Identification on Formalin Content in Swamp Wastewater: Abdurrab University Campus Environment Case

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Abstract: Formalin is a harmful chemical content which has high toxicity and can cause cancer containing in wastewater. Formalin is used in non-food industry and corps preserving. In a university, a bad laboratories wastes management can affect hazardous chemistry content in its neighborhood wastewater, such as formalin. It is important to make sure that the wastes are managed carefully and will not harm enclosing people and environment. This research aims to identify formalin content in wastewater surrounding Abdurrab University campus in Pekanbaru. The formalin was identified using three kind reagents of Schiff, cromatofat acid and FeCl₃. The result shows that all of samples do not contain formalin that could be seen from the color’s change from colorless to pink or violet using Schiff and cromatofat acid or the formation of violet ring using FeCl₃.

Keywords: formalin, Schiff, cromatofat acid, ferric chloride, wastewater, laboratories.

1. Introduction

The Environment has an enormous impact in human’s life continuation, especially in human’s health. A bad balance of environment can cause kinds of diseases which are due to solid wastes and wastewater pollution. It is essential to do a good management of wastes and wastewater to avoid the contamination (Mubarak dan Nurul, 2009). Wastewater is a mixture of water and other contaminations which are solved or suspended. The wastewater is gotten from industry and domestic sources, such as housing and commerce. The waste water, in particular time, will be blended with soil, surface, or rain water (Suparman dan Suparmin, 2002). Active laboratories, such as in universities, have huge contribution for wastewater contamination. A poor laboratories waste management can give negative impacts for human health and environment balance, chronically. One of hazardous compounds that is present in the wastewater is formalin.

Formalin is a toxic chemistry compound. The toxicities have been evaluated by many named organizations such as IARC (International Agency for Research on Cancer), ATSR (Agency for Toxic Substances and Disease Registry, USA), and IPC (International Program on Chemical Safety). Formalin is classified by IARC into a high risk compound of causing cancer (Uzairu et al, 2010). Formalin is usually used for disinfection of vegetative bacteria, such as fungi and virus, and spore bacteria. Furthermore, it is used in non-food industry and corps preservation. The formalin contamination can harm biota existence in water and human’s health. The laboratories formalin waste will contaminate surroundings through sewers and be blended in water. There will be a possibility that a high level of formalin content in wastewater affecting the surrounding people live, chronically, by causing some health disorders. This research aims to determine formalin content in wastewater surrounds Abdurrab University campus as a campus with active laboratories.

2. Methodology

First of all, sample wastewater was taken from five spot sewers surround the campus in the morning and noon. The samples were stored in clean bottle and labelled. After that, the formalin content in fresh sample was identified using reagents of Schiff (Tatu et al, 20016), cromatofat acid
(Hastuti, 2010) and FeCl₃ (Suwahono et al., 2009), qualitatively. The determination was held three times for each sample to analyze the color change of sample from colorless into pink or violet using Schiff and cromatofat acid reagent and the formation of violet ring using FeCl₃ reagent. The data were collected during five days a week for three months from January to March 2018.

3. Result and Discussion

From all analyzed samples, non of the samples are positive containing formalin. There was not color change sign of sample from colorless into pink or violet (Table I). Because of the sensitivity of Schiff reagent, there are two result possibilities of the research. The first is, the wastewater is negative containing formalin and the second is the wastewater contains formalin but the level is too low to be identified using Schiff reagent.

Schiff is the most common regent used for formalin identification, qualitatively. The reagent was prepared by blending fuchsin base, sodium bisulfite, and chloride acid in distilled water. The reagent has a good sensitivity in determining formalin content to concentration of 10 ppm. The sensitivity of Schiff reagent can be increased to 0.01 ppm by adding curium sulfate into the solution (Tatuh et al., 2016).

The positive result of formalin content using Schiff reagent is analyzed by the color change of sample from colorless into pink or violet. The change is due to the reaction between aldehyde group of formalin with the reagent (Tatuh et al., 2016). Furthermore, the reaction will form the colored complex compound formaldehyde (Manoppo et al., 2014). The color will be stronger by an increase of formalin concentration in the sample solution (Kusumawati dan Trisharyanti, 2004).

