PROCESSES OF PURIFICATION FOR WASTE WATERS FROM MEAT AND MILK PROCESSING ESTABLISHMENTS

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ABSTRACT

The waste water from the food industry is characterized by a high content of mineral and decomposabile organic matter (which consumes oxygen), suspensions, microbial germs inhibitor, including pathogenic germs.

The main effect on receiving waters consists in the contamination with organic matter readily degradable, which causes reduction in dissolved oxygen content from the water. As a result, the richness of water with feed materials introduced in the form of mineral, or as a result of decomposition of organic matter, determine an indirect form of pollution - Eutrophication, which has an unfortunate effect on the quality of the water.

Waste waters from meat processing units are characterized by a very high content of organic matter (in the solution and suspension), large quantities of nitrogen and phosphorus, and a temperature of 30 to 40°C. The discharge at this temperature favors the installation of a very quickly aerobically decomposition process, which consumes oxygen.

The technological processes specific for milk processing is characterized by important losses of dry matter in the waters discharged. Waste waters from the technological processes of milk processing contain significant quantities of proteins, lipids and lactose. Due to these components, simple discharge, without a prior purification would cause environmental pollution.

After the application of specific procedures of purification, the discharge of waste water into the watercourses receivers must not endanger aquatic flora and fauna, or make water unfit for use in industry, as well as for consumption (as drinking water).

INTRODUCTION

The degree of contamination of the waste water can appreciate by determining the following indicators (Banu C. et al., 2002; Glodeanu M., 2003):

- Chemical oxygen demand (CCO);
- Biochemical oxygen demand (CBO_5);
- pH;
- the solid suspensions and dissolved substances;
- the presence of the nitrogen;
- presence of the phosphorus and also of chlorides.

The purpose of the work is to analyze the characteristics of waste waters derived from meat and milk processing enterprises.

In addition to the high content of organic matter readily degradable, as well as the substances which cause eutrophication, many of waste waters from slaughterhouses and meat processing enterprises containing large amounts of fats (whose discharge to receiving waters should be prevented).

Sometimes the aerobically decomposition process is anaerobically continued, being accompanied by the unpleasant odours. It is also possible the transmission through these waste waters of pathogenic micro-organisms.

In enterprises for obtaining drinking milk and milk products , industrial waste waters are represented by the waters of washing and cleaning. Waste waters from the technological processes

of the processing of milk contain significant quantities of proteins, lipids and lactose. Due to the presence of these components, simple discharge, without a prior purification would cause environmental pollution (Popescu C., 2005; Popescu C., 2009; Pumnea C., Grigoriu G., 1994).

From the biochemical point of view, waste waters from the processing undertakings of the milk occupies a special position, as they may move very quickly at the stage of acid fermentation. Such waste waters become acidic, and the decrease of pH below 3,5 causes the precipitation of the protein. Also the temperature of 25-35°C of these waste water accelerates fermentative processes (Banu C. et al., 2002; Edeline F., 1979).

The volume of industrial wastewater from milk processing enterprises is dependent on the type of milk product to be processed (Banu C. et al., 2002; Levin M. A., Gealt M. A., 1993).

Depending on the characteristics of these waste water it will identify the main techniques and technologies of purification, used for the purpose of correcting certain quality indicators.

MATERIAL AND METHODS

The experimental research has been carried out for the purpose of determining the characteristics of the waste waters from meat and milk industry.

Research consisted in the following:

- method of field research (taking of samples resulted before and after the implementation of the purification processes, specific to the type of industry: meat, milk);
- method of research in the laboratory in order to determine in laboratory conditions the main indicators that characterises these waters (before and after the implementation of the purification processes).

The monitoring of the quality of the effluents coming from the analyzed units it was carried out by sampling of waste water from the final point of discharge into surface waters (receiver).

The method of field research

Water samples were collected in sterile bottles and their preservation has been carried out by refrigeration, freezing or the addition of certain preservatives substances, in accordance with the accepted legal norms in force.

The method of research in the laboratory

The laboratory tests have been carried out in a laboratory for the health chemistry, in accordance with the standardized methodology in force (CBO_5 - SR 1899/2-2002; total suspension - SR EN 872-2005; pH - ISO 10523-1997; total nitrogen - SR EN ISO 11905/1-2003; total phosphorus - SE EN 1189-2000; chlorides - SR EN 9297-2001) (Oneț C., 2011).

The experimental research also consisted in identifying the specific purification processes and determination in laboratory conditions the main indicators that characterises these waters. In this way, it can appreciate the effectiveness of the purification processes used.

The specific purification processes identified for waste waters from the analyzed branches of the food industry are:

1. For waste waters from slaughterhouses and meat processing enterprises (Banu C. et al., 2002; Chiriac, V et al.,1977):

- coagulation with aluminum sulfate (300 mg/l) and of the lime (500 mg/l);
- decantation;
- cleaning through a biological filter.

