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**INFLUENCE OF THE WASTEWATER FROM CHOSEN FOOD  
PROCESSING INDUSTRIES ON A QUALITY OF WATER IN THE MOUTH  
SECTION OF RIVER Odra**

Jerzy Wira, Krzysztof Tarnowski

*Department of Water Environment Engineering, Technical University of Szczecin,  
Piastów Ave 50, 70-311 Szczecin, Poland*

**Abstract**

Influence of the wastewater from chosen food processing industries located in Szczecin on a quality of receiver's water was presented. The theoretical part of the paper comprises general fundamentals of the biological treatment of the wastewater, the sources of the wastewater and their impact onto a sewerage system and the receiver at meat processing and dairy industries were also presented in this part of the paper.

Szczecin Dairy and Szczecin Poultry Processing Company are both equipped with biological wastewater treatment plants. The treated wastewater is discharged to the receivers that are directly linked to River Odra, thus has an impact on the quality of River Odra water. Basing on a performed research on parameters of untreated and treated wastewater, the treatment performance of the wastewater treatment plants was described as well as an attempt to estimation of an impact of the wastewater onto the receiver was made.

**INTRODUCTION**

Biological sewage treatment is a process based on of micro-organisms action, which as a source of energy and building material of a new cell substance, use dissolved organic pollution. If there is a sufficient amount of dissolved oxygen in environment of micro-organisms action, biochemical oxidising process occurs. In oxygen condition a substance decomposition occurs much quicker than in non-oxygen condition. This is why oxygen is usually provided to biological sewage treatment equipment. A speed of biochemical pollution decomposition process depends on many factors. First of all it depends on the amount of micro-organisms, provided oxygen, food substance and temperature. There are some substances that decompose very quickly, others decompose very slowly and some are practically biologically undecomposed.

## **WATER-SEWAGE MANAGEMENT IN SELECTED BRANCHES OF FOOD INDUSTRY**

### **Meat industry plants**

Water management system is generally varied in meat plants. Basic production departments have open systems, some auxiliary departments use water simultaneously, or have closed circulation. Water consumption depends both on the amount of processed raw material and on production assortment in meat processing industry. Four categories of sewage arise in meat processing plants:

1. industrial sewage - polluted, including fat,
2. industrial sewage - polluted, without fat, including sand,
3. industrial sewage - clean, heated - from barometer condensers and from cooling circulation refreshing process,
4. civil sewage.

First category sewage are piped away to central fat remover by separate sewage system. Sewage without fat enter to common sewage system and then they are piped away to urban sewage system.

### ***Influence of meat processing industry sewage on a receiver and a municipal sewage system***

Sewage from meat processing plants piped away directly to receiver can cause many unprofitable effects. First of all, quick use of oxygen dissolved in water. This process is heightened by decomposition of sediment layers consisting mainly of parts of organic compounds, which are accumulated at the bottom of a receiver. Strong organic sewage pollution, expressed by high  $BOD_5$ , may destroy life in receivers, in insufficient diluting conditions.

Sewage piped away to sewage systems are treated by mechanical pre purifying. It is based on exuding fat and bigger particles of suspension. Sewage can clog up pumps and rotary sprinklers of biological deposits in sewage treatment plants. Sometimes special equipment for crumbling bigger particles of suspension is used to prevent from stopping them in sewage treatment plant. It increases the amount of sediments in urban sewage treatment plant but it prevents pipes with small cross sections from clogging.

### **Dairy industry**

Sewage quantity in dairy industry depends on type and size of creamery. Dairies equipped only with refrigerators have the smallest amount of sewage. The largest amount of ones is met in dairies producing butter and cheese. There are three kinds of sewage produced in dairies:

1. production sewage,
2. civil sewage,
3. water from refrigerators and condensers.

They can be divided into unpolluted and strongly polluted. Cooling waters, which is 60 - 98 % of global amount of sewage, are unpolluted ones. Polluted sewage comes directly from production and they vary among themselves, depending on what kind of dairy industry they are piped away from. In proper process sewage are mainly produced while rinsing of butter. Production sewage consists of cleaning water in condensed milk plants. Often, especially in small dairies, sewage-containing whey from cheese departments are piped away. Such sewage plays the biggest role in global pollution. Other dairy sewage is waters from rinsing and washing containers and rooms.

#### ***Influence of dairy industry sewage on a receiver and a sewage system***

Sewage from dairies, which are piped away to small receivers, causes a big danger. They can cause effects like: intensive consumption of oxygen in receiver's water, creation of sediments on the bottom and sometimes decreasing value of pH in receiver's water. Biochemical decay of organic compounds coming from sewage and rot decay of sediments at the bottom in receiver's water can cause total disappearance of oxygen in long sections of polluted river. It destroys animal and vegetable organisms, giving off unpleasant odours and changing other water characteristics.

Also harmful influence of dairy sewage on sewage pipes can be observed. If it is possible, sewage from dairy should be fresh, not to cause corrosion of sewage pipes.

### **SELECTED FOOD PROCESSING INDUSTRIES IN SZCZECIN**

Two food-processing plants are presented below. Also the influence of sewage arising in these plants on receiver was analysed. Researches were done in Szczecin Poultry Processing Company "Drobimex - Heintz" and in Szczecin Dairy.

#### **Szczecin Poultry Processing Company**

Szczecin Poultry Processing Company consists of many plants. They slaughter chickens, produce cold meats and flour from wastes. Sewage arising in plant should fulfil the following parameters: average  $Q = 2500 \text{ m}^3 \text{ day}^{-1}$ ,  $\text{BOD}_5 = 400 \text{ mg O}_2 \text{ dm}^{-3}$ , total suspension =  $367 \text{ mg dm}^{-3}$ .

