

INDUSTRIAL WASTEWATER QUALITY OF HOA BINH CITY IN 2014 – 2015 PERIODS, CASE STUDY: DA RIVER LEFT-BANK INDUSTRIAL ZONETran Thi Lan Huong¹, Nguyen Tuan Dung^{2*}¹College of Agriculture and Forestry - TNU, ²Thai Nguyen University**SUMMARY**

This study assessed industrial wastewater quality of Da River Left-bank Industrial Zone - Hoa Binh City in the 2014-2015 periods and then proposed solutions for decreasing the water pollution. Regarding to the state of wastewater treatment, Da River Left-bank Industrial Zone is a place that has largest amount of wastewater discharge in Hoa Binh City. In the Industrial Zone, a number of companies discharged wastewater directly into Dung stream (flowing to Da River) an extremely large amount of industrial wastewater with concentration of BOD₅, COD, total Coliform, AOX, TSS, etc seriously exceed the permissible standards, cause serious pollution in the 2014 – 2015 periods and effect the environment and local people. After assessing the situation in the Industrial Zone, the essential solutions were proposed. In term of management, local authorities need to take coercive measures against companies which discharged the untreated or unsatisfactory treated wastewater directly into environment. With technological solution, the Industrial Zone has to select appropriate production technologies and innovative technology. Overall, the options considered and evaluated in the thesis indicated that Da River Left-bank Industrial Zone can implement those options to prevent and manage the quality of wastewater in order to protect environment in a legal, logical and financially practical way.

Keywords: *Industrial Zone, wastewater, treatment, pollution, discharge, industry, etc*

INTRODUCTION

Environment is a system of natural and artificial material factors which impact on the survival and the development of humans and animals (Environmental Protection Act, 2014). One of the most crucial and necessary factors for all life on earth in general and human in particular is water. It does not only affect human's health, daily activities, but it is also a factor to ensure the prosperity of mankind. (NORWECO, n.d). Nowadays, the development of science and technology has accelerated the pace of socio-economic development, creating a giant volume of material goods for meeting the growing demands of human but a huge amount of wastewater has been discharged (Hellawell, J.M. 1989). As a country with a growing economy, Vietnam has become the heavily polluted water on the world. Among them, the Da River Left-bank Industrial Zone, Hoa Binh City is one of the hot spots of

wastewater pollutants, especially industrial wastewater.

The Industrial Zone is consisted of many companies operating in different fields such as productions of plastic sheet, silicone rubber; spare parts for cars and motorcycles; automobile engine, sanitary ware products; hardware assessories, barcode printers, etc.

Due to the versatility of the Industrial Zone, wastewater is harmful and impacts on the environment not only the Industry Zone but also surrounding area. This paper reports field research from August 2014 to December 2015 for assessment of wastewater of Da River Left-bank Industrial Zone.

STUDY SITES AND RESEARCH METHODS**Study sites**

Empirical data for this study was gathered primarily in Da River Left-bank Industrial Zone, Huu Nghi Ward, Hoa Binh City. Hoa Binh City is situated at a valley surrounded by hills and rocky mountains and has low rate of economic growth. (Hoa Binh Department of Natural Resources and Environment 2013)

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The Industrial Zone is one of the important part for social - economic development of Hoa Binh. It has 18 projects including 02 foreign investment projects and 16 domestic investment projects, with total registered capital of 100 billion VND (Hoa Binh DNRE, 2015). There are 14 projects which have already runned, 03 projects are in construction and 01 project has not implemented. Leased land area is 28.61 ha, accounting for approximately 53.6% of total salable land area of the Industrial Zone (Hoa Binh statistic office, 2013).

Research methods

A range of methods was employed in order to generate information, to triangulate insights and to build up an accurate, detailed picture of water environment of the Industrial Zone. Secondary data are collected through official documents of Hoa Binh City People's Committee, Huu Nghi Ward People's Committee, EPA, management board of Da River Left-bank Industrial Zone, etc. on natural, socio-economic conditions of the area, results of previous analysis on wastewater samples in 2014 2015, etc.

Additionally, data in scientific reports, conferences, books, newspapers, on the internet and other materials are also exploited. Methods of getting, maintaining and analyzing samples taken from different points of Da River were used to analyze wastewater from the Industrial Zone. Besides, questionnaire and interview were used to collect opinions of workers employed in the industrial zone and people nearby. People in following groups: group 1, group 3, group 7, group 12, group 17, and group 23 - Huu Nghi Ward - Hoa Binh City are chosen as subjects of the survey.

