Journal of Engineering and Applied Sciences 13 (14): 5848-5853, 2018
ISSN: 1816-949X

The Quality of Waste Water Treatment Plant in "Sharrcem" Cement Plant-Hani Elezit-Kosova

[1]Sylejman Berisha, [2]Halil Berisha, [3]Muhamet Malsiu and [4]Elon Berisha
[1]Faculty of Edukation, University of Prishtina "Hasan Prishtina", Prishtina, Kosovo
[2]"Sharrcem Plant", Hani i Elezit, Kosovo
[3]Ministry of Environment and Spital Planing, Department of Environment, Prishtina, Kosovo
[4]Faculty of Economics, Univerzitet of Prishtina, "Hasan Prishtina" Prishtina, Kosova

Abstract: The water is one of the major components for the sustainable development of biggest companies even though its impact in the industry of cement in Sharrcem-Hani Elezit-Kosovo is relatively small compared to the other sectors. The priority of water management efficiency emerged at the World Business Council for Sustainable Development Initiative (WBCSD/CSI). The Sharrcem cement plant in Hani Elezit, Kosova except other investment on environmental improvement recently has installed Waste Water Treatment Plant (WWTP) which have been in service, since, the beginning of 2016 a serious investment whose purpose was to improve the quality of the polluted waters prior to discharge into the Lepenc River to prevent potential water pollution to protect the environment and the health of the employees of Sharrcem and of the local community. The waste water treatment plant operates with the latest technology according to serial reactors (Sequencing Batch Reactors-SBR) with a fully automatic system and a capacity of 500 equivalent residents where a number of local residents of the city Hani i Elezit are connected. The application of new technologies in WWTP is showing high results in the quality of treated water, compared to the previous state of the plant where the wastewater was unloaded directly untreated in the Lepenc River flow. The polluted water quality analysis in industrial operators is estimated through the main parameters of pollution such as: potassium bacteria with fecal origin, Biological Oxygen Demand for 5 days-BOD5, Chemical Oxygen Demand-COD, Suspended Solids-TSS and pH value as well as other physico-chemical accompanying parameters such as, the presence of various metals, sulfate groups, nitrate groups, etc. From the monitoring results for 2016 and 2017, it appears that the pH value is within the allowed values while solid suspended chips TSS, after treatment are able to drop threefold below the allowed values for the flow of waters. The Chemical Oxygen Demand-COD and the Biological Demand for 5 days Oxygen-BOD5, after treatment reaches tenfold below the allowed values according to the required standards. Positive encouraging results were also demonstrated in the monitoring of other physical and chemical parameters which after treatment fell below the limit values, before discharging polluted waters in the Lepenci River. The water quality monitoring results at the plant show that, the water which comes out of the Waste Water Treatment Plant (WWTP) and is discharged into the Lepenci river meets and exceeds multiple quality requirements in accordance with EU and national standards for wastewater discharge values. (Kosovo Water Law No 04/L-147 and Administrative Instruction No. 30/2014 on the conditions, methods, parameters and limit values for the discharge of waste water into the public sewage network).

Key words: Water quality, waste water treatment plant, environment, parameters, sewage network, Kosova

INTRODUCTION

In this transitional period of general developments, treating the wastewater in Kosova in compliance with European Union's sanitary requirements and provisions as well as in accordance with Kosovo Water Law will be one of the most serious standards to be met which is a condition for regional and wider integrations.

Socio-economic factors have been proved to be crucial determinants in the selection of waste water treatment plants in developing countries, provided that their local needs and constraints are closely connected with the technical remedy.

The Sharrcem cement plant is located in the southern part of Kosovo near the border with the Former Yugoslav Republic of Macedonia (FYROM) in the municipality of

Corresponding Author: Sylejman Berisha, Faculty of Edukation, Univerzitet of Prishtina "Hasan Prishtina", Prishtina, Kosova

Hani Elezit of the Republic of Kosovo. Sharrcem as a member of the Titan group company is currently thleading cement supplier in Kosovo. The enterprise management set itself the objective in integrating high standards at all levels of operation as well as improving and advancing the technological process of cement production.

