

# ***River's Rubbish Catcher Machine (RRC-Machine)*** **The Planning of A Machine Instrument To Catch The Rubbish In the River Towards Healthy Environment**

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**Abstract**— Indonesia has at least 5.6 thousand main rivers and 65 thousand streams. Out of 5.5 thousands of main rivers. Nevertheless, river pollution is getting increased, most of the pollutants of the river is solid materials, for example plastic waste. Therefore, an innovative technology is needed to solve this problem. The Water Resources Constitution in 2004 explain that water resources conservation can be done by water management and good restraint of water pollution. The objective of this paper is to know the planning of The River's Rubbish Catcher Machine design by calculating the specific technology working system. The machine is called River's rubbish Catcher Machine (RRC – Machine), a machine working to catch the rubbish in the watershed of the city. This machine consists of machine box, waste bin, belt, and blade turbine. RRC-Machine is designed with the special design to catch the rubbish and then automatically will brought it to the rubbish bin. Beside it, RRC-Machine is built by using turbine principle with the diesel machine as the mover. This machine is good for solving the rubbish problem in the river. Therefore, the sustainable production development of RRC– Machine is needed to be done.

**Keywords**— *machine; pollution; river; rubbish; technology.*

## I. INTRODUCTION

Indonesia has at least 5. 6 thousand main rivers and 65 thousand streams. Out of 5.5 thousands of main rivers, with 1.5 billion km<sup>2</sup> for the watershed width. Besides having the hydrological functions, the river also has a role in maintaining biodiversity, the value of economy, culture, transportation, tourism, and others. However, in addition to the many functions and the benefits of the river, the river pollution is also getting increased along with the increase in population and the number of people living in riverside areas [1]. In West Java, from 40 watersheds, most of them are damaged and polluted. Most of the pollutants of the river in the form of solid materials, for example the waste from food and sugar cane industries, the garbage of aquatic plants such as dead water hyacinth, household waste and dirt. The decomposition process takes a lot of oxygen, so if trashes are in the water, then the water will be deprived of oxygen. In addition, the high amount of garbage in the river could lead to blockage of the river flow that on the rainy season, many rivers in urban areas overflow and cause floods. Furthermore, the amount of garbage in the river also makes the beauty of the city is disrupted and causes disease. Therefore, very important to build a technology to overcome the problem of garbage on the river.

## II. REVIEW OF LITERATURE

### A. Water Pollution

Wedaran [2] said that the river pollution is closely related to water pollution. Water pollution is a change of the condition in water shelters such as lakes, rivers, oceans, and groundwater due to human activities. Lakes, rivers, oceans, and groundwater are important parts of the human life cycle and are parts of the hydrological cycles. The utilization of water is for agricultural irrigation, a source of drinking water, and as a tourist attraction. Based on the data, an estimated 700 million people of India do not have access to the toilet, and 1,000 Indian children die of diarrhea every day. About 90% of Chinese cities suffer from water pollution to a certain extent, and nearly 500 million people do not have access to healthy drinking water. In a recent national report on water quality in the United States, 45 percent of the river miles, 47 percent of the hectares of the lake, and 32 percent of the bay are classified as contaminated, for example in Ciliwung, Kelurahan Kebon Baru, Kecamatan Tebet, South Jakarta (Fig.1).



Fig.1. Kali Ciliwung in Kelurahan Kebon Baru, Kecamatan Tebet, South Jakarta, Monday (29/12). [3]

### B. The Causes of River Pollution

According to wedaran, river pollution can be caused by many things and has different characteristics:

- 1). Organic waste such as sewage, increases oxygen demand in water that reduces oxygen which can have a serious impact on the entire ecosystem.
- 2). Many kinds of pollutants in the water caused by various industries, such as heavy metals, organic toxins, oils, nutrients and solid waste. The waste water has thermal effects, especially those caused by the power plant, which can also reduce the oxygen in the water.
- 3). Water pollution by inorganic waste, such as plastic waste, food wrappers, and others.

### C. The Impacts of River Pollution River

Christy [4] studied the river pollution that has broad impact on the community activities, for example, poisoning the drinking water sources and pet food, an imbalance of the river ecosystem, and so forth (Fig.2). In the river area, nitrogen and phosphate from agricultural activities have led to the growth of aquatic plants that are out of control (excessive eutrophication). This phenomenon has caused the explosive growth of oxygen that should be used by the entire animal or plant water to be reduced. When aquatic plants die, their decomposition sucks up more oxygen. As a result, the fish will die, and bacterial activity decreases.