RESULTS

Overview of Da River Left-bank Industrial Zone

The main sectors located in the Industrial zone are: machinery and manufacturing industry, material and construction industry and different light industry. Among them, 6 companies are likely to cause the highest pollution due to their usage of huge amount of water and high level of pollutants. This is clearly shown in table 1:

Table 1. Fuel and water consumption of some operating companies in Da River Left-bank Industrial Zone

No.	Name of company	Fuel using	Water using (m3/ day)
1	R-Vietnam technical research Company, Ltd	- Glass, grind stone, grind fluid, grind and polish material, cutting fluid, detergent chemical, waste treatment liquid, maintaining material - Electric, diesel, petrol, gas	280
2	Huu Nghi ISC for Agricultural and Forestry Products	- Soaked piece of bamboo - NaOH 95 - DO - Ink types	150 - 200
3	Sankok Vietnam Company, Ltd	- Copper wire, circuit, chip resistor, tin rod, white flesh, plastic liquid, packing plastic bag, glue, tape, ink - Turpentine oil, detergent gasoline, diesel.	70
4	Sugar Hoa Binh JSC	- Sugar cane - Lime, sulfur, phosphoric acid, soda 96% - Bagasse, FO	3.500
5	Beer factory - Hoang Gia JSC	- Gas	950
6	Construction and Trade Investment Lam Binh JSC	Sand, gravel, cement, stone, lined mold oil, steel	730

(Source: Hoa Binh Provincial People's Committee, 2014)

Assessment of current situation of water in Da River Left-bank Industrial Zone and the surrounding areas

The situation of water at Da River Left-bank Industrial Zone in 2014 – 2015

With current situation of the Industrial Zone productions, wastewater is polluted seriously with the levels of indicators as pH, BOD₅, COD, TSS, Zn, Mn, Fe, mineral oil, vegetable and animal oils, NH₃-N, total N, Coliform exceed permissible limits.

Because the Industrial Zone's companies do not have a centralized wastewater treatment system, this study chooses 2 production bases in the list of businesses causing serious water

pollution of Hoa Binh province in the 2014 – 2015 periods to analyze the current state of water pollution, including R Vietnam technical research Co, Ltd., and Huu Nghi JSC for Agricultural and Forestry Products.

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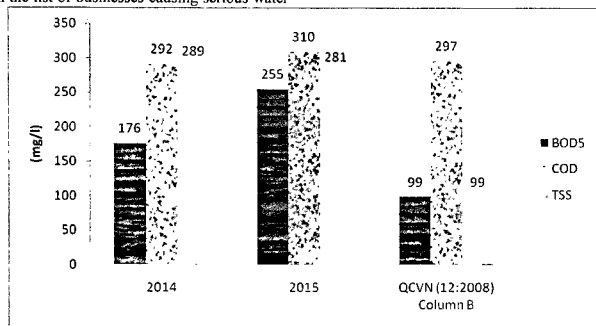


Figure 1: Concentration of BOD₅, COD and TSS in the 2014 – 2015 periods in wastewater at discharged point into environment of wastewater treatment plant - Huu Nghi Joint Stock Company for Agricultural and Forestry Products

Comments: Concentration of BOD₅, COD and TSS were very high, have value exceeding the permissible limit. This is a warning sign for Huu Nghi Jsc for Agricultural and Forestry Products about the production activities in Da River Left-bank Industrial Zone and the impacts caused seriously environmental pollution. Besides, compared with 2014, the indicators BOD₅ and COD had increased trend in 2015, the indicator TSS had reduced, but not significantly. At the same time, level of TSS had exceeded more than 3 times the permissible limit. It could be seen that Huu Nghi JSC for Agricultural and Forestry Products need more effort and apply reasonable solutions to reduce environmental pollution, especially water.

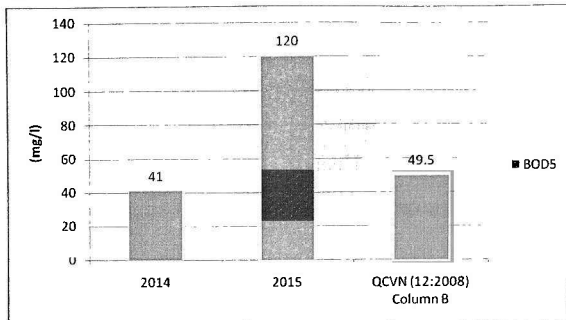


Figure 2: The concentration of BOD₅ in the 2014 – 2015 periods in the domestic wastewater sample at the discharged point into environment, R technical research Vietnam Co, Ltd.