2. For waste waters from the processing undertakings of the milk:

- separation of fats (passing through separators), then followed by a treatment with Coagulants and Disinfectants (neutralization with lime to pH = 7,6...7,8);
- cleaning through a biological filter in which the waste waters are inserted after a dilution with pre-cooling water.

In figure 1 are shown schematically the stages of the process of purification for waste waters, derived from meat and milk processing enterprises.

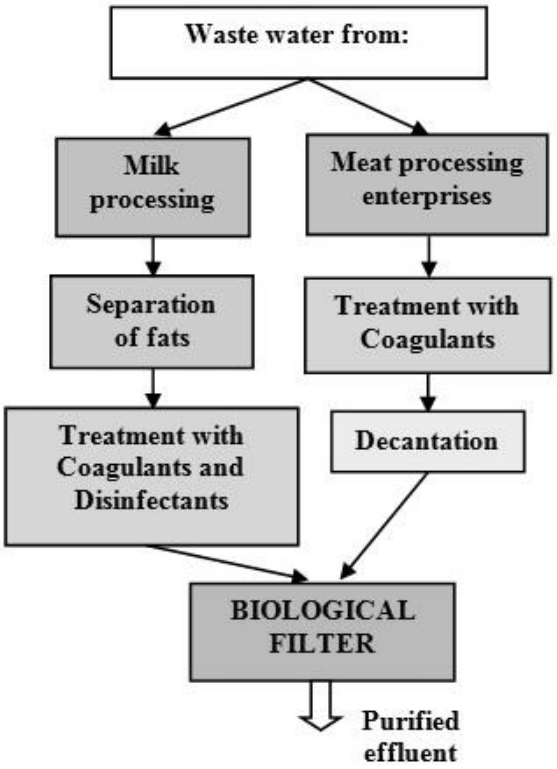

Figure 1. The stages of the progress of the process of purification for waste waters from meat and milk processing establishments.

After performing the activities and the specific stages of the purification processes (in accordance with the origin of the waste water), according to the characteristics of the effluent it will determine to what extent it meets the conditions of discharge into one of three categories of receivers (Banu C. et al., 2002; Government Decision 352/2005; International Organization for Standardization. "13.060: Waterquality". Retrieved 29 February 2008):

- natural catchment areas for drinking water supplies (Class I);
- basins for water supply to the food industry and fishery centers (Class II);
- basins used only for recreation or architectural purposes (Class III).

RESULTS AND DISCUSIONS

The characteristics of the waste water from the meat and milk processing enterprises (before and after implementation of the purification processes) are shown in tables 1 and 2.

Comparative values of the indicators taken in the study, before and after the application of specific treatment processes are represented in the graph of figure 2 and figure 3.

Table 1

The characteristics of the waste water from meat processing enterprises

Physico-chemical determinations		Results of the analyzes (number of sample)			
	I	II	III	IV	Average values
$CB0_5$ (mg/l)	724	889	904	862	844,7
	6,5	**5,6**	**7,9**	**6,9**	**6,7**
Total suspensions (mg/l)	428	611	797	764	650,0
	29	**35**	**37**	**32**	**33,2**
pH	7,7	8,3	7,6	7,5	7,7
	7,3	**6,7**	**6,5**	**6,6**	**6,7**
Total nitrogen (mg/l)	1613	1478	1245	765	1275,4
	7,2	**4,8**	**5,6**	**3,9**	**5,3**
Total phosphorus (mg/l)	393	346	429	176	335,7
	1,8	**0,8**	**0,7**	**1,1**	**1,1**
Chloride (mg/l)	428	366	339	398	382,7
	284	**261**	**254**	**322**	**280,2**

☐ Before applying the treatment
▒ After applying the treatment

Table 2

The characteristics of the waste waters from the processing undertakings of the milk

Physico-chemical determinations		Results of the analyzes (number of sample)			
	I	II	III	IV	Average values
$CB0_5$ (mg/l)	6210	2420	4725	5230	4646,2
	10	**5**	**9**	**11**	**8,7**
Total suspensions (mg/l)	6012	2986	2970	5930	4474,5
	34	**41**	**38**	**46**	**39,7**
pH	8,9	6,7	8,1	7,9	7,9
	7,7	**7,4**	**7,2**	**7,3**	**7,4**
Total nitrogen (mg/l)	684	850	214	270	511,2
	11	**15**	**22**	**17**	**16,2**
Total phosphorus (mg/l)	104	211	82	65	115,5
	6	**4**	**2**	**5**	**4,2**
Chloride (mg/l)	584	325	548	692	537,2
	320	**270**	**290**	**310**	**297,5**