Fig.2. Waste in watershed (5.698 ton), Jakarta. [5]

The impacts of water pollution are generally divided into four groups, namely:

- 1). The impact on aquatic life, the amount of pollution substances in the river water will reduce the levels of dissolved oxygen in the river water. As a result, the river ecosystem will be disrupted as the death of the river biota, and others.
- 2). The impact on the quality of ground water, river contaminated by fecal was commonly measured by faecal coliform that occurred on a broad scale. It is proven by a survey of shallow wells in Jakarta. Many studies indicate the occurrence of contamination.
- 3). The impact on health, polluted water is a carrier of various infectious diseases, among others, water as a medium for microbial pathogen life, water as a nest of disease insects, and water as a medium for disease vector life.
- 4). The impact on the aesthetics of the environment, with the increasing number of organic substances discharged into the aquatic environment of the river, it will increase the polluted waters which are usually characterized by a pungent odor besides piles that can reduce the environmental aesthetics.

*D. Citarum River as the World's Most Polluted River*

Citarum river is one of the most polluted rivers in the world. Citarum river, located in Bandung, is indicated as one of the nine most polluted places in the world (Fig.3). Eight other places are the City of Los Angeles, the city of Linfen in China, the Niger Delta in Nigeria, London, city of Dzerzhinsk in Russia, the city of Phoenix in the US, the city of La Oroya in Peru, and Lake Karachay in Russia [6].



Fig.3. Citarum river [7]

Citarum river is the longest and largest river in West Java. The length of river channel reaches more than 300 km with 562 958 hectares of Watersheds. The river is also among the 13 rivers with the highest level of watershed damage in Indonesia. Across the river there are more than 500 plants that dispose various wastes into the river. In addition, more than 5 million people living in the river also throw away their various garbage and household waste; whereas 5 million people also rely on river water to meet the daily needs [6].

*E. Government Policy*

The government has set the rules regarding the conservation of water resources as listed in the Law on Water Resources in 2004 [8]. In the Water Resources Law, it is explained that the conservation of water resources can be done, one of them, through water quality management and water pollution control that can be done by managing the good and healthy river water. Control of water pollution can also be done by preventing the entry of objects that can pollute water sources, especially rivers. The purpose of the management and control of water pollution is to maintain and restore water quality to be better.

III. RESULT AND ANALYSIS

*A. RRC-Machine*

In addressing the river pollution mainly caused by solid wastes such as plastic waste which is difficult to be destroyed, one of the ways is to design a mechanical device that can be used to catch waste solid as a control of Watershed, especially in the high population urban area. One of the designs of the mechanical devices created is named River Rubbish Catching Machine (RRC-Machine). PRC-Machine is a machine designed to catch the garbage in Watershed (DAS) (Fig.5). This machine's working system is by filtering the flow of water in the watershed, then catch the waste that come flowing along the flow of the river. The aim is to remove the trash from the river.

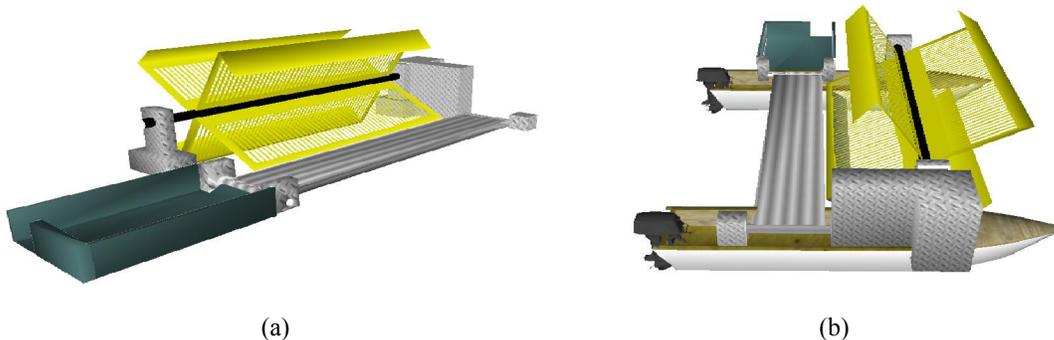


Fig.5. RRC-Machine (a) permanent system (b) mover system

**B. Components of RRC-Machine**

RRC-Machine consists of several parts as shown in Fig.6. The first part is a turbine blade with a shaft used to assist the rotation of the turbine. Secondly, the belt part which is also equipped with a shaft. Third, a litter box part. Fourth, the machine box.

