Environment Protection Engineering

Vol. 34 2008 No. 2

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THE WAY OF SAMPLING AS A FACTOR INFLUENCING THE QUALITY OF WASTEWATER FROM LAUNDRY

The aim of the study was to check whether the pollutant concentration and the quality of treated wastewater from the laundry depend directly on the way and the depth of sampling. Wastewater samples were collected from a retention tank. There was a statistically significant correlation between the depth of sampling and the concentration of surface active substances, total phosphorus, total suspended solids and temperature. It was proved that sampling from the top layer of wastewater, commonly practiced by the service responsible for the control of treated laundry wastewater, led to the misjudgement on the content and characteristics of treated laundry wastewater.

1. INTRODUCTION

The amount and quality of wastewater generated by industry change, depending on the rate and profile of production [1]. Even in the same branch of the industry there are the differences in wastewater composition. It is quite common to use the range or category of the pollutant concentration [2]. In the same factory, the quality of the wastewater generated frequently changes in the daily cycle, depending on the stage of production. Therefore it is difficult to control the quality of treated wastewater and an appropriate average of its content.

Different concentration of pollutants in wastewater not only may depend on the stage of production or technological section of the industry, but also on the way and place of wastewater sampling. Inadequate and unreliable way of sampling can mislead the service staff responsible for the control of treated laundry wastewater. This poses serious environmental hazards, i.e., pollutant concentration exceeding the permissible values, which is connected with paying heavy financial penalty [3].

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Reliable results of pollutant concentration in wastewater from different branches of industry are highly recommended for people who are responsible for designing the technological systems for wastewater treatment. An effective technology is inseparably connected with a detailed knowledge of the amount and characteristic of generated wastewater.

The aim of the present investigation was to check whether the pollutant concentration and the quality of treated wastewater from laundry depend directly on the way and the depth of sampling.

2. MATERIALS AND METHODS

The wastewater for analysis was collected from the retention tank of treated wastewater in laundry whose basic service is water washing. The retention tank, 5.0 m × 5.0 m and the depth of 4.5 m, is made of concrete. Laundry offers a comprehensive service to the hospitals, resorts and individuals clients. During the research period laundry received about 4.0 Mg of cloths per day.

