Jurnal Teknologi dan Pengelolaan Lingkungan
Journal homepage: jurnal.pelitabangsa.ac.id

THE EFFECT OF WASTEWATER OF BATIK INDUSTRY TO THE QUALITY OF DENGKENG RIVER

Agus Riyadi

Program Studi Teknik Lingkungan
Sekolah Tinggi Teknologi Pelita Bangsa
agusriyadi@pelitabangsa.ac.id

ABSTRACT

Kebon Village, Bayat Sub-district is one of the village in Klaten Regency which can develop batik industry. In 2013, the number of batik industry in Kebon Village reached 160 units. However, this industry brings the negative impact of waste pollution and it affects many complex problems for the environment surrounding. The objectives of this research were: (1) Analyzing concentration of the parameter in batik wastewater, (2) Analyzing concentration of the parameter in Dengkeng River, (3) Evaluating productivity of Wastewater Treatment Plant, and (4) Knowing the level of public awareness in Kebon Village, Bayat Sub-district. This research used primary and secondary data. The primary data were obtained from laboratory analysis results while the secondary data were obtained from Kebon Village Office, Bayat Sub-district Office, and Local Development Planning Agency of Klaten Regency. Sample taking technique used for this research was Purposive sampling. The results of this research were that the batik's waste-water parameter in Kebon Village had been polluted based on Regulation of the Province of Jawa TengahNo. 5 of 2012 on wastewater quality standards, while some Dengkeng River water were still in accordance with the River Water Quality Standards Class III of Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control. The batik's societies also have awareness to the river environment based on questionnaire assessment.

Informasi Artikel

Diterima : 7 Februari 2019
Direvisi : 5 Maret 2019
Dipublikasikan : 15 April 2019

Keywords: home industry, batik, pollution, wastewater, environment.

I. INTRODUCTION

The increasing necessities for life and life activities will have a significant impact on environment. Batik industry is one of the businesses that produces wastewater. Batik industry center in Kebon Village, Bayat Sub-district, Klaten Regency as a research area has had Wastewater Treatment Plant (WWTP), where the integrated waste processing system has had sewer network communally and placed in a basin, which is further processed there. The processed waste is flowed into the river that is located next to the WWTP, and then the water is used for irrigation of rice fields.

Kebon Village, Bayat Sub-district is a village with the largest batik home industry in Klaten Regency. These home industry activities are potential to generate pollution. This waste dominated by wastewater has characteristics of dark color, high BOD and COD, and high turbidity. The varying degree of public awareness on river environment resulting in a lot of waste in the area around the river.

Based on the problems contained in the background, then the research aimed at:

1. Analyzing concentration of the parameter in batik wastewater which includes BOD, COD, TDS, TSS, phenol, color, pH, temperature which have become Quality Standardsof Regulation of the Province of Jawa TengahNo. 5 of 2012 on Wastewater Quality Standards and Government Regulation No. 82 of 2001 on the Water Quality Management and Water Pollution Control, River Water Quality Standards Class III, and both before and after through the WWTP in Kebon Village, Bayat Sub-district, Klaten Regency.
1. Analyzing concentration of the parameter in Dengkeng River which includes BOD, COD, TDS, TSS, phenol, color, pH, temperature at Dengkeng River water in Kebon Village, Bayat Sub-district, Klaten Regency which refers to

Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution control, River Water Quality Standards Class III.

2. Evaluating productivity of WWTP in batik industry center in Kebon Village, Bayat Sub-district, Klaten Regency.
3. Knowing the level of public awareness in Kebon Village, Bayat Sub-district, Klaten Regency on wastewater management of batik industry.

The varying human activities in meeting human needs from home industry and farming will generate waste that affects to a decrease in river water quality (Suriawiria, 2003). According to Mulyanto (2007), there are two main functions of river naturally, i.e. draining water and transporting sediment as the results of erosion in watershed and its channel. Both of these functions occur together and influence each other.