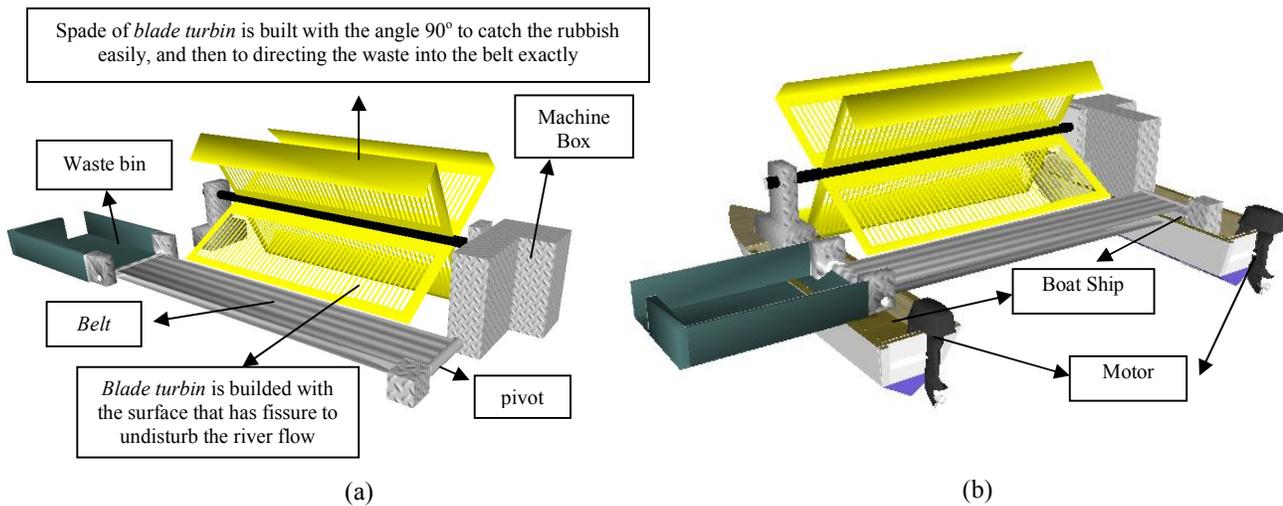


Fig.6. Components of RRC-Machine

Engine diesel motor is positioned inside of the box. Diesel motor will act as the rotation driver of the turbine blade and the shaft belt. The series of box machine will be equipped with the gear circuit driver (Fig.7.).

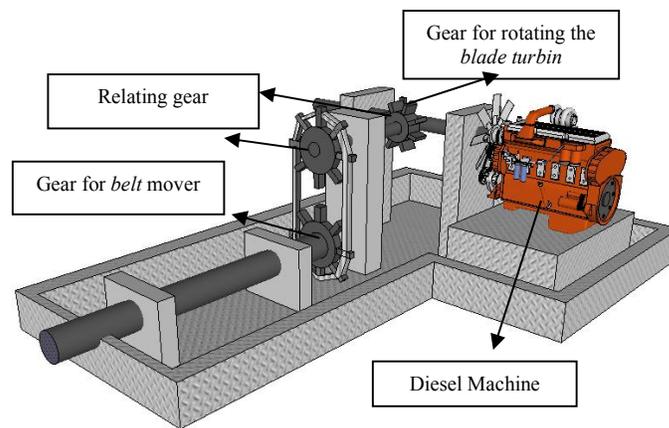


Fig.7. Connecting structure of machine box on RRC-Machine

**C. Components Size of RRC Machine**

RRC-Machine has a specific size, as shown in Table.1 and Fig.8. This measure is certainly just as factory standard size, for its implementation, the size will be adjusted to the customer and depending on the size of the river.