Sharrcem in 2014 received the Integrated Environmental Pollution Prevention and Control (IPPC) permit. It has also been certified with the ISO 14001 environmental management system, OHSAS ISO 18001-health and safety management system ISO 9000-management system quality and with SA-ISO 8000-social responsibility management. The company now follows integration policies such as environmental policies, water management in the process of cement production in its wards and raising awareness and improving efficiency at research. These objectives are in accordance with the World Business Council's Sustainable Development Cement Initiative (Anonymous, 2016). Based on the requirements of the Integrated Pollution Prevention and Control (IPPC) to improve the quality of wastewater before discharging them into any water body Sharrcem in March, 2016 has invested and finalized the Waste Water Treatment Plant (WWTP) project. (Detail design project SBR+WWTP 100 m^3/day, 2015).

Prior to the installation and implementation of this project, the monitoring of waste water in the all discharge points, the water quality and contaminant parameters (coliform bacteria, BOD5, COD, TSS and pH content) have not met the values allowed by the national water legislation and the criteria given in the IPPC permit for the quality of wastewater discharge from treatment plant.

Secondly because since, there are missing markets for quality and quantity of treated wastewater which are public or quasi-public goods, hypothetical, stated preference methods were preferred to capture the value of these. Among, the stated preference methods the choice experiment method was deemed preferable to the contingent valuation method, since, the former enables estimation of the various benefits that may be generated by different interventions and their trade-offs.

Starting from this situation and the general requirements arising from the IPPC improvement program, the Sharrcem company implement the project of Waste Water Treatment Plant (WWTP) witch is finalized in 2016. The project aims to improve the existing network which has worked as a mixed network with all atmospheric and sewage waters collections. While now, the plant has a new network with pipediameter 200 mm and a length of 962 m completely separated from the atmospheric water network. This pipe collects all wastewater discharges at a single point in the waste water treatment plant. Then the treated water from the plant is discharged in the stream witch is through cross the cement plant and then goes to the Lepenci River, 200 m distance from the plant. It is known that the primary water quality assessment parameters of water discharged into the water bodies are potassium bacteria from fecal origin, BOD5-Biological Oxygen Demand, COD-Chemical Oxygen Demand, TSS-Total Suspended Solids, pH value and other physical-chemical parameters (presence of various metals, sulfate groups SO4, nitrate groups NO_3, NO_2 and NO monoxides) (Anonymous, 2014a-c).

MATERIALS AND METHODS

Sharrcem cement production company in the municipality of Hani i Elezit is set to verify the quality of wastewater discharge in rivers or water bodies, conforming to the actual local legislation in Kosovo by the local operators, especially of the operators near the border inspection areas.

Wastewater Treatment Facilities (WWTP) operate from the beginning of 2016. The treatment technology has been designed to meet the standards for sewage discharge quality as per IPPC requirements, Administrative Instruction AI 30/2014 and the regulatory EU 91/271/ EEC (1999) (Anonymous, 1999). The global water tool for the cement sector is a sector-based customization of the global water tool. It was developed to support member companies in reporting the CSI Indicators for water whichare specified in the protocol for water reporting for the cement industry.

Further analysis was conducted in consideration of the Kyoto protocol. The Kyoto protocol agreed upon on 16 February, 2005, required developed countries to reduce designated amounts of such greenhouse gases as carbon dioxide and methane. The Clean Development Mechanism (CDM) is one of the mechanisms employed to reduce green house gases under the Kyoto protocol. Therefore when developed countries implement projects certified for CDM, they can obtain so-called carbon credit from reducing the amount of green house gases emitted by said projects Sequencing Batch Reactors (SBR) technology is fully automated and has linked several families of the neighboring community to handle their polluted waters.

The waste water quality control company has contracted the licensed laboratory which according to the respective methodologies performs all services from sampling, analysis of pollutant parameters to processing of analysis results. The research has lasted for almost 2 years, exactly, since, the launch of the equipment in

March, 2016 until the end of December, 2017. From the results of the monthly analysis, the average annual value of every pollutant parameter is extracted separately. Then the results of the pollutant parameters are compared after the installation of WWTP contaminated cleaning equipment with the pollutant parameters results prior to the WWTP cleaning equipment.

The analysis of the quality of polluted water is estimated through the main parameters such as, Potassium factors of biological origin, Biological Demand of BOD5, Chemical Oxygen Demand-COD, Suspended Solids-TSS and pH. In this research, other physical and chemical parameters as well as the presence of ions of iron and other metals, SO_4 sulfate ions, the presence of nitrogen in the form of nitrates, N-NO_3, the presence of N-NO_2 nitrogen and the presence of N-NH_4) were followed and analyzed (Anonymous, 2014a).

