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Research Article

Biostimulation of Indigenous Fungi with Agung Banana Semeru Lumajang Peel Extract in Reducing Ammonia Levels

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Abstract

Indonesia is the second rubber producer in the world, in its processing rubber produces liquid waste that contains quite high ammonia levels. This study aims to provide an alternative solution to the problem of water pollution due to ammonia in rubber industry liquid waste using a bioremediation process with a simple bioreactor. This study used indigenous fungi treatment of 4% and banana peel extract of 0%, 5%, and 10%. This study studies the potential of indigenous fungi with banana peel extract nutrients to reduce ammonia levels in water. The parameter measured is the level of ammonia in the water in the bioreactor. The results showed that indigenous fungi with banana peel extract nutrients had an effect on ammonia parameters. Treatment with a concentration of indigenous fungi 4% and banana peel extract 10% had a significant effect on reducing ammonia levels. The more indigenous fungi inoculum and banana extract used, the more effective it is in reducing ammonia in water.

Keywords: *Ammonia; Banana Agung Semere Peel Extract; Fungi; Indigenous.*

Introduction

Indonesia is one of the countries that has the largest plantations in the world and has the potential to be the largest rubber producer. Indonesia is also the second rubber producer in the world after Thailand according to data from FAO [1], [2]. In its processing, rubber not only produces the desired product, but rubber also produces waste that can damage the environment. The liquid waste of rubber factories is generated from the process of washing, shearing, grinding, sanding, drying, and pressing. Rubber factory liquid waste contains organic matter with high nitrogen levels such as protein, phosphate and ammonia [3], [4].

Waste that is not treated first and directly discharged into the environment is the cause of environmental pollution, one of which is water pollution by ammonia. Rubber waste treatment in Indonesia generally uses activated sludge, anaerobic and facultative ponds which are quite expensive and the treatment only reduces carbon levels but phosphorus and nitrogen compounds are still relatively high [5], so that other techniques are needed in its management. One of the methods used to reduce ammonia levels of rubber factory waste in the aquatic environment, one of which is by using a bioremediation method that has been proven to be more effective [6].

Bioremediation does not only use bacteria, fungi can also decompose some organic compounds in waste that are larger than bacteria. Fungi contain extracellular enzymes that are able to break down complex compounds through nonspecific oxidation reactions [7]. Other advantages of fungi compared to bacteria are the ability to survive in low pH, low temperatures, as well as improve the decomposition of orgnic materials [8]. In the environment of waters that have been polluted with ammonia, there are several indigenlus fungi, namely *Aspergillus sp.*, *Fusarium sp., Penicillium sp.*, and several yeast groups, which have the ability to act as bioremediation agents [5].

Fungi need nutrients to reproduce and in their survival. Although fungi can survive in a state of minimal nutrients, fungi cannot survive for a long time in a state of minimal nutrients and cannot decompose organic compounds such as ammonia to the maximum extent [9]. An alternative in overcoming the lack of nutrients as a factor for fungal growth is by utilizing organic waste from banana peels, one of which is the Agung Semeru Lumajanag banana peel which can effectively reduce ammonia levels in polluted water [9]. Banana peels can be used as an alternative to adding nutrients to indigenous microbes, namely bacteria [10] or culture media for fungi, because it contains 14.4% cellulose which can meet the nutritional needs of fungi [11]. Based on this background, the research on the use of Agung Semeru Lumajang banana peel extract as a nutrient biostimulation agent in indigenous fungi can reduce ammonia levels in polluted waters.

Materials and Methods

1. Tools and Materials

The tools used in this study are petri cups, glass beakers, measuring pipettes, tweezers, stirrers, Bunsen, magnetic stirrer, Erlenmeyer, digital scales, pH meters, ammonia level measuring instruments, autoclaves, and scissors. The materials used in this study are sterile aquatics, PDA, banana peels, and liquid waste from the rubber industry, physiological salts, spirtus, cotton, aluminum foil, markers, label paper, wood paper, and indigenous fungi [12].

2. Sterilization of tools and materials

All tools and materials to be used are washed and dried. The mouthpiece of the pipette, and the Erlenmeyer are covered with cotton then coated with aluminum foil while the petri cup is wrapped in paper. Then the whole appliance is wrapped in wooden paper/brown paper, then sterilized with an autoclave 1 atm, 121ºC for 120 minutes [13].

3. Test Microbial Suspension Manufacturing

The manufacture of the test microbial suspension is carried out with a pour plate. Inoculation of 1 ml of suspension from river water polluted by waste is then put into a petri dish aseptically. The special nitrified media is poured and flattened by rotating on a flat plane to form the number 8 so that the media and suspension are homogeneous, then the media is incubated at a temperature 25^0C for 48 hours [8].

4. Making Agung Semeru Banana Peel Extract Lumajang Variety

The making of the Great Semeru Banana Peel Extract is by way the Lumajang variety Agung Semeru banana peel is cleaned first and then dried using an oven with a temperature of 45ºC for ±3 days, the banana peel that has been curned is blended until smooth, after that it is sifted and then soaked with aquaades. Then weigh as many as 100 grams of Agung Semeru banana peel of the Lumajang variety that has been crushed and then soaked with 300 ml of aquaades, then the beaker glass is closed using aluminum foil and stored in a pending cabinet for 24 hours. The extract obtained after soaking is a thick extract that is ready to use [14].

can degrade ammonia if their nutritional needs are met. This proves that the hypothesis prepared is proven to be correct.

Several supporting parameters to strengthen the results of this study that were measured during the study were pH. In addition to ammonia, pH also has an effect on waters, one of which is on biochemical processes in waters, if the pH changes, it will inhibit the nitrification process. pH also determines the development of fungal growth, the optimal pH for fungal growth is 5, 6 and 7, if the pH is below 5, the growth of fungi will be inhibited and cause a decrease in pigment production in fungi [26]. The results of the measurement of supporting parameters showed the pH value obtained in the range of 5 - 8. This value shows that the pH of the water in the bioreactor is below the quality standard value in Government Regulation No. 82 of 2001, which is 6 - 9. From these results, fungi can grow optimally at a concentration of P10F4 with a pH of 5.80 which has a Total Plate Count (TPC) or the highest number of colonies, which is ± 402 colonies and water in the bioreactor can be used because the pH still meets the quality standards.

The results of measuring other supporting parameters, namely temperature, during the study obtained temperature values ranging from 27.8 – 28.24ºC. This value shows that the water temperature is in optimal conditions for fungal growth. Counter *et al* [26], stated that the optimum temperature for fungal growth is 28ºC. Temperature is one of the factors that affect cell metabolism, if the temperature increases, it can cause cell damage and inhibit the work of enzymes so that it affects the growth of fungi [26].

Conclusion

Treatment with a concentration of indigenous fungi 4% and banana peel extract 10% had a significant effect on reducing ammonia levels. The more indigenous fungi inoculum and banana extract used, the more effective it is in reducing ammonia in water.

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