Comments: The result of analysis above showed that in 2014, the concentration of BOD₅ was under permissible limit. However, after 1 year, this indicator rocketed up to 120 mg/l in 2015, exceeding over 2 times the permissible limits. This is a disturbing result and should be found the solution immediately in the coming years in the environmental protection.

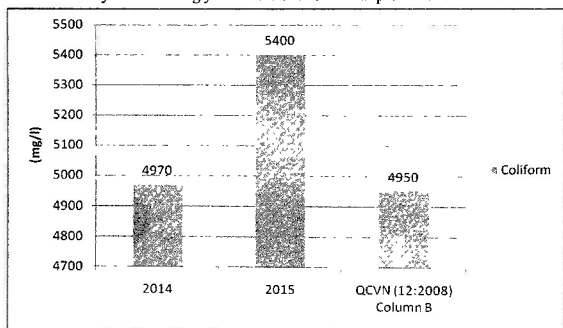


Figure 3: The concentration of Total Coliform in the 2014 – 2015 periods in domestic wastewater at the discharged point into environment, R technical research Vietnam Co, Ltd

Comments: Based on the above result, in 2014, total Coliform exceeded the permissible limit, compared with QCVN 14:2008 and tend to strongly increase in 2015. Due to negligence in the management of discharge, R technical research Vietnam Co, Ltd discharged a large amount of wastewater directly into environment. The company would be handing violations in the following years if they do not repair the discharge management.

Assessment of wastewater impacts of Da River Left-bank Industrial Zone to local people based on survey

Through the result of investigation, the situation of using water of local people as below:

With domestic water: almost people in Huu Nghi Ward use water from fresh water supply project of Hoa Binh Fresh Water JSC. Some households are still using well water. With agricultural water: 100% of people use water from Dung stream to serve for agricultural production. Because Dung stream is a directly receiving source of wastewater from Da River Left-bank Industrial Zone, agricultural production is effected seriously.

Wastewater's impacts of the Industrial Zone to agriculture production and the health of people living around there:

- With the crop: 60% of people in group 1, 30% of people in group 3, 50% of people in group 7, 50% of people in group 12, 50% of people in group 17, 60% of people in group 23, Huu Nghi Ward said that wastewater of the Industrial Zone made them cannot continue to produce. The rest of people the wastewater of the Industrial impacted to their crop yields. No one said that the wastewater did not impact to their production activities.

- With the breeding: 80% of people in group 1, 60% of people in group 3, 40% of people in group 7, 60% of people in group 12, 40% of people in group 17, 70% of people in group 23, Huu Nghi Ward said that wastewater of the Industrial Zone impacted to their breeding and caused diseases to animals. The rest of investigated people said that wastewater of the Industrial Zone reduced the growth of animals. No one said that the breeding was not affected by wastewater of the Industrial Zone.

- With health: 100% of people in the groups have been investigated said that wastewater of the Industrial Zone impacted to their health, caused several diseases such diseases of skin, eyes, respiratory, etc. No one said that

wastewater from the Industrial Zone did not impact to their health.

In investigated groups, group 12 and group 17 suffered the most impacts from the Industrial Zone's wastewater because those groups are located nearest to the discharge source.

Recommendation of solutions to overcome and minimize water pollution of Da River Left-bank Industrial Zone

To address water pollution of the Industrial Zone and bad effects of wastewater to human's life, health and production activities, recommendation of solutions and minimization of water pollution are essential. In order to achieve high efficiency, it is necessary to apply both management and technology solutions.

Management solutions

Management solutions in mechanisms, policies and technical require a synchronous coordination and assignment of responsibilities for related sectors. If the causes of water pollution of the Industrial Zone are well-recovered, a huge of amount of pollutants would decrease and would be under the values regulated in column B of QCVN 40:2011, QCVN 12:2008 and QCVN 14:2008.

To implement coercive measures against Da river Left-bank Industrial Zone if they continue to discharge untreated or unsatisfactory treated wastewater into the environment and pollute receiving water source.

- * The functional units have to organize inspection and examination of the observance of regulations in environmental protection of the Industrial Zone.

- * In addition, local government needs to apply mechanisms to charging fees for environmental protection and wastewater discharge according to regulations.

- * For Da River Left-bank Industrial Zone

To timely build wastewater treatment system to treat wastewater for whole

Industrial Zone. At the same time, to operate wastewater treatment system regularly to affectively treat a huge of amount of wastewater in the Industrial Zone.

