ECOLOGICAL TREATMENT PROCESSES OF WASTEWATERS FROM MILK INDUSTRY

GLODEANU MIHNEA, ALEXANDRU TUDOR, VASILE CRISTIAN
University of Craiova, Faculty of Agriculture

Keywords: dairy products, processing enterprises, wastewater

ABSTRACT

Specific technological processes milk is characterized by a significant loss of dry matter in the effluents. Wastewaters from technological processes milk contain large amounts of protein, fat and lactose. Thanks to these components, simple discharge, without prior purification would cause environmental pollution.

Wastewater from milk processing enterprises are composed of industrial waste water (pollution); domestic wastewater from toilets and clean conventional wastewater (cooling, heating and condensing) – unpolluted.

In enterprises to obtain drinking milk and acidic dairy products, industrial waste waters are represented by the washing and cleaning waters results at the reception of raw milk, or to fill containers, at sanitizing the means of transport (trucks), of pasteurizers, the evaporators etc. These waters contain traces of milk and chemicals used for cleaning and disinfection.

Industrial waste water include also washing waters results from the processing of butter (buttermilk). Usually, due to the content of fat and minerals, the first wash waters are used in order to feed purpose.

In some cases, whey obtained from cheese production is discharged with wastewater. Because these waters represent an important factor of pollution, is recommend the use of the feed, or exploitation in other ways.

The other components of industrial waste water from a milk processing enterprises are represented almost exclusively by water washing and cleaning appliances, container and manufacturing spaces.

INTRODUCTION

In terms of biochemical point of view, waste water from a milk processing enterprises occupies a special position because it can pass very quickly in acid fermentation stage (due to their lactose content) (Banu C., et al., 2002). Because components, uncontrolled discharge of those waters on ground can cause pollution (Popescu C., 2005; Popescu C., 2009).

In this process, the lactose can be converted into lactic acid, butyric acid, propionic acid and gas (carbon dioxide, hydrogen). So waste water becomes acidic and the pH decrease below the 3 causes protein precipitation. In this process, the lactose can be converted into lactic acid, butyric acid, propionic acid and gas. So waste water becomes acidic and the pH decrease below the 3 causes protein precipitation. The temperature of 28-35 °C of wastewaters accelerates fermentative processes (Banu C., et al., 2002; Edeline F., 1979).

From the hygienic point of view, special attention will be given to water wash reception hall and raw milk storage containers, because they present the risk of containing pathogenic microorganisms. The volume of industrial wastewater from milk processing enterprises is dependent on the type of milk product to be processed, the processing capacity and the degree of re-use of water. The average composition of waste water resulting from a processing of milk is shown in table 1.

Table 1

The average composition of waste water resulting from a milk processing enterprises

Type of waste water	**Residue** (mg/l)		**Proteins** (mg/l)	**Lipids** (mg/l)	**Lactose** (mg/l)	**pH** pH units
	total	fixed				
Receive milk	1500-4600	500-1700	200-1000	300-1100	200-1400	8,3-10,1
Manufacture butter	400-7500	300-2100	20-2900	100-600	20-1600	6,5-9,7
Manufacture cheese	1200-16200	400-2900	400-2000	300-500	100-9400	4,3-7,9
Total waste water	1200-3100	700-1800	340-380	240-350	350-920	7,4-9,4

after (Banu C, 2002, 164)

The measured values of indicators of pollution (by category of milk industrialization enterprises) are presented in table 2.

Table 2

The average indicators of pollution by category of milk industrialization enterprises

Type of etreprises	Indices							
	Flow (m^3/m^3)	**CCO** (mg/l)	**$CB0_5$** (mg/l)	**Suspensions** (mg/l)	**Lipids** (mg/l)	**Nitrogen** (mg/l)	**Phosphorus** (mg/l)	**Chloride** (mg/l)
Dairy products	14,0	7600	3900	2300	680	1500	110	380
Milk and butter	14,2	13700	5600	4900	2200	260	65	640
Cheeses (cheese fresh products)	38,0	58300	28600	27800	4400	1600	620	13900