The color change using Schiff reagent is depended on formalin concentration in sample solution (Putri et al., 2016). The color will be stronger by an increase of formalin concentration in the sample solution (Kusumawati dan Trisharyanti, 2004). There are four level of colors in the identification. The color will change into pink (if the formalin concentration is lower than 25 ppm), red (if the concentration is about 50 ppm), violet (if the concentration is about 70 ppm), and blue (if the concentration is more than 100 ppm) (Putri et al., 2016).

Table 1. Formalin content in wastewater from five sewer’s spots

| Sample* | Conc. |
|---------|-------|
|         | Schiff | FeCl₃ | Cromatofat acid |
| Spot 1  |        |       |                 |
| 1st month | Morning | Colorless | Colorless | Colorless | Negative |
| Noon    | Colorless | Colorless | Colorless | Negative |
| 2nd month | Morning | Colorless | Colorless | Colorless | Negative |
| Noon    | Colorless | Colorless | Colorless | Negative |
| 3rd month | Morning | Colorless | Colorless | Colorless | Negative |
| Noon    | Colorless | Colorless | Colorless | Negative |
| Spot 2  |        |       |                 |
| 1st month | Morning | Colorless | Colorless | Colorless | Negative |
| Noon    | Colorless | Colorless | Colorless | Negative |
| 2nd month | Morning | Colorless | Colorless | Colorless | Negative |
| Noon    | Colorless | Colorless | Colorless | Negative |
| 3rd month | Morning | Colorless | Colorless | Colorless | Negative |
| Noon    | Colorless | Colorless | Colorless | Negative |
| Spot 3  |        |       |                 |
| 1st month | Morning | Colorless | Colorless | Colorless | Negative |
The result shows that non of the samples positive containing formalin which were identified using cromatofat acid and FeCl$_3$ reagent. There was not color changing of sample into violet using cromatofat acid reagent and the formation of violet ring using FeCl$_3$ reagent. Both reagents are used to identify aldehyde group of formalin compound. The cromatofat acid method is used to identify formalin composition, qualitatively. The method is held by the addition of cromatofat acid and sulfate acid into solution sample. The cromatofat acid will release the formalin bond in sample and form colored complex compound (Salosa, 2013). The positive result of the identification using cromatofat acid is the formation of pink to bright violet color from colorless solution. The color will be stronger as an increase of formalin concentration (Hastuti, 2010). Ferric chloride can be used to identify aldehyde group of formalin. The reagent is a sensitive solution to determine aliphatic aldehyde group. The method is performed by dropping some ferric chloride solution into sample and followed by the addition of strong sulfate acid. The positive result can be seen by the production of violet ring in solution sample (Suwahono et al, 2009).

Water is the most important thing for human live. Furthermore, keeping water clean is very essential to maintain human health (Droste, 1997). There are some types of pollutant that can be present in wastewater, such as inorganic, organic and biological pollutant. The kind of substances might have a high toxicity and carcinogenic effect for human (Gaston, 1979). The pollutants could be achieved from some resources, such as industrial, agriculture, and domestic movement. So, as a miniature of industry, an active laboratory might contribute to water pollution (John, 1990). For a biomedical laboratory, the usage of formalin is crucial and as the result, it becomes an undeniable waste (Rao, et al, 2004). Needing a special treat to manage the waste, such as on histology specimens and water. For the specimens, the cremation is a one way to manage the waste. However, it is important to wash the remaining formalin with water before incinerating to avoid resulting toxic gases. Moreover, the formalin has to be washed with water as much as possible to elute the formalin content. The elution is needed to decrease the level of formalin in water as low as possible before releasing it (Chitnis et al, 2005).