- To maintain controlling of environmental pollution annually and report to functional authorities as a base for environmental management and monitoring;

To build plans for prevention and overcoming environmental incidents;

To implement solutions to protect environment in accordance with laws such as:

+ To urge wastewater treatment of factories and companies in the Industrial Zone, especially companies that are in the list of polluters of Hoa Binh DNRE;

+ To ensure wastewater treatment to meet the national technical standards;

- To provide warning and discipline levels for irresponsible behavior leads to environmental incidents for the Industrial Zone. At the same time, to provide reward levels for individuals or groups having good initiative to reduce the level of pollution in the Industrial Zone;

To raise constantly awareness in environmental protection for workers and employees such as organizing short-term training through organizations to educate people the consciousness of environmental protection.

Technological solutions

In order to reduce to a minimum in both amount and concentration of pollutants, the Industrial Zone has to select appropriate production technologies. Solutions should be made as follows:

+ To issue a number of policies to encourage companies which still use outdated technologies. So, they would invest in improving production lines, apply clean technologies to minimize maximum the amount of wastewater.

+ To allow only investment projects which already have advanced technologies and create less amount of wastewater

CONCLUSION

Through research result, it can be discussed the specified contents as following:

Firstly, the Industrial Zone did not have centralized wastewater treatment system.

Secondly, the wastewater situation of the Industrial Zone and surrounding areas are complex and alarming. Some companies in the Industrial Zone have wastewater samples with very high levels of BOD₅, COD, total Coliform, AOX, TSS, etc that cause serious pollution in the 2014 - 2015 periods. Consequently, wastewater affected local people health and their agricultural production levels by making crop yield reduction, causing disease for human and animals, and reducing the growth of livestock.

Finally, solutions to minimize wastewater pollution are pointed out. It is necessary to apply management and technology solutions together. Authorities have to enhance regulations on water resources to the Industrial Zone. Besides, it should be applied a clear mechanism for management of water resources and irrigation structures, to coordinate and manage the construction, approval of organizations and individuals that are directly related to the exploitation and water resources. In the coming years, the Industrial Zone has to operate and improve centralized wastewater treatment system.

With whole scene of pollution and its impacts, it is an alarm for not only the Industrial Zone but also local people and authorities in environmental protection. A further research for this study can focus more on solutions to improve wastewater in the Industrial Zone, then to propose amendment and adjustment for the next step of implementation.

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TÓM TẮT

ĐÁNH GIÁ CHẤT LƯỢNG NƯỚC THẢI CÔNG NGHIỆP GIAI ĐOẠN 2014 – 2015 CỦA KHU CÔNG NGHIỆP BỜ TRÁI SÔNG ĐÀ, THÀNH PHỐ HOÀ BÌNH

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Nghiên cứu này đánh giá chất lượng nước thải của KCN Bờ trái sông Đà – thành phố Hoà Bình trong giai đoạn 2014-2015 và sau đó, đưa ra đề xuất các giải pháp để giảm thiểu ô nhiễm nguồn nước. Về tình trạng xử lý nước thải, KCN Bờ trái sông Đà là nơi xả nước thải lớn nhất của thành phố Hòa Bình. Trong KCN, một số công ty đã xả nước thải trực tiếp vào suối Đứng (chảy vào sông Đà) với số lượng rất lớn nước thải công nghiệp với hàm lượng BOD₅, COD, total Coliform, AOX, TSS, etc vượt quá tiêu chuẩn cho phép, gây ra ô nhiễm nghiêm trọng trong giai đoạn khảo sát 2014 – 2015, ảnh hưởng đến môi trường và người dân địa phương. Sau khi đánh giá tình hình nước thải tại các khu công nghiệp, các giải pháp cần thiết được đề xuất. Về mặt quản lý, chính quyền địa phương cần phải thực hiện các biện pháp cưỡng chế đối với các công ty xả nước thải chưa qua xử lý hoặc không đạt yêu cầu trực tiếp ra môi trường. Với giải pháp công nghệ, các khu công nghiệp nên lựa chọn công nghệ sản xuất phù hợp và tiên tiến. Nhìn chung, các giải pháp được xem xét và đánh giá trong nghiên cứu chỉ ra rằng KCN Bờ trái sông Đà có thể thực hiện những giải pháp để ngăn chặn và quản lý chất lượng nước thải nhằm bảo vệ môi trường một cách hợp pháp, hợp lý và thực tế về tài chính.

Từ khóa: Khu công nghiệp, nước thải, xử lý, ô nhiễm, xả thải, công nghiệp

Ngày nhận bài: 19/01/2016; Ngày phản biện: 23/02/2016; Ngày duyệt đăng: 15/3/2016

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