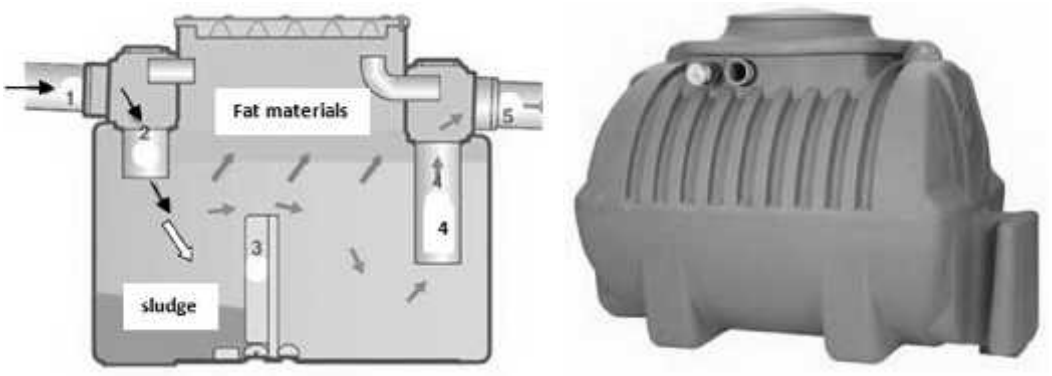
MATERIAL AND METHODS

The first step in wastewater treatment is the separation of these fats (passing through the separator), followed by treatment with coagulants and disinfectants. Acidic waste water (containing lactic acid) is neutralized with lime to a pH = 7,6...7,8 (Banu C., et al., 2002; Glodeanu M., 2003).

Biological treatment can be achieved naturally (irrigation) or routed, in biofilters or aeration tanks with activated sludge, where the waste water is introduced after a prior dilution with water cooling (Banu C., et al., 2002, Glodeanu M., 2003; Chiriac, V et al.,1977; Solt G. S., Shirley C. B., 1991).

The experiments were carried out using the following:

- *a fat separator, type DGAE* assigned to the volume of 1200 liters, provided with built-settler (volume 500 l); walls separator made of polyethylene prevents fat sticking, ensuring an easy mentanance (fig. 1);
- after separation of the fat materials the wastwaters were passed through a *biofilter (Entsorga type);* as one scroll of the material filter is not always enough to ensure the desired efficiency, the effluent is recycled (fig. 2).



after (Fat and starch separators catalog Techneau, 2012)

Fig. 1. Fat materials separator DGAE ARONDE.

Fat separator operates on principle decantation. The material harder as water, mud, sand, fall to the bottom separator. The materials which are lighter (fats), remain on the surface. Water that contains fat enters through the inlet separator 1, which is adjusted with a nozzle (2) which prevent spraying, to avoid disruption of sludge and fat materials already separated. Partition wall (3) retains the sludge in the first half and the siphon (4) maintain the fat materials inside the separator. Water is separated from sludge and fat and discharged through the outlet network (5).

after (Biofilters catalog, Entsorga, 2000)

Fig. 2. Entsorga biofilter.

RESULTS AND DISCUSIONS

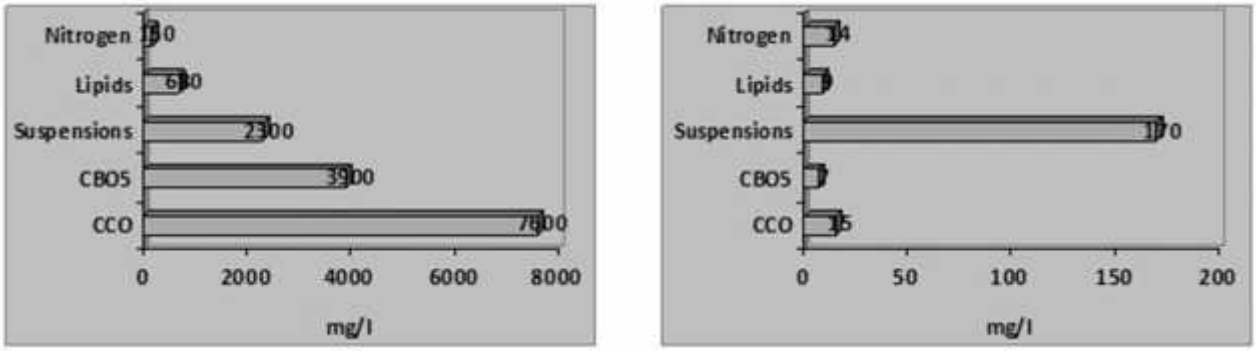
The main characteristics of the treated effluent, after application specific treatment processes are presented in table 3.

Comparative values of the indicators taken in the study, before and after the application of specific treatment processes are represented in the graph of figures 3, 4, 5.

Table 3

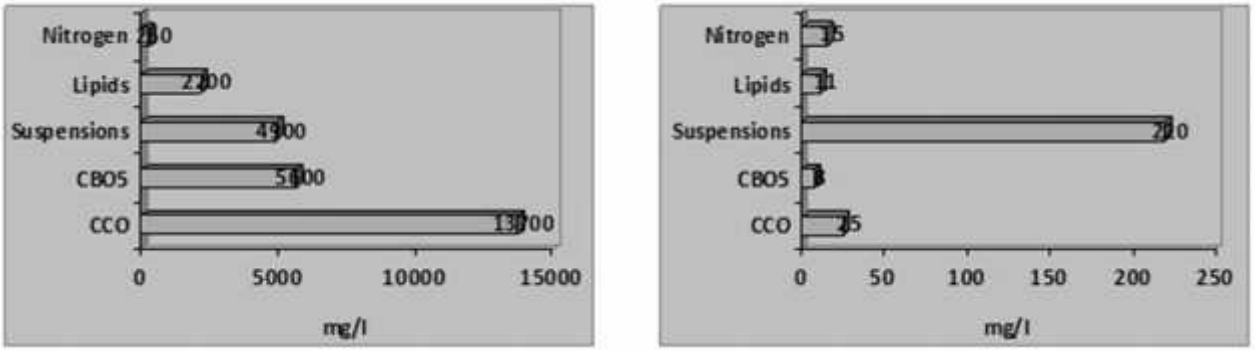
The main characteristics of the treated effluent