Description of the location and operation of wastewater treatment plant: Sharrcem cement production company in the municipality of Hani i Elezit is set to verify the quality of wastewater discharge in rivers or water bodies, conforming to the actual local legislation in Kosovo by the local operators, especially of the operators near the border inspection areas. Wastewater Treatment Facilities (WWTP) operate from the beginning of 2016. The treatment technology has been designed to meet the standards for sewage discharge quality as per IPPC requirements, Administrative Instruction AI 30/2014 and the regulatory EU 91/271/EEC (1999) (Anonymous, 1999). Sequencing Batch Reactors (SBR) technology is fully automated and in which are connected in to the same network some of the neighboring community to treat their polluted waters.

The wastewater quality control company has contracted the licensed laboratory which according to the respective methodologies performs all services from sampling, analysis of pollutant parameters to processing of analysis results. The research has lasted for almost 2 years, exactly, since, the launch of the equipment in March 2016 until the end of December, 2017. From the results of the monthly analysis, the average annual value of every pollutant parameter is extracted separately. Then the results of the pollutant parameters are compared after the installation of WWTP contaminated cleaning equipment with the pollutant parameters results prior to the WWTP cleaning equipment.

The analysis of the quality of polluted water is estimated through the main parameters such as potassium factors of biological origin, Biological Demand of BOD5, Chemical Oxygen Demand-COD, Suspended Solids-TSS and pH. In this research, other physical and chemical parameters as well as the presence of ions of iron and other metals, SO_4 sulfate ions, the presence of nitrogen in the form of nitrates, N-NO_3, the presence of N-NO_2 nitrogen and the presence of N-NH_4 were followed and analysed.

The appropriate location for the installation of the waste water treatment plant is selected near the final discharge point in the dimces stream passing through the Sharrcem factory, a location that enables the expansion of the potential wastewater treatment system of the factory. The location belongs to the cadastral parcel No. 124, owned by Sharrcem with an area of approx. S = 2.229.70 m^2 and with coordinates; X = 4667451 and Y = 7524643 (Fig. 1).

Waste water treatment technology and working cycle of SBR reactors: SBR technology-reactors research consists in principle of five stages of operating processes such as filling, mixing, reaction, sedimentation and decanting according to the detail design project SBR+WWTP 100 m^3/day November, 2015 from fluid "project.

Fill phase: Filling of reservoirs with dirty water. During filling in the reservoir, we also have a quantity of biomass remaining from the previous cycles which is mixed with the amount of contaminated water. Static filling (without mixing operation) results in minimal energy costs and high concentration of substrates at the end of this phase. The anaerobic filling (without airing) results in the denitrification of the solution while in the case of the presence of nitrates leads to the reduction of BOD and energy, the anaerobic conditions required for the biological removal of phosphorus. In the case of Sharrcem, static filling phase of SBR reactor is recommended.

Reaction phase: At this stage, it is required to introduce a high concentration of oxygen (ventilation). The time

Fig. 1: The location of the waste water treatment plant in Sharrcem premises

dedicated to reacting at this stage varies from 0 to over 50% of the total cycle time. If the organic matter is good, the ventilation period may be short for up to 15 min while the ventilation time may be extended to more than 4 h if long term sustainability and nitrification is sought. In the case of Sharrcem the reactor is recommended to be 60 min.

Sedimentation phase: Another mechanical process is the process of particle sedimentation. The sedimentation time in the reactors is defined and at the end of the reservoir the sedimentation of active silt occurs.

Decantation phase: At the end of the sedimentation process, the decanter starts the water decanction process treated by the reactor. At this stage water is removed from the reactor. The time at the decanation stage varies from (5-30%) of the total cycle. The duration of the decanting time may cause silt growth. At the Sharrcem factory, the decantation time at the SBR reactor is tolerated max. The 60 min while the pump is selected during the installation phase.