TABLE 1.COMPONENT SIZE OF RRC-MACHINE

Components of RRC-Machine	Size (m)
Width of blade turbin	2
length of blade turbin	5
Fissure dimation of blade turbin	0,01 x 1,75

Width of <i>turbin spade</i>	0.5
Length of <i>Belt</i>	5.5 x 2
Width of <i>Belt</i>	1
Length of <i>pivot</i>	1.05
Dimention of waste bin	1.5 x 1.5 x 1.5
Hight of <i>post</i>	1.2
Distance of <i>post to belt</i>	1.7320
Dimenson of ship boat	3.8828 x 1.5 x 1.5

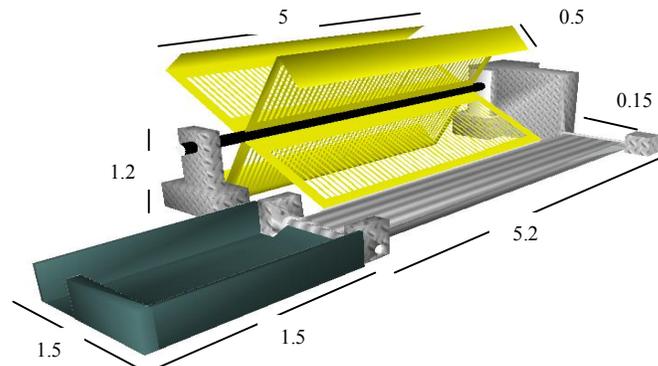


Fig.8. Components Size of RRC-Machine

a. Blade Turbin

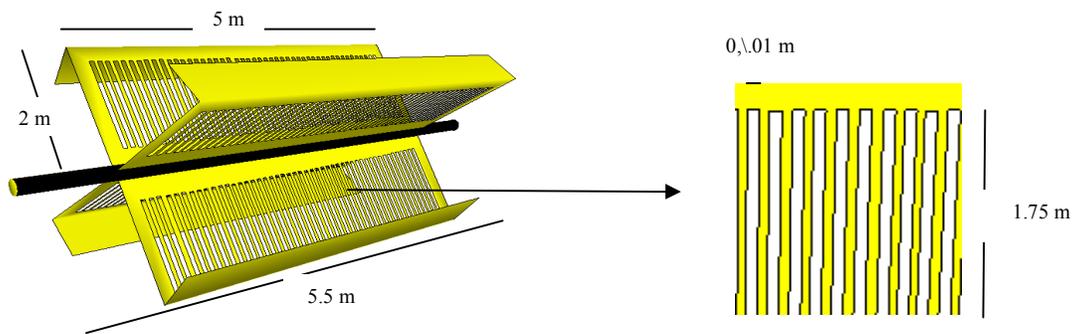


Fig.9. Blade Turbin

b. Belt and waste bin

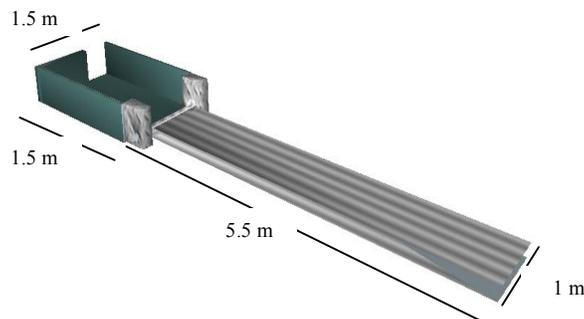


Fig.10. Belt and waste box system

c. Ship Boat

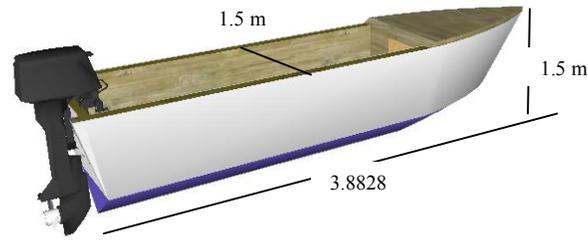


Fig.11. Shp boat as the mover system of RRC-Machine

d. Machine Box

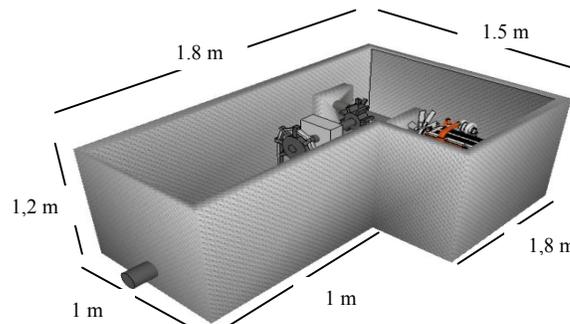
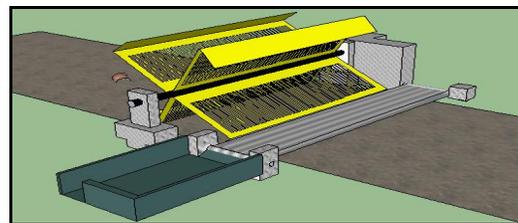