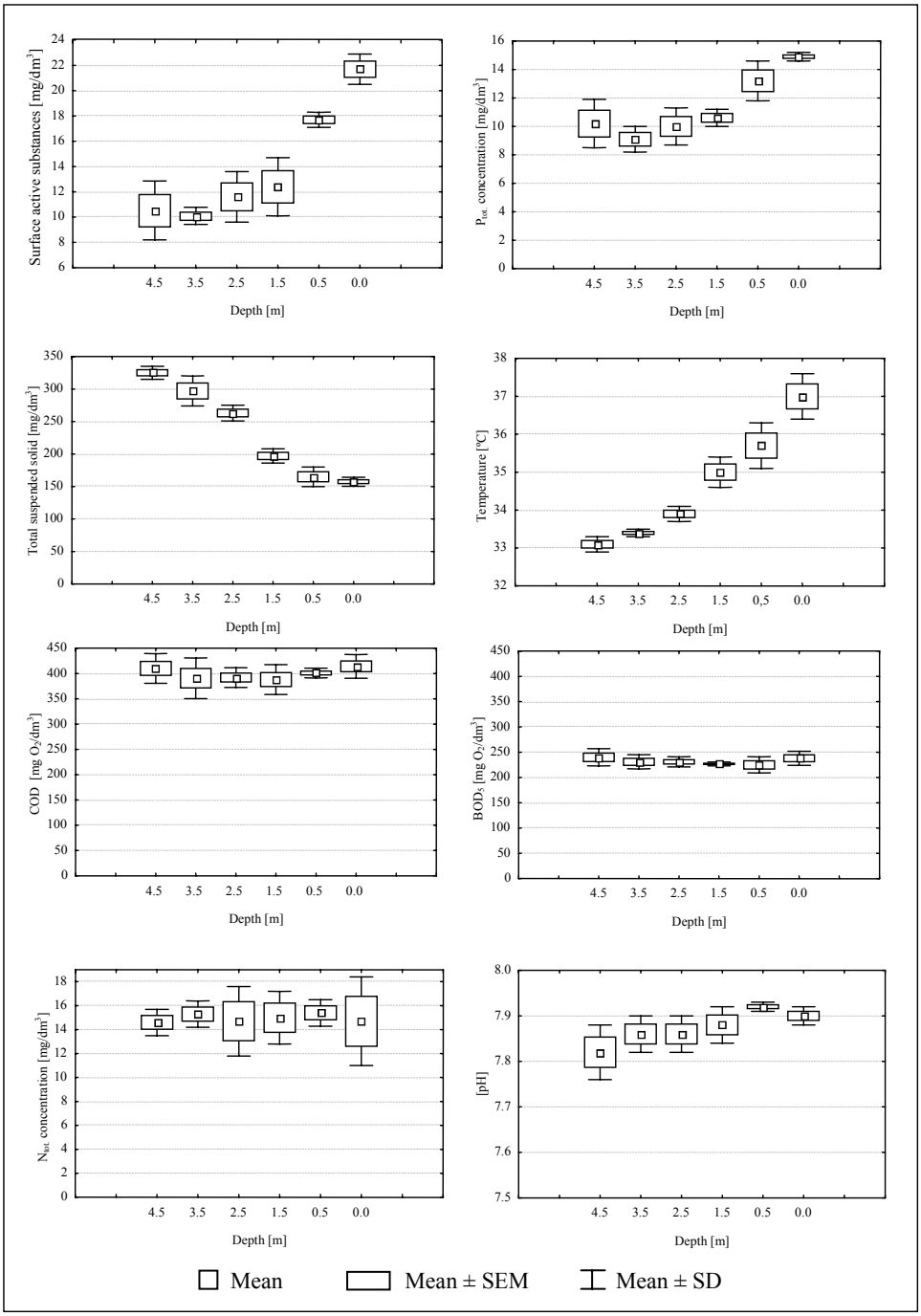
In order to characterize the quality of laundry wastewater, the samples were taken at different depths of the retention tank, after its filling up. The samples were collected every 1.0 m from the top to the bottom of the tank by means of Rutner's ladle. The following measurements were carried out: pH, COD, total nitrogen, total phosphorus, surface active substances, total suspended solids, and temperature. The same measurements were performed for the samples taken in a traditional way by means of ladle from the top layer of wastewater. This method is commonly used by the service staff responsible for the control of treated laundry wastewater.

Statistical analysis of the results obtained was done using variance analysis, at the assumed accuracy level ($p < 0.05$). The analysis of the differences between means from the particular groups was carried out using Tukey's test (reliable significant differences).

3. RESULTS

Based the comparison of the parameters measured in the samples from the top layer and from other layers it can be concluded that they significantly differ in pollutant concentration.

The greatest differences were observed in surface active substances (SAS), whose concentration in the sample from the top layer of wastewater was significantly greater than their concentration in the deeper layers. At the depth ranging from 1.5 m below the surface layer to the bottom of the retention tank the concentration of surface active substances was similar, i.e., from 10.5 mg/dm^3 to 12.4 mg/dm^3. Much higher SAS concen-



Variation of pollutant concentration in laundry wastewater, depending on the depth of sampling

tration was observed in the samples taken at the depth of 0.5 m below the top layer of wastewater. In this case, their mean concentration reached 17.7 mg/dm^3. The highest SAS concentration in the top layer of wastewater averaged out at 21.7 mg/dm^3.