☐ Before applying the treatment
▒ After applying the treatment

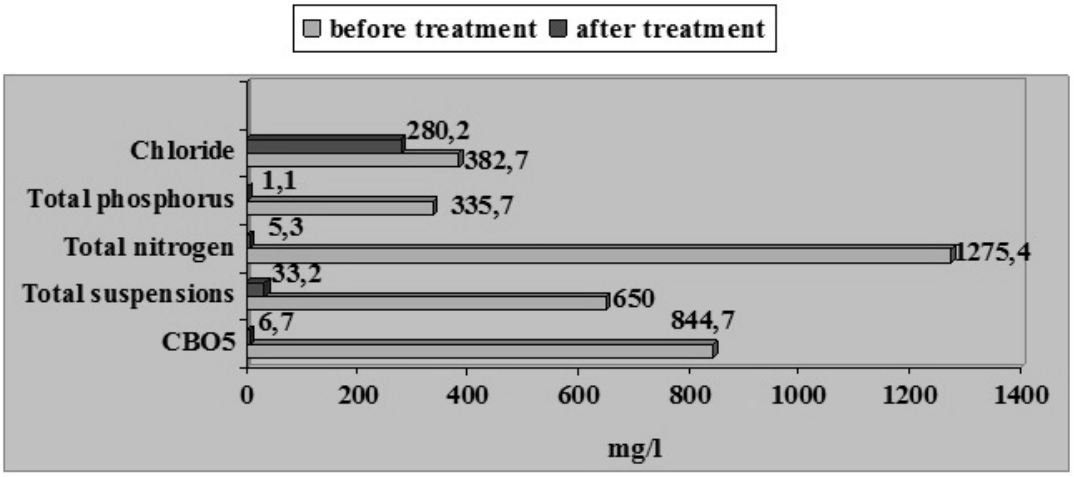

Figure 2. The plot of the evolution of the quality indicators for waste waters from meat processing enterprises.

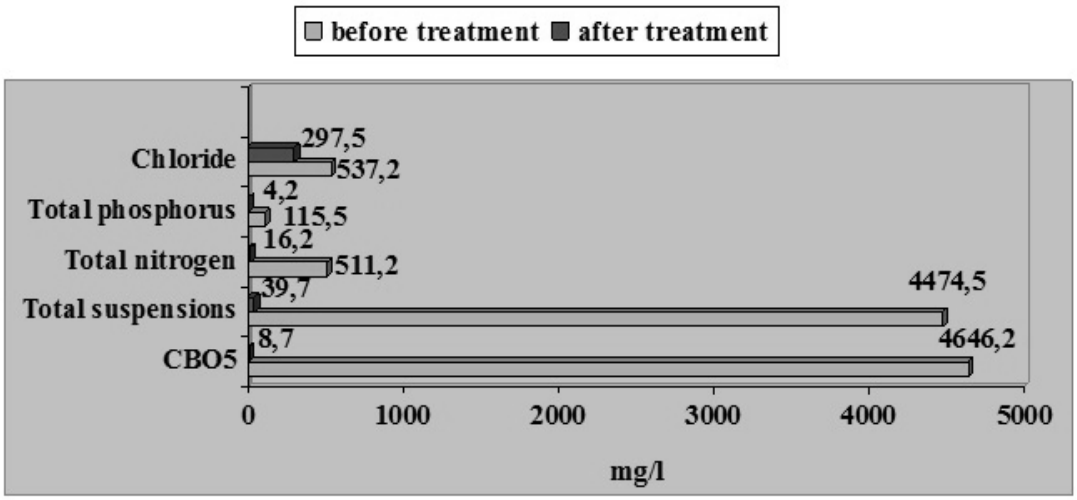

Figure 3. The plot of the evolution of the quality indicators for waste waters from milk processing enterprises.

From the above data base it can be observed the following (taking account the conditions of the discharge of waste waters into surface watercourses):

- the purified effluent resulting from meat processing enterprises meets the conditions of discharge into basins for water supply to the food industry (Class II);
- the purified effluent resulting from milk processing enterprises, also meets the conditions of discharge into basins for water supply to the food industry and fishery centers (Class II).

CONCLUSIONS

- The analysis of the samples of water taken after application of specific purification processes shows that the waste-water plants of the enterprises have worked to optimally, in accordance with the quality conditions of the waste waters.
- The analysis of the results obtained before application the purification processes show that:

- the waste waters from milk processing enterprises are characterized by higher values of the concentrations in chlorides, CBO_5, compared with the corresponding values of the waters resulting from the meat industry;
- the pH values of waste water resulting from the milk industry were greater compared with those originating from the meat industry;
- waste waters from the meat industry and meat preparations have presented high concentrations of Nitrogen and Phosphorus.

➢ Using green-treatment of waste water from the food industry has the following advantages:

- the treatment is completely natural: no synthetic chemicals are used (the process is not selective); by biological processes and non-chemical properties, biofilter can reduce different types of odorous compounds;
- these types of systems are easy to install and does not require any special utility or civil works;
- In case of biofilters the filter material must be replaced every 4-5 years; at the end of the operating cycle, its discharge has no environmental consequences;

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