Sanitary and technological sewage systems are equipped with pre treatment sewage devices like mud and fat removers and neutralising machine. Then sewage goes to mechanical – biological sewage treatment plant. Process of sewage treatment is realised by method of active sediment. Treated sewage are piped away to River Chelszczaca. The total length of river is 9.8 km. It falls to Lake Dąbie.

### Szczecin Dairy

There is a separated sewage system in a factory. Sewage are piped away to a biological sewage treatment plant. According to the project, the sewage treatment plant is able to purify such sewage: average  $Q = 2700 \text{ m}^3 \text{ day}^{-1}$ , average  $\text{BOD}_5$  in fresh sewage =  $870 \text{ mg O}_2 \text{ dm}^{-3}$ , average total suspension =  $500 \text{ mg dm}^{-3}$ .

Sewage treatment plant is planned to purify technological and sanitary sewage. Rainwater is piped away directly to the receiver, which is River Bukowa.

### THE EXPERIMENT

Results concerning effects of purifying sewage in plants described above are presented in tables. There are given maximum and average monthly values of selected indexes in selected months. Completed data can be obtained at authors of this study

Table 1  
Data for sewage treatment plant of Szczecin Poultry Processing Company  
Drobimex-Heintz

Date of test	$\text{BOD}_5 [\text{mgO}_2 \text{dm}^{-3}]$		$\text{COD} [\text{mgO}_2 \text{dm}^{-3}]$		Total suspension [ $\text{mg dm}^{-3}$ ]	
	not treated sewage	treated sewage	not treated sewage	treated sewage	not treated sewage	treated sewage
24.04.96	1260	50			1235	52
27.04.96			3500	190		
average for month	1090	41	2427	114	1022	34
08.05.96	1280	36	2500	83	1013	45
average for month	953	33	2098	54	873	39
16.12.96	2040	65	3500	150	1295	48
average for month	1585	45	3050	108	1095	42
08.01.97	1920	31	2590	95	943	36
average for month	1415	29	2355	86	824	28
27.08.97	1120	39	2500	112	1250	30
average for month	1040	31	2330	92	1081	30
14.09.97	1760	50	2660	158		
03.09.97					1860	44
average for month	1325	42	2325	141	1625	41
average for year 1996	1292	27	2161	116	921	36
average for year 1997	1134	45	2736	116	1164	38

Table 2  
Data for sewage treatment plant of Szczecin Dairy

Date of test	BOD <sub>5</sub> [mg O <sub>2</sub> dm <sup>-3</sup> ]		COD [mg O <sub>2</sub> dm <sup>-3</sup> ]		Total suspension [mg dm <sup>-3</sup> ]	
	not treated sewage	treated sewage	not treated sewage	treated sewage	not treated sewage	treated sewage
22.01.96	1000	7.4				
12.01.96			920	29.6	495	11.6
average for month	491	6.6	890	22.5	349	10.1
27.06.96	264	6.6	962	18.3	265	16
average for month	260	5.8	952	18.3	240	14
21.03.97	980	6.8	880	39.6	680	22
average for month	885	6.5	870	32.1	480	16.8
03.11.97	380	4.6	920	21.6	620	26
average for month	350	4.0	905	20.6	605	10.5
average for year 1996	438	4.4	997	22.6	282	16.9
average for year 1997	676	8.1	917	28.5	533	18.9

## SUMMARY AND CONCLUSIONS

The research shows that sewage treatment plant of Szczecin Poultry Processing Company is overburdening. Obtaining sewage with proper parameters is not guaranteed. It can cause a harmful influence on receiver's water, by the disturbance of biological balance, or reduction of receiver's water auto-purifying efficiency process as a result of dropping content of oxygen in water. Also an excessive content of suspension in treated sewage can have an unprofitable influence on auto-purifying process of water.

Results of research for sewage treatment plant in Szczecin Dairy show big differences in sewage quality piped away to sewage treatment plant. Nevertheless, parameters of treated sewage are lower than values permissible for sewage piped away to 3<sup>rd</sup> class purity water. As a result it appears that the influence of sewage from Szczecin Dairy on quality of receiver's water, which is River Bukowa, is insignificant.

## REFERENCES

- Koziorowski, B. 1980. Industrial sewage treatment. Wyd. Nauk Tech., Warsaw.  
 Mielcarzewicz, E. 1980. Water and sewage management in industrial plants. Book of Technical University of Wroclaw, Wroclaw.

**WPŁYW ŚCIEKÓW Z WYBRANYCH ZAKŁADÓW PRZEMYSŁU  
SPOŻYWCZEGO NA JAKOŚĆ WÓD POWIERZCHNIOWYCH NA TERENIE  
MIASTA SZCZECINA**

**Streszczenie**

W pracy został przedstawiony wpływ wybranych zakładów przemysłu spożywczego zlokalizowanych w Szczecinie na jakość wody w odbiorniku.

Teoretyczna część pracy opisuje generalne zasady biologicznego oczyszczania ścieków, źródła ścieków w omawianych zakładach - przetwórstwa mięsnego i mleczarni, a także wpływ tych ścieków na odbiornik.

Ścieki ze Szczecińskich Zakładów Drobiarskich „DROBIMEX-HEINTZ” oraz Szczecińskich Zakładów Mleczarskich są oczyszczane w biologicznych oczyszczalniach ścieków. Oczyszczone ścieki są odprowadzane do odbiorników bezpośrednio połączonych z rzeką Odrą, w związku z czym mają wpływ na jakość jej wód.

W oparciu o przeprowadzone badania parametrów nieoczyszczonych i oczyszczonych ścieków dokonano oceny w/w zakładów na jakość wody w rzece Odrze w jej ujściowym odcinku.