| Spot 4 | Noon | Colorless | Colorless | Colorless | Negative |
|--------|------|-----------|-----------|-----------|----------|
| 2nd month | Morning | Colorless | Colorless | Colorless | Negative |
|         | Noon    | Colorless | Colorless | Colorless | Negative |
| 3rd month | Morning | Colorless | Colorless | Colorless | Negative |
|         | Noon    | Colorless | Colorless | Colorless | Negative |

| Spot 5 | Noon | Colorless | Colorless | Colorless | Negative |
|--------|------|-----------|-----------|-----------|----------|
| 1st month | Morning | Colorless | Colorless | Colorless | Negative |
|         | Noon    | Colorless | Colorless | Colorless | Negative |
| 2nd month | Morning | Colorless | Colorless | Colorless | Negative |
|         | Noon    | Colorless | Colorless | Colorless | Negative |
| 3rd month | Morning | Colorless | Colorless | Colorless | Negative |
|         | Noon    | Colorless | Colorless | Colorless | Negative |

*Sample was taken and analyzed every morning and noon twice a week in a month.
4. Conclusion

It can be concluded that all of wastewater samples taken from sewers surround Abdurrab University campus are negative containing formalin. The negative result is analyzed by there is not the formation of pink to violet color using Schiff regent and cromatofat acid and violet ring using FeCl₃ from colorless liquid sample. Because of the sensitivity of reagent (more than 10 ppm), there is a possibility that the negative result is caused by the formalin level in the sample is low and can not be identified using the three reagents.

5. Reference

[1] Hastuti, S. (2010). Analisis Kualitas dan Kuantitas Formaldehida pada Ikan Asin di Madura. Agrointek, 4(2), 132-137.
[2] Kusumawati, F. dan Trisharyanti, D. K. I. (2004). Penetapan Kadar Formalin yang Digunakan sebagai Pengawet dalam Bakmi Basah di Pasar Wilayah Kota Surakarta. Jurnal Penelitian sains & Teknologi, 5(1), 131-140.
[3] Manoppo, G., Abidjulu, J., Wehantouw, F. (2014). Analisis Formalin pada Buah Impor di Kota Manado. Pharmacon, 3(3), 148-155.
[4] Mubarak, W.I. dan Nurul, C. (2009). Public Health Science Theory and Applications. Salemba Medika: Jakarta.
[5] Putri, A. D., Pane, E. R. dan Khasianturi, V. (2016). Uji Kandungan Formalin pada Buah Pepaya (Carica papaya L.) dan Buah Nanas (Ananas comosus L.) yang Dijual Di Lingkungan UIN Raden Fatah Palembang dengan Metode Spektrofotometri. Jurnal Biota, 2(1), 76-81.
[6] Refwalu, M.H., Rorong, J., Sudewi, S. (2016). Analisis Kandungan Formalin pada Berbagai Jenis Daging di Pasar Swalayan Kota Manado. Pharmacon, 5(4), 168-173.
[7] Salosa, Y.Y. (2013). Uji Kadar Formalin, Kadar Garam dan Total Bakteri Ikan Asin Tenggiri Asal Kabupaten Sarmi Provinsi Papua. Depik, 2(1),10-15.
[8] Suparman dan Suparmin. (2002). Pemburnan Tinja dan Limbah Cair. EGC: Jakarta.
[9] Suwahono, Taufik, M., Faizah, N. (2009). Analisis Kualitatif Formaldehida pada Ikan Asin. Makalah yang tidak dipublikasikan Jurusan Tadris Kimia Fakultas Tarbiyah IAIN Walisongo Semarang.
[10] Tatuh, H.A., Rorong, J., Sudewi, S. (2016). Analisis Kandungan Formalin pada Berbagai Jenis Ikan di Kota Manado. Pharmacon, 5(4), 162-167.
[11] Uzairu, A., Yiase, S.G., Ugye, T.J. and Anhwange, B.A. (2010). Formaldehyde Levels in Some Manufactured Regular Foods in Makurdi, Menue State, Nigeria. Journal of Applied Sciences in Environmental Sanitation, 5(3), 223-226.33
[12] Zimmer, C. And McKinley, D. 2008. New Approaches to Pollution Prevention in the Healthcare Industry. Jornal of Cleaner Production, 16(6), 734-742.