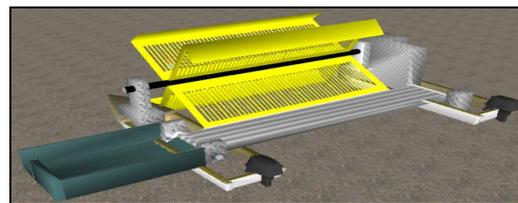
Fig.12. Machine box on RRC-Machine

D. System Installation

System installation of the equipment at the Watershed is shown in Fig.13. At the Watershed with a width of  $\leq 5 < 10$  m, the machine is mounted on the left and right side of the watershed with permanent systems (a). If the watershed with a width of  $> 10$  m, the machine is installed by using a motorboat on the left and right sides that has the same speed as the moving system, so the machine moves freely in the river to catch the trash (b).



(a)



(b)

Fig.13. The scenario of RRC-Machine in the river ; (a) permanent system (b) moving system

*E. How the RRC-Machine Works*

RRC-Machine is designed by utilizing the working system of diesel engine. The working system of diesel motor uses fuel by converting the chemical energy of the fuel into mechanical energy, so that the diesel engine will perform rotational movement (rotation). RRC-Machine consists of a combination of the turbine blade and belt technology. Diesel motor will rotate belt and blade turbine technology which are specifically designed to filter and catch solid waste in the river. The working system of this machine is very specific with a combination of interlocking work between one circuit to another circuit as shown in Figure 4.4. When the turbine blade rotate, garbage in the river will be caught and subsequently kept the garbage that has been channeled to the belt, the belt that has been automatically run will bring garbage headed to the trash box. The working system of the machine is shown in Fig.14 and Fig.15.

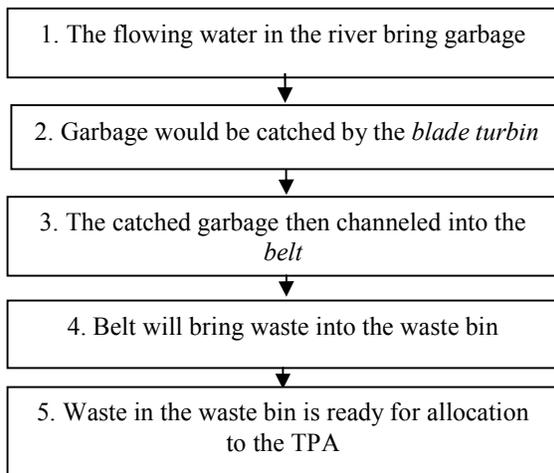


Fig.14. Work mechanism of RRC-Machine

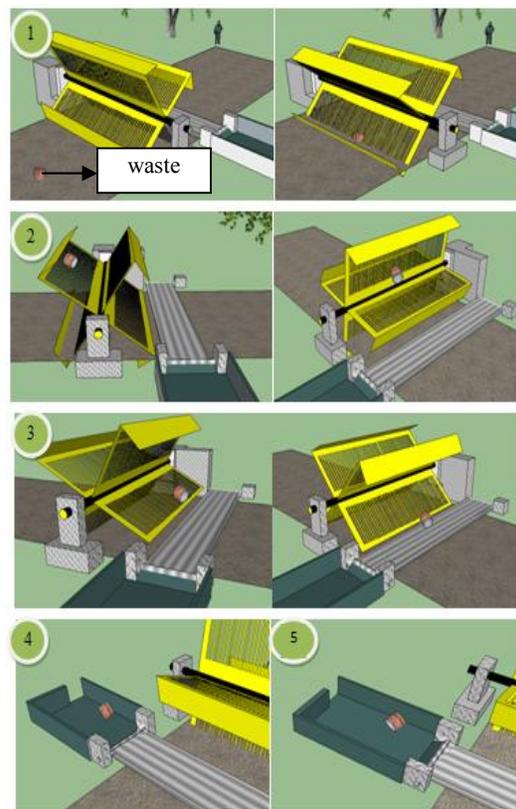


Fig.15. Work system of RRC-Machine

*F. Advantages and Benefits of the RRC-Machine*

In terms of handling solid waste in rivers, RRC-Machine has several advantages and benefits, including:

- 1). The applied technology is environmentally friendly
- 2). Requires simple handling and control, can work in any conditions, and has a controlled working system
- 3). The filtration system is effective, filters and captures trash in any form, and automatically brings garbage to the trash box
- 4). Can prevent flooding caused by blockage of trash
- 5). A technology that does not disturb the aesthetics and beauty of the city

*G. Opportunities of Machine Sustainability*

In its implementation, with the condition of rivers in Indonesia, especially in urban areas which is increasingly critical because of the pollution of the river, then the production of RRC-Machine technology can be applied most likely to control the cleanliness of the river by installing on every river in urban areas. Control activities and the production of these tools is done in collaboration with:

- 1). Central Government as power holders and licensing as well as policies that provide a response to the RRC-Machine production by granting state funds. The production plant and heavy equipment and repair shop.

- 2). Local Government (LG), as local power holders and licensing as well as policies that provide a response to the installation of the RRC-Machine in rivers as control over the cleanliness of river areas, especially urban areas.
- 3). The community is expected to receive and support the production and installation of the RRC-Machine in urban streams.

#### *H. The Socialization Into Society*

In socializing the River Rubbish Catching Machine (RRC-Machine), first is to socialize it to the Local Government (LG). That is because the RRC-Machine tools and large-scale purchases can only be done by a group of people through the Head of the Regional or Local Government. Additionally, the machine is also used together for the benefit of the wider community and not for personal purposes. The socializing steps are:

- 1). Making the public service ads directed at the local government or Head of the Region, especially urban areas that have polluted rivers or dirty
- 2). Conduct a nationwide campaign through print media or electronic media.

#### *I. The Impacts*

There are some positive impacts on the production of RRC-Machine. The impacts are maintaining the cleanliness of rivers and controlling the cleanliness of rivers especially urban rivers. It also helps the revitalization activities and supports urban hygiene. In addition, the RRC-Machine only uses affordable electricity that is effectively and efficiently beneficial in maintaining the cleanliness of the river and help overcome the pollution of the river.

### CONCLUSION

*River's Rubbish Catcher Machine* (RRC-Machine) is the design of a machine made to capture waste in the river which consists of several parts, the turbine blade, belt, shaft, litter/trash box, and engine diesel motor as a driver with a combination of interlocking between the turbine blade and belt technology with diesel motor as the driving force. RRC-Machine has many advantages, including environmentally friendly, simple handling and control, can work in any conditions, and others. Production of RRC-Machine technology can be applied in the activities most likely to control the cleanliness of the river to be installed on every river in urban areas particularly polluted river. In socializing the tool, first it should be socialize prior to the Local Government (LG). In addition, the effective working of the machine gives positive impact. Therefore, it is necessary for the development, production, and application of the machine in urban polluted rivers.

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### REFERENCES

- [1] Alhada-fisip11. (2012, April 12). "Pencemaran Air Sungai Di Indonesia" [online]. Available: <http://alhada-fisip11.web.unair.ac.id>.
- [2] Wedaran. (n.d). "Penyebab Pencemaran Air" [online]. Available: <http://www.wedaran.com>.
- [3] Tata Ruang. (2014, December). "Repotnya Tangani Sampah Warga di Sungai dan Saluran" [online]. Available: <http://tataruangpertanahan.com>.
- [4] Mahawi, Christy. (2014, February 6). "Sebab & Dampak Pencemaran Sungai" [online]. Available: <http://dasawa.luya.weebly.com>.
- [5] Nawasis. (2014, February 18) "Banjir 5 Hari, Sampah di Badan Sungai Jakarta Jadi 5.698 ton" [online]. Available: <http://www.nawasis.com>.
- [6] Viva. (2013). "Sungai Citarum Dapat Predikat Paling Kotor dan Tercemar Di Dunia" [online]. Available: <http://nasional.news.viva.co.id>.
- [7] MNN. (n.d). "The 15 most toxic places to live"[online]. Available: <http://www.mnn.com>.
- [8] Bappenas. (2004). "Undang-Undang Republik Indonesia Nomor 7 Tahun 2004 Tentang Sumber Daya Air"[online]. Available: <http://pkps.bappenas.go.id>.

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