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THE POLLUTING EFFECT OF SLAUGHTERHOUSE WASTEWATERS DISCHARGED INTO SURFACE WATERS

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Introduction

Following Romania's transition towards a free market economy, many small and medium-size slaughterhouses appeared during the last 15 years. For instance, in Cluj county only, with its 6,650 square km surface and its 763,000 inhabitants, 39 such units were recorded in 2002 (Borda et al., 2002). As the sanitary-veterinary legislation became more restrictive, the number of these units decreased to 16 by the beginning of 2005 (Mihaiu, 2005). Previous studies showed that part of these slaughterhouses, although discharging their wastewaters into the urban sewage system, are still pollution generating units (Borda et al., 2002; Borda et al., 2003).

Material and methods

The present study dealt with a slaughterhouse located near Cluj-Napoca town, which discharges residual waters into surface waters. A monthly average of 25 cows and 120 pigs are slaughtered in there, with an end production og 15 tons of meat products. For cleaning of its wastewaters, the slaughterhouse employs a three-compartment settling tank, from where the water is evacuated into minor dried up riverbed (figure1.), without disinfection. The spring had been collected upstream, its water being used for the needs of the slaughterhouse. 180 meters farther, the outflow water enters the Valea Racilor stream, which at its turn feeds the neighbouring fisheries. Samples were collected in two points: where the water leaves the settling tank and where it enters the stream.

The following parameters were determined:

- sediment: with Imgoff cones;
- total suspensions: centrifugation method;
- electric conductivity: with electronc conductivity-meter;
- fix residue: fix residue at 105 ^{o}C, after centrifugation;
- pH: with electronic pH-meter;

- ammonium: by distillation;
- calcium: by titration, with EDTA;
- chemical oxygen demand: potassium permanganate method;
- biochemical oxygen demand: Winkler method;
- total number of mesophilic germs (TNMG): with nutrient agar;
- most probable number of total coliforms and fecal coliforms: the multiple test tubes method, with lactose broth for the presumptive test, and with Levine medium for the confirmation of total coliforms and brilliant bile broth for the confirmation of fecal coliforms.

Fig. 1. Minor dried up riverbed with wastewater

Results

The results of the wastewater analyses are represented in Table 1 and 2.

Table 1. Physical and chemical characteristics

Parameter	Settling tank outlet	Stream inlet	Maximum acceptable
Sediment (mL/L)	0	0,5	-
Total suspensions (mg/L)	40	80	60
Electric conductivity (µS/cm)	624	670	-
Fix residue (mg/L)	591,83	497,82	2000
pH (units)	7,78	8,04	6,5-8,5
Ammonium (mg/L)	16,13	14,83	3
Calcium (mg/L)	120,24	117,04	300
COD-Mn (mg/L)	35,07	26,94	40
BOD_5 (mg/L)	31,55	19,25	20

Table 2. Bacteriological characteristics

Parameter	Settling tank outlet	Stream inlet	Maximum acceptable
TNMG (cfu/mL)	13,950	4000	-
MPN of total coliforms/L	348,000	221,000	10,000,000
MPN of fecal coliforms/L	348,000	221,000	100,000

Discussion

Analizing the results, regarding the physico-chemical characteristics, there can be finding followings:

- the sediment is absent, both at the point where the water leaves the decantation pool and at the point where it enters the stream;
- total suspensions increase as to double their weight, exceeding admitted limits by 33% (NTPA-001/2002);
- electric conductivity increases by 7,37%;
- the fix residue decreases by 15,88%, being within admitted range;
- the pH increases by 3,34%, also within admitted range;
- ammonium, although by 8,05% lower, still remains as high as 394,33% of the upper limit;
- calcium decreases by 2,66% and is within limits;
- COD-Mn and BOD_5 decrease by 31,73% and by 38,98%, respectively, also within limits;

Regarding the bacteriological characteristics it can be notice that:

- the total number of mesophilic germs is by 71,32% lower;
- the probable number of total and fecal coliforms decreases by 36,49%, however fecal coliforms surpass the upper limit by 121%.

Conclusion

Given that values registered for total suspensions, ammonium and probable number of fecal coliforms exceeded the admitted limits for residual waters discharged in surface waters, the existing water cleaning system has to be improved. The first step should be employing of disinfecting substances, a legally enforced measure anyway (NTPA-011).

Also, a second decantation pool needs to be put into use; this second pool does exist within the slaughterhouse's perimeter, but had not been connected by then. Its use would bring the above-mentioned parameters within admitted levels, as proven by previous studies (Borda and Drăghici, 2004).

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