

The Usage of Aloe Vera Extract as a Natural Disinfectant to Reduce Total Coliform in River Water

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Abstract : The population growth has experienced enhancement year by year. It is in line with the increasing demand for clean water. Nevertheless, the pressure of human needs and handling of water causes the quality of water continues to decline. Based on the result of total Coliform bacteria test in Code River taken in Suryatmajan, Danurejan, Yogyakarta, it is shown that the bacteria result has exceeded the quality standard, 2400×10^3 MPN/100mL. Aloe vera leaves are potential to be used as natural disinfectant because of the active ingredients content anthraquinones (aloe-emodin, chrysophanol), anthranols (saponin, aloesanol-I, II), anthrones (aloin A & B), pyrones (aloinin), chromones (aloesin), isoflavone glycoside, acemannan, carboxypeptidase, lectin (alocin A & B), lignin. This research aims to determine the most optimum concentration of aloe vera extract to lower the Coliform numbers in Code River water. This research is an experimental research using One Group Pretest Posttest. Aloe vera was extracted by maceration method using 70% ethanol. The concentration of Aloe vera extract added into the river water sample was 20 mL/L, 30 mL/L, 40 mL/L. The addition of Aloe vera extract as many as 20 mL/L, 30 mL/L, 40 mL/L are able to reduce the total Coliform bacteria content in the river water into 24000 MPN/100 mL, 2400 MPN/100 mL, and 2400 MPN/100mL. It shows that Aloe vera extract is able to be used as natural disinfectant with optimum concentration 30 mL/L and 40 mL/L.

Keyword : Aloe Vera extract, River Water, Disinfectant

1. Introduction

Rivers are the most significant ecosystem for living things. Rivers become one of water resources which are widely used to fulfill the water needs, either for humans or other living things. Humans can use the river water for various activities such as agriculture, fisheries, industry, and domestic. Code River which flows in Gemblakan Bawah RW 09, Suryatmajan, Sub-district Danurejan, Yogyakarta is one of rivers with residential areas along it. The residential potential is the highest source of contamination. The people's activities effects to the quality of river water because the waste are disposed either directly or indirectly to the river. The residents who are living around Code River have already had toilet, so they do not defecate in the river. However, there are still many residents who dispose the garbage to the river. One of the parameters which is commonly used to identify the contamination of domestic waste in a certain area is microbiology parameter. The indicators of microbial contamination in the water are total Coliform bacteria and Escherichia Coli (E. Coli) bacteria. Based on the result of Code River water quality analysis conducted by the researchers show that the total number of Coliform in the sample exceeds the quality standard, 2400×10^3 MPN/100ml. It is in line with the monitoring results of Yogyakarta City Environment Service (Dinas Lingkungan Hidup Kota

Yogyakarta) in Code river, especially in Sayidan monitoring point on March 5th, 2020 where the total amount of total Coliform bacteria is above the quality standard 920×10^4 (amount/1000mL). This contamination can cause health problems, so that the water must be processed first before it is used.

Aloe vera leaves can be used as natural disinfectant because they have antibacterial compounds. Aloe vera contains saponin which functions as natural antibacterial (Gusviputri, 2013). Besides being able to kill the bacteria, Aloe vera is also environmentally friendly because of the organic compounds which are easily biodegradable and safe for consumption. Based on Dyanti research (2016), it showed that Aloe vera has saponins, anthraquinones, flavonoids, polyphenol, and also tannins which are able to inhibit the growth and development of microorganism. Saponin can dissolve into polar solvents such as water and ethanol (Ahmad, 2018). Based on Ariyan's research (2018), the levels of saponin, lignin, and anthraquinones in Aloe vera gel were 977,91 mg/kg, 11,58% and 126,81 mg/kg. Saponin work as antibacterial by disrupting the stability of bacterial cell membrane, in that the work mechanism of saponin included into antibacterial group that inferes with the permeability of bacterial cell membranes, which can cause the damage of membrane cells and release various significant components from bacterial cells, such as protein, nucleic acid, and nucleotides (Darsana, et al., 2012). Moreover, anthraquinone is a broad- spectrum antimicrobial. Aloe vera contains several anthraquinone glycosides (aloin, aloe-emodin and barbaloin) (Rahardja, et al., 2010). Anthraquinones work by inhibiting protein synthesis so that these bacteria are not able to grow in media containing Aloe vera extract (Puteri dan Tiana, 2016).

