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## DEVELOPMENT AND ACTIVATION OF THE SECOND TECHNOLOGICAL PIPE IN THE WASTEWATER TREATMENT PLANT IN DOBRON

### ROZBUDOWA I URUCHOMIENIE DRUGIEJ LINII TECHNOLOGICZNEJ W OCZYSZCZALNI ŚCIEKÓW W DOBRONIU

**Abstract:** The aim of the investigation was characterizing and operation assessment of the municipal wastewater treatment plant in Dobron, taking into consideration its current flow capacity (700 m<sup>3</sup>/d) after development including building of the second similar technological pipe with the same flow capacity (350 m<sup>3</sup>/d), finished in September, 2009. Concise description of the applied wastewater treatment technology and results of investigations concerning flow rates of wastewater within last few years, are presented. Example results of wastewater composition analysis before and after the treatment process are shown. Moreover, amounts of wastes (screenings, sand and stabilized sludge) formed in the wastewater treatment process, are presented.

**Keywords:** Ecolo-Chief type wastewater treatment plants, phosphorus and nitrogen reduction in wastewater

Industrial and municipal wastewater generated during new investments realization as well as development of sewerage systems in villages and towns causes the necessity of building of new wastewater treatment plants and development of existing ones. These plants include conventional mechanical and biological treatment methods (1st and 2nd stage) and guarantee removal of biogenic compounds, ie, nitrogen and phosphorus, in the third stage of treatment [1-5].

Ecolo-Chief type wastewater treatment plants are process lines designed and produced by CHIEF INDUSTRIES, INC. (Nebraska, USA). The wastewater treatment system was modernized by Multibranch PPU Sumax, Inc. (Krakow) within the range of biogenic compounds removal and secondary settling tank operations. About 75 wastewater treatment plants using this technology, have been built in Poland [5, 6].

### Experimental

The aim of the investigation was characterizing and operation assessment of the wastewater treatment plant in Dobron taking into consideration its flow capacity (Q), before (~350 m<sup>3</sup>/d) and after development including building of the second technological pipe with the same flow capacity (350 m<sup>3</sup>/d), finished in September, 2009 (Fig. 1). Concise description of the applied wastewater treatment technology and results of investigations concerning flow rates of wastewater within last few years, are presented below. Wastewater treatment plant in Dobron (Ecolo-Chief type) operates according to the technology of low-loaded activated sludge with aerobic sludge digestion [6-8]. The wastewater treatment plant after the development includes the following systems:

- ❖ 1 drainage point of supplied wastewater with storage reservoir,
- ❖ 1 wastewater pumping station with basket screen,

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- ❖ 2 sand traps,
  - ❖ 2 primary settling tanks,
  - ❖ 2 oxygen deficiency tanks (anoxic),
  - ❖ 8 aeration tanks,
  - ❖ 2 tanks of aerobic sludge digestion,
  - ❖ 2 secondary settling tanks,
  - ❖ 2 wastewater wells for measurement of wastewater flow,
  - ❖ 2 set of rotary blowers.
- Technological system for sludge treatment consists of:
- ❖ 2 tanks of aerobic sludge digestion,
  - ❖ 1 sludge pumping station,
  - ❖ 1 tape press for mechanical removal of sludge (sludge dewatering).



Fig. 1. The view of the developed wastewater treatment plant in Dobron

Ecolo-Chief type wastewater treatment makes an increase in the main unit efficiency by combination of particular modules, possible. This is important especially during development of sludge units and gradual increasing of disposed wastewater amount, what concerned the municipal wastewater treatment plant in Dobron. This system operates perfectly in such objects where seasonal wastewater dump (for example in summertime) significantly exceeds the average dump in the other months. An application of the treatment system with periodical recirculation of a part of wastewater and sludge causes that all system operates under the condition of a full pollutants load also in the period of lower wastewater supply.

### Results and discussion

Data concerning amounts of wastewater received in the wastewater treatment plant, pollutants loads and formed technological wastes (screenings, sand removed from sand

traps and stabilized sludge) are presented in Tables 1-3. Example results of analysis wastewater composition, before and after the treatment process are shown in Tables 4.

Annual volumes of wastewater supplied to the wastewater treatment plant in Dobron over the period from 1999 to August, 2010 [9, 10]

Table 1

Year	Q [m <sup>3</sup> /year]
1999	41100
2000	50010
2001	61116
2002	51369
2003	59179
2004	60515
2005	71794
2006	70526
2007	78647
2008	87818
2009	93304
I-VIII 2010	92462

Daily average load of pollutants supplied to the wastewater treatment plant in Dobron over the period of 2007-2009 [9, 10]

Table 2

Indicator name	Concentration [g O <sub>2</sub> /m <sup>3</sup> or g/m <sup>3</sup> ]	Pollutants load [kg/day]
BOD <sub>5</sub>	247	67.9
COD-Cr	511	140.5
Total nitrogen	86.2	23.7
Total phosphorus	10.4	2.9
Total suspended solids	222	61

