STUDY OF THE WASTEWATERS CHARACTERISTICS GENERATED BY THE FOOD OPERATIONS

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Abstract

Samples of wastewaters were assessed using their physical and chemical quality parameters as indices. Characteristics of the wastewaters generated by the monitored milk factory were compared with those of the wastewaters from a meat factory.

Wastewater quality was expressed according to the following indicators:chemical oxygen demand, biochemical oxygen demand, total suspended solids, pH, chlorides, total nitrogen and total phosphorus. Wastewaters from the meat processing industry had higher concentrations of N and P compared to the concentrations determined in wastewater samples from dairy industry. The highest values of the COD and BOD_5 indicators, pH and chlorides were recorded in the samples of the wastewater generated by the monitored milk processing factory.

Keywords: monitoring, water, quality, food industry.

INTRODUCTION

Food processing can be divided into four major sectors including fruit and vegetables, meat, poultry and seafood, beverage and bottling and dairy operations. All of these sectors consume huge amount of water for processing food. A considerable part of these waters are potential wastewaters to be treated for safe disposal to the environment.

Wastewater generated from food operations have distinctive characteristics that set it apart from common municipal wastewater managed by public or private sewage treatment. Processing of food from raw materials requires large volumes of high grade water. Animal slaughter and processing produces very strong organic waste from body fluids, such as blood, and gut contents.

This wastewater is frequently contaminated by significant levels of antibiotics and growth hormones from the animals and by a variety of pesticides used to control external parasites (Tchobanoglous, G., et.al, 2003).

The key environmental issues for the wastewaters quality from food industry are the biochemical oxygen demand (BOD), total suspended solids (TSS), excessive nutrient loading, namely nitrogen and phosphorus compounds, pathogenic organisms, which are a result of animal processing and residual chlorine and pesticide levels (unido.org.).

Wastewaters derived from meat industry are very harmful to the environment. Effluent discharge from meat processing factories cause the

deoxygenation of rivers and the contamination of groundwater. The pollution potential of meat-processing plants has been estimated to be at large scale. Blood, one of the major dissolved pollutants in meat processing wastewater, has a chemical oxygen demand (COD) of 375 000 mg/L (Tritt and Schuchardt 1992).

The waste stream of the dairy sector is pure milk raw material mixed with water. These waste streams contain waste milk and sanitary cleaners and are one of the principal waste constituents of dairy wastewater. Over time, milk waste degrades to form corrosive lactic and formic acids. Approximately 90% of a dairy's wastewater load is milk (unido.org.).

MATERIAL AND METHODS

The research was done in 2014, in two food processing factories. The monitored food units are placed in Bihor County. Following the visits made at the two food units (meat and milk processing factories) were obtained information on the wastewaters characteristics generated by different stages of food processing.

Monitoring of the quality of treated wastewater in case of the food units which have own treatment plants was performed by taking samples of wastewater from their final discharge point to surface water (receiver).

Determinations of the wastewater parameters were performed according to the standard methods and were achieved in the Hygiene Laboratory of Environmental Protection Faculty from Oradea.

For determining the quality indicators of the wastewater the following methods were used: biochemical oxygen demand was obtained by determining the dissolved oxygen content in water after harvest and after 5 days, and the difference was BOD_5; chemical oxygen demand was determined by potassium dichromate method; total suspensions were determined by their separation with filtration or centrifuging, depending on their size; pH of the wastewater - using a pH meter; chlorides were analyzed by titration with silver nitrate using chromate as indicator (Mohr method); total nitrogen was determined with Kjeldahl method; total phosphorus was determined using ammonium molybdate spectrometric method.

RESULTS AND DISCUSSION

In the following, to assess wastewaters quality from dairies and meat factories the values of the monitored parameters of the wastewater from meat factory were compared with the values obtained for the wastewater parameters from milk factory. The wastewater quality must conform with the normative regarding the quality of wastewater evacuated in surface waters G. D. 188/2002, NTPA-001/2002. As it can be seen in table 1, all the

analysed parameters of the wastewater generated by the meat processing factory coresponded to water quality standards, except total nitrogen and phosphorus concentrations.

Table 1

Characteristics of the wastewater from meat processing factory

Crt. nr..	Physico-chemical parameters	Unit of measure	Results of analysis					Allowed values
			I 07.03.14	II 06.05.14	III 12.07.14	I V 06.09.14	V 06.11.14	
1	COD	mg/l	122,82	63,0	74,09	83,83	74	125
2	BOD	mg/l	8,88	9,69	4,86	3,70	23,2	25
3	Suspended solids	mg/l	6,60	9,82	4,64	32,06	34	35
4	pH	pH units	6,49	6,41	6,39	7,19	8,3	6.5 – 8.5
5	Chlorides	mg/l	265,66	346,86	338,98	491,45	425,6	500
6	Total nitrogen	mg/l	24	20	21	16	9	10
7	Phosphorus	mg/l	0,6	8	3	1,2	0,8	1

Table 2

Characteristics of the wastewater from milk processing factory

Crt. nr..	Physico-chemical parameters	Unit of Measure	Results of analysis					Allowed values
			I 07.03.14	II 06.05.14	III 12.07.14	I V 06.09.14	V 06.11.14	
1	COD	mg/l	245	230	256	185	120	125
2	BOD	mg/l	120	250	152	65	20	25
3	Suspended solids	mg/l	40	51	38	41	32	35
4	pH	pH units	7,35	7,40	7,67	7,44	8,11	6.5 – 8.5
5	Chlorides	mg/l	350	460	450	440	350	500
6	Total nitrogen	mg/l	0,36	1,42	5,33	4,39	8,4	10
7	Phosphorus	mg/l	5	0,38	0,67	0,27	0,85	1

The highest values of the COD and BOD_5 indicators were recorded in samples of wastewater from milk processing units (table 1,2).

The BOD for all food-processing wastewater is relatively high compared to other industries.

A high BOD level indicates that a wastewater contains elevated amounts of organic material, dissolved and/or suspended solids, minerals, nitrogen and phosphorus. COD and BOD_5 are important to the food processing industry because they can be used to indicate lost product and wasteful practices.

High BOD_5 and COD levels indicate increased amounts of product lost to the waste stream. Measurements at various process locations can help locate sources of waste (unido.org.).

The highest chloride concentrations and pH values were recorded in the wastewater samples taken from the milk factory compared to those registered in the samples of wastewater from the meat factory.

Chloride concentrations values in the wastewater from milk industry are much higher than those from the meat industry since the washing waters resulting from the processing of butter and cheese making are heavily loaded with inorganic salts.

Wastewaters from the meat processing industry had higher concentrations of N and P compared to the concentrations determined in wastewater samples from dairy industry (table 1,2).

Wastewaters discharged from the monitored milk factory not comply with the regulations in force and recorded exceeding of indicators: COD, BOD_5, total suspended solids, total phosphorus. The situation was corrected and later the monitored parameters recorded corresponding values.

CONCLUSIONS

Wastewaters from the milk industry presented different characteristics from those generated by the meat industry.

The highest values of COD and BOD_5, total suspended solids and total phosphorus were registered in the samples of the wastewater from milk processing unit.

Wastewaters from the meat processing industry had higher concentrations of N and P.

Wastewaters discharged from the monitored milk factory not comply with the regulations in force and recorded exceeding of indicators: COD, BOD_5, total suspended solids, total phosphorus.

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