Batik in Indonesian Dictionary is a pictorial fabric and the like (patterned) made by dotting (initially written or imprinted them with wax then dyed with indigo and soga plants) (Poerwadarminta, 1976). Water pollution according to Ginting (2007), water is identified polluted when one or more of these conditions are met.

1) Increasing or decreasing in pH.
2) The damage in the physical properties of water.
3) Water surface is covered by a floating layer.
4) Increasing in organic matter content.
5) Increasing in suspended substances in the water.

II. RESEARCH METHOD

The method applied in this research was field survey method, by performing sampling and interviews with local people. Samples taken consisted of river water and batik wastewater. Purposive sampling method was used. River water sampling was conducted at three sampling points by repeating in each sampling point of three times. The first point (P1), i.e. before the river water entered Kebon Village, Bayat Sub-district. It aimed to determine the condition and description of river water before it was mixed with textile waste as

well as a control. The second sampling point was located at the junction between the river water and batik waste, to be exact, there had been a mixing of Dengkeng River water and batik wastewater. The last sampling point or third sampling point was on the river body within approximately one kilometer from the WWTP outlet. Self-purification was expected at this last point.

As for wastewater, sampling was done in a collect tank before entering the treatment plant (WWTP). Second wastewater sampling was done at WWTP outlet but before mixing with river water. After sampling, analysis in the laboratory was done to determine parameter of pollutants contained in wastewater and river water. After the results obtained, the results were compared to the applicable regulations.

III. FINDINGS AND DISCUSSION

These research findings will be discussed with a comparative study, i.e. comparing the findings to product of law relating to water quality standards and the designation, i.e. Government Regulation No. 82 of 2001 on water quality management and water pollution control.

Temperature

From the measurement of the average temperature for three days in river water samples at first point, fourth point and fifth point, the results were obtained respectively by 28.1^{o} C; 28.07^{o} C; 28.07^{o} C. The temperature measurements at the first point (P1), fourth point (P4) and fifth point (P5) were in accordance with Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control. As for the batik wastewater at the second point (P2) was 28.3^{o} C and at the third point (P3) was 27,93^{o} C.These figures were in accordance with Regulation of the Province of Jawa TengahNo. 5 of 2012 on Amendment to the Local Government Regulation No. 10 of 2004 on Wastewater Quality Standards.

Electrical Conductivity

Electrical Conductivity is one indicator of contamination in water body. The average measurements at the first point (P1) was 757.39 µmhos/cm, at fourth point (P4) was 1056 µmhos/cm and at fifth point (P5) was 388.63 µmhos/cm. As for the batik wastewater at the second point (P2) was 6558.8 µmhos/cm and at the third point (P3) was 1037.95 µmhos/cm. These figures were still within the range of the threshold of River Water Quality Standards Class III of Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control.

The measurements average results of Electrical Conductivity (EC) taken were three repetitions at the first point (P1), i.e. 658 µmhos/cm, then an average result of 6558.8 µmhos/cm at the second point was obtained. There was a quite dramatic jump on this second point. This was because the second location was in the wastewater tank, so that the wastewater had not degraded because the treatment had not performed yet. Once entered the Wastewater Treatment Plant (WWTP), the analysis result at the third point was 1037.95 µmhos/cm which was in line with the expectations of the society and was an indicator that the wastewater treatment plant was still operating even though the result was not in accordance with Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control. From the fourth point, the analysis result of 1056 µmhos/cm was obtained. The occurrence of decreasing in EC parameterat this point was due to the mixing of wastewater and river water. In addition, the fourth point was located at the junction between wastewater and river water. The fifth point kept showing a decrease in EC, which amounted to 388.6 µmhos/cm. The fifth point was a point located approximately three kilometers of the fourth point.