2. Materials and Methods

It is experimental research using One Group Pretest Posttest without control. It was conducted in the laboratory of Natural Healthy Home (Rumah Sehat Alami) STIKes Surya Global Yogyakarta. The sample of river water used was from Code river taken in Gemblakan Bawah village, RW 09, Suryatmajan, Sub-district Danurejan, Yogyakarta at 10 a.m.

For the production of 70% Aloe vera Ethanol Extract using Maceration method. 2000 grams of old Aloe vera leaves are washed then blended. After it is smooth, add 7 Liters of 70% ethanol and set aside for 5 days while stirring it repeatedly. The extract is strained using flannel cloth and evaporated with temperature 60°C until the ethanol is disappear, so we will get the entire active substance. In the river water process, This research consists of 3 treatments with different variation of Aloe vera 20 ml/L, 30ml/L, 40 ml/L, each treatment is repeated 3 times. Pour 1000 mL sample of river water into beaker glass which has been sterilized with temperature 120°C for 30 minutes. Add Aloe vera extract as many as 20 mL, 30 mL, 40 mL, then stir using jar test with 120 rpm for 1 minute, continue with 30 rpm for 20 minutes, and then set aside for 60 minutes. Strain supernatant, then analyze the total Coliform using MPN method (Most Probable Number) with SNI-01-2332.1-2006.

3. Results and Discussion

Based on *Most Probable Number* (MPN) test, the sample of river water in Code river taken in Gemblakan Bawah village RW 09, Sub-district Suryatmajan, Sub-district Danurejan, Yogyakarta contain total Coliform bacteria as many as 2400×10^3 MPN/100mL. It indicates that the content of total Coliform in the sample has exceeded the quality standard. Thus, a correct processing method is required to overcome this problem. Coliform bacteria are known as bacteria which cause diarrhea and digestive disorders. Coliform are enter-pathogenic or can cause harmful disease for humans such as diarrhea (Supardan, 2018). Total Coliform can be classified into two types, *Fecal Coliform*, such as *E. Coli* which comes from feces of human or warm-blood animals and *Non-Fecal Coliform*, such as *Aerobacter* and *Klebsiella* which come from dead animal or plants. A way to reduce total Coliform content in the water is by adding disinfectant. Disinfectant which is commonly used in the form of artificial chemicals from synthetic chemicals. Synthetic chemicals have advantage where they can reduce bacteria quickly, but can leave residues and difficult to decompose (Widyastari, 2015). Therefore, it is necessary to go after alternative disinfectants from natural ingredients. The advantage of using Aloe vera disinfectant is being able to kill bacteria and environmentally friendly because it comes from organic materials which are easily decomposed, easy to obtain, easy to breed, inexpensive, and safe if it is swallowed.

Based on the research result, after adding Aloe vera extract with concentration 20mL/L, there was a decrease in total Coliform content in the river water sample as many as 90 %, 2400×10^2 MPN/100mL. By adding Aloe vera extract with concentration 30 mL/L and 40 mL/L, there was a decrease in total Coliform content in river water as many as 99%, 2400×10^1 MPN/100mL.