Similar relationships between the concentration and the depth of sampling were observed for phosphorus. In the deeper layers of the retention tank, phosphorus content ranged from 9.1 mg P/dm^3 to 10.6 mg P/dm^3. The samples taken 0.5 m below the surface layer contained, on average, 13.2 mg P/dm^3. The highest phosphorus concentration, 14.9 mg P/dm^3, was measured in the top layer of wastewater in the retention tank.

Significant differences were observed in the concentration of total suspended solids in the samples taken at various depths. The highest TSS concentration, on average 325 mg/dm^3, was observed 4.5 m below the surface level. The deeper the layer of wastewater sampling, the higher the TSS concentration. The lowest content of total suspended solids measured 0.5 m below the surface layer and in the surface layer reached 165 mg/dm^3 and 158 mg/dm^3, respectively.

Based on the measurement of the wastewater temperature in the retention tank, we may infer that it depends on the tank depth. A temperature of the surface layer was 37.0 °C. Between the surface layer and the layer 1.5 m below the surface the difference in temperatures approached 3.0 °C. The temperature of wastewater at the bottom of the retention tank was 33.1 °C.

In the case of other pollutants, there were no significant differences in the concentration between the samples from various depths of the retention tank. COD ranged from 391 mg O_2/dm^3 to 414 mg O_2/dm^3, and BOD_5 was on the same level. The concentration of biodegradable organic matter ranged from 225 mg O_2/dm^3 in the samples taken 0.5 m below the surface layer to 240 mg O_2/dm^3 in the samples from the bottom of the retention tank.

In general, the concentration of total nitrogen only to a small extent depended on the depth of sampling. Its average values obtained during the study ranged from 14.6 mg N_{tot}/dm^3 to 15.4 mg N_{tot}/dm^3.

pH of treated laundry wastewater averaged out at 7.87. The value of this parameter was independent of the place of sampling and did not differ significantly in terms of statistics.

4. CONCLUSIONS

1. The values of organic matter concentration expressed by COD and BOD_5 and total nitrogen content were on the similar level independently of the point of sampling.

2. There were the statistically significant differences in the concentration of surface active substances, total phosphorus, total suspended solids and temperatures between the samples collected at various depths of the tank.

3. It was shown that the pollutant concentration and the quality of technological wastewater from the laundry directly depended on the depth of sampling.

4. Sampling from the surface layer of wastewater, the common way of sampling, may lead to the misjudgement on the effluent wastewater content and characteristic.

5. This study provides the basis for the works aimed at preparing the procedures and standards of wastewater sampling which allow the reliable results to be obtained.

6. The present research shows that the mixing of wastewater in the retention tank before wastewater sampling is always necessary. It allows the samples to be standardized and excludes the possibility of incorrect evaluation of the wastewater. In the retention tank, where the mixing system is not installed, the zones of different concentration of wastes can be expected.

ACKNOWLEDGEMENTS

The financial support received from the Foundation for Polish Science is greatly appreciated.

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WPŁYW SPOSOBU POBORU PRÓB NA OCENĘ JAKOŚCI ŚCIEKÓW TECHNOLOGICZNYCH POWSTAJĄCYCH W ZAKŁADZIE PRALNICZYM

Celem prezentowanych badań było stwierdzenie, czy wartości wskaźników zanieczyszczeń oraz ocena jakości ścieków technologicznych powstających w zakładzie pralniczym zależą bezpośrednio od sposobu oraz głębokości poboru prób. Analizowane podczas badań ścieki pochodziły ze zbiornika retencyjnego. Stwierdzono, że różnice w stężeniach substancji powierzchniowo czynnych, fosforu ogólnego, zawiesiny ogólnej oraz temperatury są istotnie statystycznie skorelowane z głębokością poboru prób. Udowodniono, iż pobór materiału do badań z warstwy powierzchniowej, czyli w sposób powszechnie praktykowany przez służby upoważnione do kontroli jakości ścieków odprowadzanych do odbiorników lub sieci kanalizacyjnych, jest przyczyną błędnej oceny składu i charakterystyki ścieków.