Color

The batik wastewater discharged into Dengkeng River was not actually contaminating the color, but the substances contained in the wastewater instead. From the sampling during three consecutive days, the results of an average

of each point of 17.36 TCU for the first point (P1), 36.78 TCU for the fourth point (P4) and 32.46 TCU for the fifth point (P5) were obtained. The figures were below the threshold of Water Quality Standards Class III of Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control. As for the batik wastewater at the second point (P2), a result of 2220.9 TCU was obtained and 77.44 TCU for the third point (P3). The figures were below the threshold of Water Quality Standards Class III of Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control.

Analysis of the color parameter taken in three repetitions at the first point (P1) was 17.363 TCU, then the average result at the second point was 2220.9 TCU. There was a quite dramatic jump at the second point. This was because the second location was in the wastewater tank, so that the wastewater had not degraded because the treatment had not performed yet. Once entered the Wastewater Treatment Plant (WWTP), the analysis result at the third point was 77.44 TCU. This was in accordance with the expectations of the society and was an indicator that the wastewater treatment plant was still operating even though the result was not in accordance with Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control. From the fourth point, the analysis result of 36.78 TCU was obtained. The decrease in color parameterat this point was due to the mixing of wastewater and river water because the fourth point was located at the junction between the wastewater and river water. The fifth point kept showing a decrease in color parameter which amounted to 32.46 TCU.

Total Dissolved Solids (TDS)

Total Disolved Solids are the solids dissolved in water. From the measurement results in the field for three consecutive days, the figures respectively of 130.7 mg/l for the first point (P1), 240 mg/l for the fourth point (P4) and 137.3 mg/l for the fifth point (P5) were obtained. As for batik wastewater, a value of 3540 mg/l was obtained from the sampling at the second point and 528.7 mg/l at the third point. These figures were still below the threshold of River Water Quality Standards Class III of Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control of 1000 mg/l.

The analysis results of Total Dissolved Solids (TDS) average parameter were taken in three repetitions at the first point (P1) with an average of 130.7 mg/l, and 3540 mg/l at the second point. There was a quite dramatic jump at the second point. This was because the second location was in the wastewater tank so that the wastewater had not degraded because the treatment had not performed yet.

Once entered the Wastewater Treatment Plant (WWTP), TDS analysis result at the third point was 518.7 mg/l which was in line with the expectations of the society and was an indicator that the wastewater treatment plant was still operating even though the result was still above the water quality standards value Class II ofGovernment Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control. From the fourth point, the analysis result of 240 mg/l was obtained. The decrease in TDS parameterat this point was due to the mixing of wastewater and river water because the fourth point was located at the junction between the wastewater and river water. The fifth point kept showing a decrease in TDS parameter which amounted to 137.3 mg/l.

Total Suspended Solids (TSS)

From the measurements results in the field for three consecutive days, the average results of first location (P1) of 403.6 mg/l, the fourth point of 338 mg/l and the fifth point of 189.5 mg/l were obtained. A value of 1674 mg/l was obtained for the measurement result for batik wastewater, and 455.8 mg/l from the third point. The figures of measurement results on these five points had exceeded Water Quality Standards Class III of Government

Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control of 50 mg/l.

The TSS parameter was taken in three repetitions at the first point (P1) in the amount of 403.6 mg/l. Then, an average result of 1674 mg/l at the second point (P2) was obtained. There was a quite drastic jump at the second point. This was because the second sampling location was in the wastewater tank before it flowed to the next processing tank, so that the parameter of pollutants in wastewater had not degraded. The analysis result at the third point (P3) was 455.8 mg/l which was in line with the expectations of the society and was an indicator that the wastewater treatment plant was still operating despite the result (outlet) was still not in accordance with Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control. The analysis result of 388 mg/l at the fourth point (P4) was obtained. The decrease in TSS parameter at this point was due to the confluence of wastewater and river water, so there was a mixing at the fourth point between wastewater and river water. The fifth point (P5) kept showing a decrease in TSS parameter which amounted to 189.5 mg/l.