Waste types and amounts per month in 2009 and over the period of I-V 2010 [10]

Table 3

Year/Month	Waste types and amounts [Mg/month]		
	Screenings	Sand traps contents	Stabilized sludge
<b>2009</b>			
January	0.53	0.2	4.16
February	0.43	0.3	8.44
March	0.3	0.2	8.8
April	0.48	0.4	7.74
May	0.43	0.3	13
June	0.39	0.33	9.82
July	0.52	0.3	6.44
August	0.42	0.4	8.94
September	0.47	0.31	7.3
October	0.44	0.5	13.2
November	0.42	0.4	15.3
December	0.42	0.4	11.44
<b>2009 Total</b>	<b>5.25</b>	<b>4.04</b>	<b>114.58</b>
January	1.08	0.6	3.24
February	1.1	0.5	7.98
March	1.08	0.8	6.22
April	1.05	0.8	7.92
May	1.0	0.6	8.22
<b>2010 I-V Total</b>	<b>5.31</b>	<b>3.3</b>	<b>33.58</b>

Increasing amount of the wastewater supplied by sewerage and by waste removal transport, and their load caused to take a decision about development of the wastewater treatment plant in Dobron (Tables 1 and 2). Before the development, plant loading was gradually approaching to the limit of its maximum loading (350 m<sup>3</sup>/d), especially in the period of increased wastewater supply. Beginning from September, 2009, the plant can treat the wastewater amount of 700 m<sup>3</sup>/d. The increased flow capacity in this plant can guarantee the achievement of satisfied operation indicators for at least several years. Composition of the wastewater supplied to Palusznica river does not cause any quality reservations and fulfils law requirements [11, 12]. This plant is not hazardous for inhabitants taking into consideration odours, due to the applied treatment technology and favourable location. This is proved by lack of inhabitants' complaints about the plant operation. Up to now, no hazard of the plant to the quality of underground and surface water was found. Solid wastes (screenings, sand from sand traps and stabilized sludge) are carried outside the plant to another firm in order to utilize them.

Table 4  
Examples of composition analyses in raw and treated wastewater over the period of 2008-2010 [10]

Date of wastewater sampling	Contamination indicator in raw and treated wastewater			
	pH [-]	BOD <sub>5</sub> [mg O <sub>2</sub> /dm <sup>3</sup> ]	COD-Cr [mg O <sub>2</sub> /dm <sup>3</sup> ]	Total suspended solids [mg/dm <sup>3</sup> ]
16.05.2008	7.4/7.4	682/10	1109/56.4	241/20
21.11.2008	7.4/7.1	319/2.7	550/17	133/14
05.02.2009	7.8/7.1÷7.3	485/8.1	804/52	34/11
14.05.2009	7.6/7.2÷7.3	739/18.0	1246/105	763/18
13.08.2009	8.0/7.8÷8.4	695/9.0	1171/45	120/13
03.11.2009	-/7.4÷7.6	-/7.03	-/40	-/6.0
16.02.2010	7.5/7.3	610/15.9	1022/72	230/6.0
10.06.2010	6.6/7.1	466/11.6	826/57	388/15
30.08.2010	7.6/7.3	366/13.8	633/64	349/5.0

## Conclusions

The increased flow capacity of the plant to 700 m<sup>3</sup>/d guarantees the achievement of satisfactory operation indicators. The plant operation is not odour hazardous for inhabitants due to its proper location to other buildings (lack of inhabitants' complaints). No hazard to the quality of surface and underground waters resulting from the treatment plant operation was found so far. Solid wastes formed during the technological process of the wastewater treatment (screenings, sand from sand traps and stabilized sludge) are disposed outside the plant in order to utilized them.

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## **ROZBUDOWA I URUCHOMIENIE DRUGIEJ LINII TECHNOLOGICZNEJ W OCZYSZCZALNI ŚCIEKÓW W DOBRONIU**

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**Abstrakt:** Celem pracy była charakterystyka i ocena funkcjonowania oczyszczalni ścieków komunalnych gminy Dobroń o przepustowości obecnej (700 m<sup>3</sup>/d), po jej rozbudowie o drugą (analogiczną do istniejącej) nitkę technologiczną (350 m<sup>3</sup>/d), sfinalizowaną we wrześniu 2009 r. Oprócz zwięzłego opisu realizowanej technologii oczyszczalni ścieków przedstawiono wyniki badań natężenia ich przepływu z ostatnich kilku lat. Ukazano także przykładowe rezultaty analizy składu ścieków przed i po procesie ich oczyszczania. Ponadto podano ilości powstających odpadów (skratki, piasek i ustabilizowany osad ściekowy) w procesie oczyszczania ścieków.

**Słowa kluczowe:** oczyszczalnie typu Ecolo-Chief, redukcja fosforu i azotu w ściekach