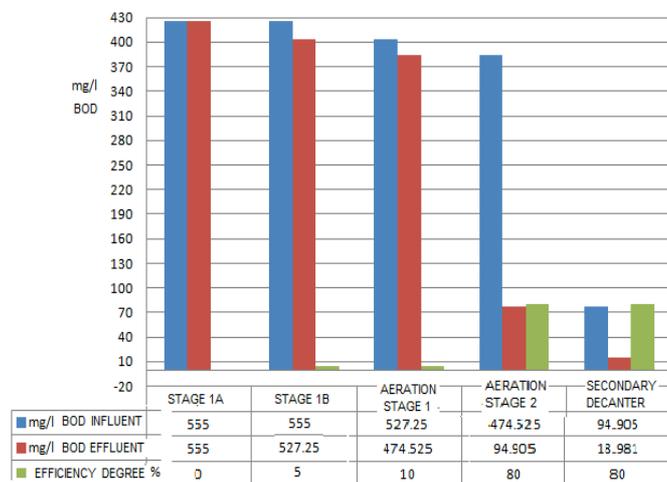


Fig. 3. BOD efficiency after install IQ Sensor Net

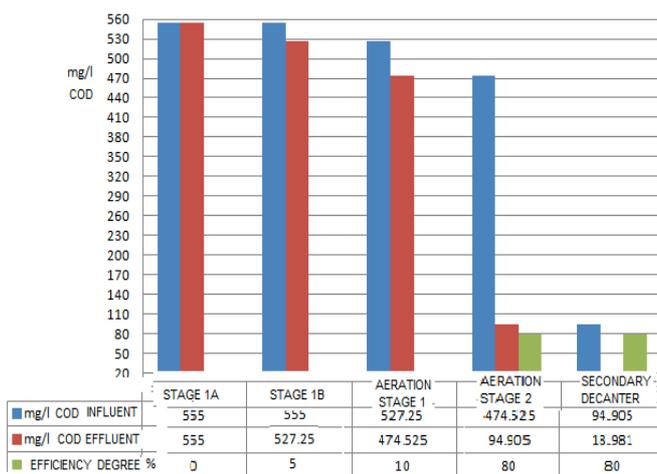


Fig. 4. COD efficiency after install IQ Sensor Net

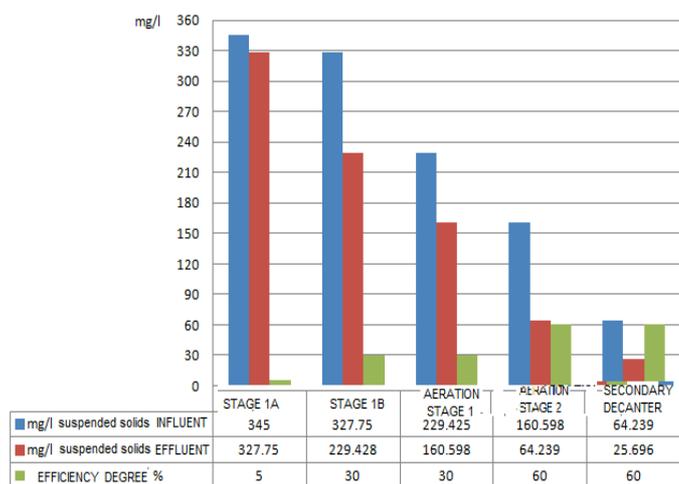


Fig.5. Suspended solids efficiency after install IQ Sensor Net

By using IQ SENSOR NET system and control process there can be noticed a significant decrease of the concentration of ammonium, up to values of 0.5 mg/l which shows a development of the performance of the biological unit from the point of view of nitrogen transformation, the oxidation of ammonia to nitrites, then into nitrates and subsequently in molecular nitrogen (there are interferences between nitrification and denitrification processes). BOD variation decreases during the experiment, less in the first part, more in the second one, after a longer time span of biological treatment, reaching in the end a value close to the maximum accepted limit according to NTPA 001/2005, de 25.12 mg/l. Total suspended solids concentration at the outlet from the treatment station registered lower values, the minimum value being 30 mg/l.

Table 1. Physico-chemical parameter values after the implementation of IQ Software Pack

Days	NH <sub>4</sub> <sup>+</sup> mg/l	Nitrate mg/l	Nitrite mg/l	BOD mg/l	COD mg/l	Suspended solids mg/l	pH
1	0.4	12.4	2.1	12.1	78.7	973.6	6.6
2	0.6	12.9	2.2	12.4	91.9	1021.1	6.6
3	0.2	13.9	2.8	10.6	99.8	948.8	6.6
4	0.5	14.8	2.1	10.9	91.8	993.1	6.5
5	0.7	17.2	1.4	11.6	78.7	1027.8	6.5
6	0.1	15.4	2.1	11.2	88.9	985.3	6.6
7	0.8	18.3	1.9	11.7	84.2	991.4	6.5
8	0.3	17.9	2.1	9.2	71.4	987.3	6.7
9	0.3	11.7	2.7	11.1	82.4	980.4	6.5
10	0.1	11.9	2.3	14.8	67.7	993.5	6.8

## IV. CONCLUSIONS

Nitrogen compounds elimination in order to treat the leachate represents a complex process. The decreasing of the ammonium concentration indicates a good functioning of the

biological stage due to the continuous optimization of the wastewater treatment process.

Because a good efficiency of the biological treatment was registered [5,7] (the values of the pollutants concentrations - BOD, COD, ammonium - at the end of the experiment getting close to the maximum accepted value according to NTPA 001/2005, sometimes even below the limit), it was concluded that the selected microorganisms have perfectly adapted to the initial characteristics of the water, which can be considered an advantage.

Comparing degrees of the treatment before and after system implementation, there could be noticed an increase to 80%. Sensors used by the IQ system provide the main physico-chemical parameters that determine the proper functioning of the treatment process. Using sensors to double the IQ system offers the possibility to add components that can be maintained for a total operating failure. Memory chips storing information in the sensor can lead to a simple identification of where and when measurements were made. Easy calibration of the sensors makes possible the elimination of the human errors that routinely occur in the laboratory. There is continuous data availability and rapid recovery of the values measured, even immediately after any power failure. The above mentioned aspects are the main advantages of the chosen system.

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