Type of etreprises	Indices						
	CCO (mg/l)	**$CB0_5$** (mg/l)	**Suspensions** (mg/l)	**Lipids** (mg/l)	**Nitrogen** (mg/l)	**Phosphorus** (mg/l)	**Chloride** (mg/l)
Dairy products	15	7	170	9	14	-	0,004
Milk and butter	25	8	220	11	15	-	0,005
Cheeses (cheese fresh products)	30	11	240	13	15	-	0,005



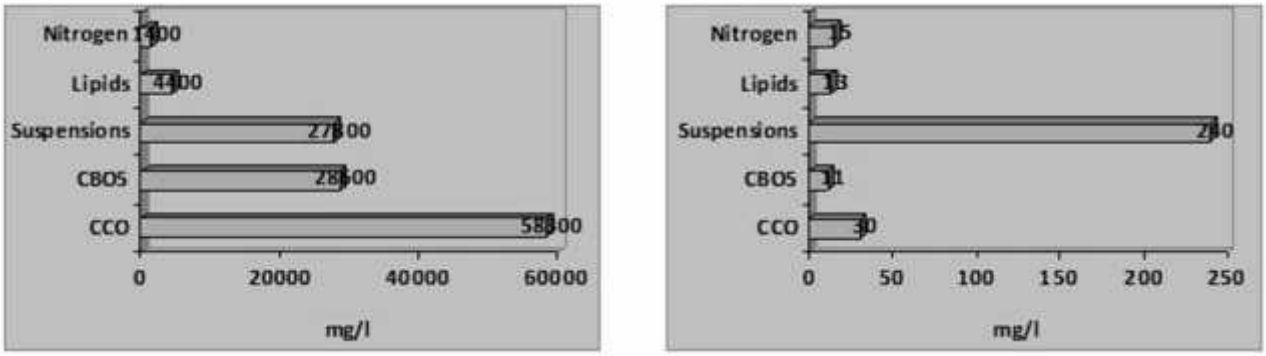
a) **b)**

Fig. 3. The characteristics of the treated effluent in case of dairy products: a) before treatment; b) after treatment.



a) **b)**

Fig. 4. The characteristics of the treated effluent in case of milk and butter: a) before treatment; b) after treatment.



a) **b)**

Fig. 5. The characteristics of the treated effluent in case of cheese fresh products: a) before treatment; b) after treatment.

CONCLUSIONS

- Using green-treatment of waste water from the dairy 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;

- The analysis of the treated effluent (taking account the conditions of the discharge of wastewater into watercourses handsets, by categories, according to STAS 4706/1988) highlights the following:
  - treated effluent from milk industrialization enterprises qualifies the conditions of discharge into pools to supply with water the food industry and fisheries centers (category II);
  - treated effluent from cheese, milk and butter enterprises does not qualify the conditions for discharge into natural pools for drinking water supply (category I), or in tanks for industry water supply (which can only be discharged in leisure pools - category III).

BIBLIOGRAPHY

1. **Banu C**., **et al**., 2002, *Engineer's handbook of food industry, TECHNICAL Publishing House,* Bucharest.
2. **Chiriac, V et al**.,1977, *Wastewater treatment and valorisation of food and animal residues, CERES Publishing House,* Bucharest.
3. **Edeline, F**., 1979, *L'epuration biologique des eaux residuaires*, Cebedoc, Liege, France.
4. **Glodeanu M.**, 2003, *Technology and equipment for environmental protection, UNIVERSITARIA Publishing House,* Craiova.
5. **Popescu C.**, 2005, *The unfavorable influence of the soluble salts on the physical, chemical and biological properties of salsodisoils from the Ghighera zone,Dolj district, Annals of University of Craiova,* vol.X (XLVI), Biology series, Horticulture, Agricultural Products Processing Technology, Environmental Engineering, ISSN 1435-1275, pp 229-232.
6. **Popescu C.**, 2009, *Ecopedologic, UNIVERSITARIA Publishing House,* Craiova, ISBN 978-973-742-984-1.
7. **Solt G. S., Shirley C. B.,** 1991, *An Engineer's Guide to Water Treatment, Avebury Technical.*
8. ******* Fat and starch separators catalog Techneau, 2012.
9. ******* Biofilters catalog, Entsorga, 2000.