Acidity (pH)

Acidity or pH is a hydrogen ion content in the water. So, it will affect the acidity of the water. From the pH measurement results of the research site during three consecutive days, the average figures of 7.21 for the first point, 7.96 for the fourth point and 7.89 for the fifth point were obtained. While for the batik wastewater, the figures of 7.96 at the second point and 6.95 at the third point were obtained. These figures were in the threshold range of Water Quality Standards Class III of Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control whose value is 6.0 to 9.0.

Chemical Oxygen Demand (COD)

COD measurement results in this research were obtained from analysis in the laboratory. While the values during the research were as follow: the first point had a value of 6.23 mg/l, while the fourth point of 24.5 mg/l and the fifth point of 9.57 mg/l. The analysis results were still below the value of River Water Quality Standards Class III of Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control of 25 mg/l. As for batik wastewater, i.e. the second point of 848.5 mg/l, this figure had exceeded the threshold of Regulation of the Province of Jawa TengahNo. 5 of 2012 on Amendment to the Local Government Regulation No. 10 of 2004 on Wastewater Quality Standards of 150 mg/l, and the figure amounted to 94.12 mg/l at the third point was obtained. The figure was still below the threshold of Regulation of the Province of Jawa Tengah No. 5 of 2012 on Amendment to the Local Government Regulation No.10 of 2004 on Wastewater Quality Standards.

The average results of COD analysis were taken in three repetitions at the first point (P1), i.e. 6.23 mg/l,then 848.5 mg/l was obtained at the second point. There was a quite dramatic jump at this second point. This was because the second location was in the wastewater tank so that the wastewater had not degraded because the treatment had not performed yet. Once entered the Wastewater Treatment Plant (WWTP), the analysis result at the third point was 94.12 mg/l which was in line with the expectations of the society and was an indicator that the wastewater treatment plant was still operating even though the result was not in accordance with Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control. The result analysis of 24.5 mg/l was obtained at the fourth point. The decrease in COD at this point was due to the mixing of wastewater and river water because the fourth point was located at the junction between the wastewater and river water. The fifth point kept showing a decrease in COD, i.e. by 9.57 mg/l.

Biological Oxygen Demand (BOD)

The amount of oxygen required to degrade organic substances in water describes the content of organic substances contained in the water. From the research results of Dengkeng River water in P1 location, a figure of 0.55 mg/l was obtained.A result of 0.5 mg/l at the fourth point was obtained, and a result figure of 1.13 mg/l was obtained at the fifth point. These figures were still below the value of River Water Quality Standards Class III of Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control of 3 mg/l. While a measuring result of 54.53 mg/l was obtained for the batik wastewater at the second point, and 19.9 mg/l at the third point. These figures had exceeded the threshold of Regulation of the Province of Jawa Tengah No. 5 of 2012 on Amendment to the Local Regulation No. 10 of 2004 on Wastewater Quality Standards of 6 mg/l. The average results of BOD analysis were taken in three repetitions at the first point (P1), i.e. 0.55 mg/l, and 54.53 mg/l at the second point.

All the parameters had a quite dramatic jump at this second point. This was because the second location was in the wastewater tank, so that the wastewater had not degraded because the treatment had not performed yet. Once entered the Wastewater Treatment Plant (WWTP), the analysis result at the third point was 19.9 mg/l which was in line with the expectations of the society and was an indicator that the wastewater treatment plant was still operating even though the result was not in accordance with Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control. The result analysis of 0.5 mg/l was obtained at the fourth point. The decrease in BOD at this point was due to the mixing of wastewater and river water because the fourth point was located at the junction between the wastewater and river water. The fifth point kept showing a decrease in BOD, i.e. 1.13 mg/l.