RESULTS AND DISCUSSION

Results achieved during the monitoring: In Table 1 and 2 are presented the main parameters of wastewater quality before treatment and after treatment in WWTP-SBR techniques. During this research due to limited space, we have presented only the average annual values of pollutant parameters derived from the monthly regular

Table 1: Presentation of physical and chemical parameters for 2016

Viti 2016			Annual average	Annual average
Water discharge quality parameters	Units	Referent value according to administrative instraction UA	Waste water before treatment	Waste water after treatment
pH	1-14	6-8.5	8.9	7.8
Suspended solids	mg/L	60	87.5	27.1
COD	mg/L	125	339.9	31.3
BOD	mg/L	60	161.3	14.5
Total Organic Carbon (TOC)	mg/L	40	121.20	9.80
Oil and grease	mg/l	10	4.56	0.25
Bakteriet califorme totale	MPN^5/100 mL	400	26.67	6.67
Sedimentation	mg/L	1.0	1.64	0.25
Iron ion (Fe)	mg/L	5.0	0.42	0.03
Manganese (Mn)	mg/L	2.5	0.12	0.02
Aluminium (Al)	mg/L	4.0	0.00	0.00
Sulphate (SO4)	mg/L	250	120.61	95.71
Ammonium (N-NH_4)	mg/L	1.0	4.66	1.64
Nitrogen of ammonium (N-NH_4)	mg/L	0.778	3.63	1.28
Nitrates (NO_2)	mg/L	1.5	1.09	0.25
Nitrogen of Nitrite (N-NO_2)	mg/L	0.456	0.33	0.08
Nitrates (NO_3)	mg/L	40	1.46	0.82
Nitrogen of Nitrate (N-NO_2)	mg/L	13.04	0.33	0.19

Table 2: Presentation of the main physical-chemical parameters for 2017

2017			Annual average
Water discharge quality parameters	Units	Referent values according to administrative instraction UA treatment 30/2014	Waste water after
pH	1-14	6-8.5	7.73
Suspended solids	mg/L	60	31.14
COD	mg/L	125	69.76
BOD	mg/L	60	15.51
Total Organic Carbon TOC	mg/L	40	34.67
Oil and grease	mg/L	10	0.35
Bakterietcaliformetotale	MPN^5/100 mL	400	13.39
Sedimentation	mg/L	1.0	0.40
Iron ion (Fe)	mg/L	5.0	0.03
Manganese (Mn)	mg/L	2.5	0.02
Aluminium (Al)	mg/L	4.0	0.00
Sulphate (SO_4)	mg/L	250	86.89
Ammonium (N-NH_4)	mg/L	1.0	1.17
Nitrogen of Ammonium (N-NH_4)	mg/L	0.778	0.91
Nitrates (NO_2)	mg/L	1.5	0.15
Nitrogen of Nitrite (N-NO_2)	mg/L	0.456	0.04
Nitrates (NO_3)	mg/L	40	0.75
Nitrogen of Nitrate (N-NO_3)	mg/L	13.04	0.50