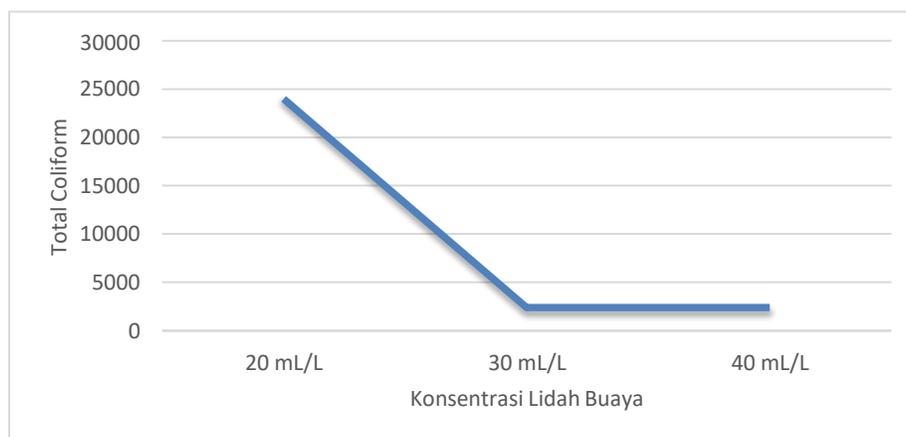


Fig.1. Total *Coliform* in the sample of Code river water after addition of Aloe Vera Extract

Aloe vera leaves have ability as anti-inflammatory, antiseptic, antibacterial because the leaves contain active Anthraquinone ingredients (Aloe-emodin, Chrysophanol), Anthranols (Saponin, Aloesapanol-I, II), Anthrones (aloin A & B), Pyrones (Aloenin), Chromones (Aloesin), Isoflavone glycoside, Acemannan, Carboxypeptidase, Lectin (Aloctin A & B),

Lignin. Based on Rajin's research (2019), Aloe vera ethanol extract contains glycosides, steroid/triterpenoid, anthraquinone, flavonoid, saponin, and tannin. Aloe vera gel can kill positive and negative gram bacteria which are isolated from Aloe vera sap show antimicrobial and antiviral activities. Antibacterial activities from emodin when killing *Escherichia coli* bacteria through the inhibition of membrane transport mechanism (Alves et al., 2004). Aloe vera leaves infusion can be used as antibacterial agent for pathogenic bacteria *Pseudomonas aeruginosa*, *Salmonella typhi*, and *Staphylococcus aureus*. (Sulistiyani, 2016). Aloe vera gel is proven to inhibit the growth of *Streptococcus* and *Shigella invitro species*, and *Trichophyton mentagrophytes* (20,0 mm), *Pseudomonas aeruginosa* and *Candida albicans*. Other substances contained in Aloe vera are saponin which are believed as antiseptic and are said to be strong antimicrobial against bacteria, fungi, viruses, and yeast (Sahu et al., 2013). The bitter taste from Aloe vera consists of anthraquinones and their derivatives barbaloin, aloemodin-9-anthrone, isobarbaloin, anthrone C-glycoside and khromon which functions as antimicrobial.

Coliform bacteria are gram-negative with rod-shaped and do not form spores. These bacteria are indicators of bacteria in water pollution and indicators of other pathogenic bacteria. Coliform bacteria found in the waters can be pathogenic towards humans presence around the waters. The presence of Coliform bacteria in the water really effects the water quality. If there are only little bacteria found in the water, it shows that the water is in good quality. However, more bacteria found in the water, it shows that the water is in poor quality. The high amount of Coliform bacteria shows that the environment around the river has decreased biologically because Coliform bacteria is bacteria indicator of contamination in the waters (Safitri, etc 2018). The presence of Coliform bacteria in the water shows the possibility of pathogenic microbes which are harmful for our health (Brooks, etc, 2013).

4. Conclusion

Aloe vera extract can be used as natural disinfectant with its most optimum concentration as many as 30 mL/L and 40 mL/L to lower the total Coliform in Code River water.

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Conflict of Interest

All Authors declare no conflict of interest and agree with the content of the manuscript.

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