Total Phenolic Compounds

Less significant figure was obtained from the content of total phenolic compounds in river water at the P1 location in three repetitions, amounting to 0.0001 mg/l. While 0.0001 mg/l on the fourth point, and the fifth point was the same, 0.0001 mg/l. These figures were still far below the River Water Quality Standards Class III ofGovernment Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control, i.e. 0,001 mg/l. While the wastewater at the second point was 0.54 mg/l. This figure already exceeded the threshold of Regulation of the Province of Jawa Tengah No. 5 of 2012 on Amendment to the Local Regulation No. 10 of 2004 on Wastewater Quality Standards of 0.05 mg/l. While a result of 0.0001 mg/l was obtained at the third point which was still below the threshold of Regulation of the Province of Jawa Tengah No. 5 of 2012 on Amendment to the Local Regulation No. 10 of 2004 on Wastewater Quality Standards of 0.05 mg/l.

The results of the analysis of phenol were taken in three repetitions at the first point (P1), i.e. 0.0001 mg/l,then 0.54 mg/l at the second point. There was a quite dramatic jump at this second point. This was because the second location was in the wastewater tank, so that the phenol parameter in the wastewater had not degraded because the treatment had not performed yet.

Once entered the Wastewater Treatment Plant (WWTP), the analysis result at the third point was 0.0001 mg/l. It was an indicator that the wastewater treatment plant was still operating even though the result was not in accordance with Government Regulation No. 82 of 2001 on water quality management and water pollution control. The analysis of 0.0001 mg/l was obtained at the fourth point. A decrease in phenolic compounds parameter at this point was due to the mixing of wastewater and river water because the fourth point was located at the junction between the wastewater and river water. The fifth point kept showing a decrease in phenolic compounds parameter which amounted to 0.0001 mg/l. To make it easier to read and to know the

condition of the parameters and the extent to which the contents

IV. CONCLUSIONS

The result of laboratory analysis on the samples of batik wastewater and Dengkeng River water was most of the parameters analyzed had a concentration that exceeded the Quality Standards of Government Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control and Regulation of the Province of Jawa Tengah No. 5 of 2012 on Amendmentto the Local Regulation No. 10 of 2004 on Wastewater Quality Standards.

The parameters on waste samples at the second location (P2) of which the treatment had not performed yet had exceeded the threshold of Regulation of the Province of Jawa Tengah No. 5 of 2012 on Amendment to the Local Regulation No. 10 of 2004 on Wastewater Quality Standards.

The impairment of pollutants parameters in the wastewater had decreased. It indicated that the productivity of Wastewater Treatment Plant was still operating properly.

People were starting to be aware with the importance of batik wastewater management.

V. REFERENCES

1.Ginting, P.S. *Sistem Pengelolaan Lingkungan dan Industri*.Yrama Widya. Bandung.

2.Kristanto, P. 2002. *Ekologi Industri*. Andi. Yogyakarta

3.Mahida, U.N. 1993. *Pencemaran Air dan pemanfaatan Limbah Industri*.Rajawalipress. Jakarta

4.Mratihatani,A.S.2013. **"***Menuju pengelolaan sungai bersih di kawasan industri batik yang padat limbah cair*".Tesis:program pasca Sarjana fakultas Ekonomika dan Bisnis Universitas Diponegoro.Semarang.

5.Mulyanto, H.R. 2007. *Sungai Fungsi dan sifat-sifatnya*, Penerbit Graha Ilmu, Yogyakarta

6.Murtihadi dkk. 1979. *Pengembangan Teknologi Batik Menurut SMIK*. Departemen Pendidikan dan Kebudayaan. Jakarta

7.Poerwadarminta W.J.S.,1991. *Kamus Umum Bahasa Indonesia*. Perum Penerbitan dan Percetakan Balai Pustaka, Jakarta.

8.Suryotomo,B. 2011. *"Pengaruh limbah batik terhadap pertumbuhan dan produksi beberapa varietas padi (oriza sativa) di wilayah kota pekalongan".*Universitas Pekalongan

9.Rahmawati, N.A.,2010. "*Pengaruh Limbah Cair Industri Sarung Tangan Pada Air Irigasi dan Pengaruhnya terhadap produksi padi dan Kualitas Lingkungan*, Tesis: Program pasca Sarjana Ilmu Lingkungan. Universitas Gadjah Mada