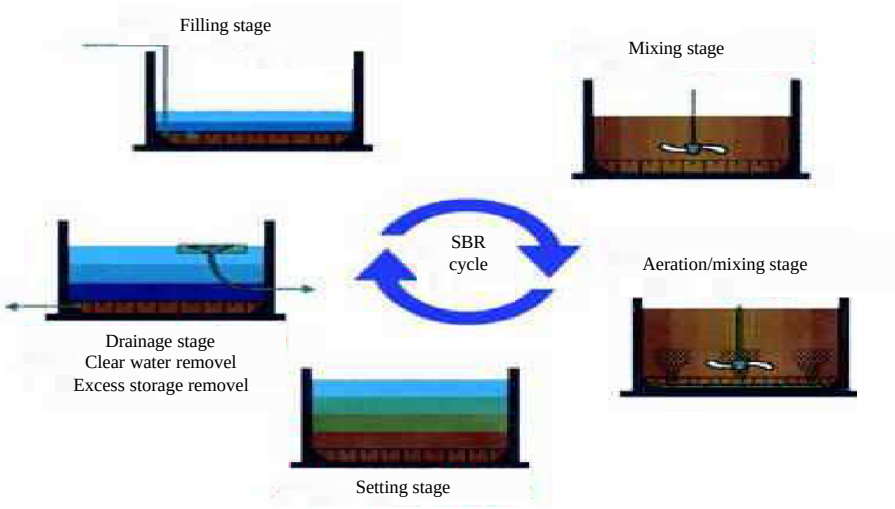

Fig. 2: Operation scheme

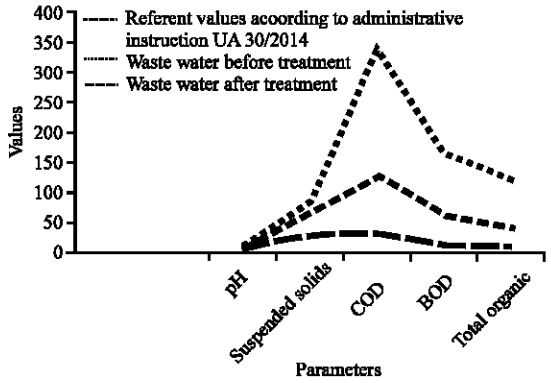

Fig. 3: Graphical presentation of the main physical-chemical parameter for 2016

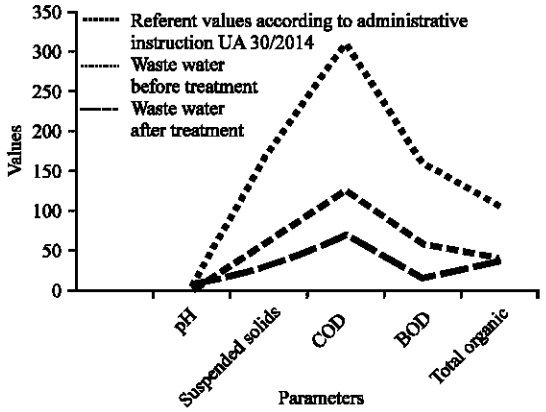

Fig. 4: Presentation of the main physical-chemical parameter for 2017

analysis values at the Sharcem plant. The parameters presented in the following table show the significant and manifold reduction of all polluted water parameters. While in Fig. 1-4 which are the function of the respective Table 1 and 2 only the main pollutants are presented which are also, the determinants of the degree of concentration of water pollution discharged into the river. Here, the main parameters of polluted water are compared to the values from the polluted water quality requirements as well as the values of pollutant parameters before and after the treatment of contaminated water at the waste water treatment at Sharrcem factory.

CONSLUSION

Investing and functionalizing the Wastewater Treatment Plant (WWTP) is a typical positive example as a sustainable investment and a prerequisite for the Sharrcem enterprise. Apart from improving the quality of polluted waters, the investment has positive effects on raising the environmental and health level of Sharrcem employees as well as families involved in this network. WWTP in Sharrcem research with waste water treatment capacity of about 100 m^3/day with a fully automated system control. From the monitoring results of the pollutant parameters of the Sharrcem waste water treatment plant for 2016 and 2017, it is evident that:

- The pH value is within the permissible values while the suspended solid particles-after treatment, reach three drops below the allowed values for the flow of water
- The Chemical Oxygen Demand-COD after treatment, reaches ten drops below the allowed values
- The Biological Oxygen Demand for five days- BOD5 also reaches ten to below the allowed values according to the required standards

- The number of coliform bacteria after treatment is able to deduct ten times the required values according to certain standards
- Positive results were also shown in the monitoring of other physical and chemical parameters during the treatment of wastewater as is the case with the reduction of the nitrogen value that comes in different forms
- Sulfate SO_4 slightly changes before and after the treatment phase but compared to the standard reference values are much lower

Based in the results of the monitoring of the pollutant parameters of the sewage treatment plant in Sharrcem, we can say that they are very encouraging positive results in improving the quality of treated contaminated water in the plant. The concentration of wastewater after treatment at the plant meets and exceeds the legal requirements deriving from the IPPC permit, Administrative Instruction AI 30/2014 and EU Regulations 91/271/EEC (1991) for discharge to the Lepenc River (Anonymous, 1999).

REFERENCES

Anonymous, 1999. Regulative 91/271/EEC concerning urban waste-water treatment. European Union, Brussels, Belgium.

Anonymous, 2014a. Administrative instruction MESP-No. 30/2014: Manners, parameters and limit values of waste water discharge into public sewage network and in the water body. Ministry of Environment and Spatial Planning (MESP), Kosovo.

Anonymous, 2014b. Global Water Tool (GWT) Cement flyer for a corporate water risk assessment: Environmental Impact Assessment (EIA) report for marl exploitation in Hani i Elezit. World Business Council for Sustainable Development, Cement Sustainability Initiative (CSI), Geneva, Switzerland.

Anonymous, 2014c. Water reporting. World Business Council for Sustainable Development, Cement Sustainability Initiative (CSI), Geneva, Switzerland. http://www. wbcsdcement. org/index.php/key-issues/water/ water-reporting

Anonymous, 2016. Guidelines for Environmental and Social Impact Assessment (ESIA). World Business Council for Sustainable Development, Cement Sustainability Initiative (CSI), Geneva, Switzerland. http://www. wbcsdcement. org/pdf/ Guidelines% 20for%20Environmental%20&%20Social%20Impact%20Assessment.pdf.