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## The Analysis of Banana Peels are used as Water Purifying Materials

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**Abstract.** Banana peels are generally considered to be waste usually thrown away, but in fact it has important benefits to clear water. The purpose of this study is to use banana peels to clear dirty water from rivers. The process used is filtered coated water using gravel sand, charcoal, palm fiber and the final filter layer is banana peels that acts as a place to disinfect raw water against germs and bacteria still present in the water. The results obtained indicate that water purification using banana peels meets the criteria for physical testing, including water levels with a pH between 7.0 8.5, and does not interfere with the taste and smell of water. Rainwater and river water can be used as cleaning water because the pH meets all requirements but cannot be used as clean water because bacteriologically all samples do not meet the drinking water

### 1. Introduction

Dirty water is water that is not only hard, but also contains solids or liquid from the disposal of waste such as garbage, carcasses, water used for washing, household waste, and others. Dirty water cannot be used directly let alone for consumption, but, that does not mean dirty water cannot be utilized, this water can be used after undergoing treatment. Like in big cities where residents find it difficult to get water. Then the river water treatment will get water that is suitable for use and also consumed. While clean water is water that is suitable for consumption. Clean water is not only clear, odorless, and tasteless, but also must meet health requirements. These health requirements, among others, do not contain toxic chemicals or bacterial germs that can interfere with health [1]. Clean water for all Indonesian people only reached 77% in 2019, meaning that this achievement is still far from the target stated in the 2015-2019 National Medium-Term Development Plan (RPJMN) which states that all Indonesian people must have access to clean water [2]. While abundant water in Indonesia, almost 85% is still consumed for Washing Bathing, Toilet (MCK) [3]. Until now there is still a lot of dirty water that has not been treated to the optimum to be clear/clear water.

Several studies conducted to process dirty water into clean water, among others, were carried out in the hamlet Kalidengen II, Kalidengen Village, Temon District, Kulon Progo Regency, namely by treating floodwater into clean water that is suitable for bathing, washing and cooking as an activity every days, by making water filters independently of sand filters quickly [4].

The process of purifying turbid water in Cukanggenteng Village, Ciwidey, Bandung Regency becomes clean water using a sand filter system and a gradual pipe. The sand filter is operated in an upflow manner and the overflow is then fed into a gradual pipe filtering. The phased pipe filter consists of three 4 "pipes containing shell charcoal, sand and sponges. The analysis shows that the



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filtering system can reduce the level of water turbidity to 91.06%, from 94.55 NTU to 8.445 NTU with a relatively fixed acidity (pH) of 6.55. Thus, filtered water can be categorized as clean water according to quality standards [5].

Purification of household wastewater uses an Arduino-based PID control system. This system consists of combining existing water purification technology with microcontroller technology that can run the system automatically. In the filtering container or water treatment consists of natural materials, namely alum, zolite, cough, ziloit sand, pumice, silica sand, ginger coral, activated carbon. After clarity of the water will be measured using an LDR sensor, if the water is still turbid it will be pumped back into the filtration container again. Water that has passed through the purifier can be reused for non daily consumption. Based on the test results, the best set of points was found at  $K_p = 1$ ,  $K_i = 0.2$ ,  $K_d = 0.01$ ,  $T_s = 0.1$ . Laboratory scale testing results for the level of turbidity of the water treatment using a prototype of this system obtained the number 2.48 NTU which is an indication that the purified water is suitable for consumption [6].

Making dirty water filtration equipment into clean water using At-mega32 microcontroller. The software used includes the operating system, programming language and data processing software. The operating system that Microsoft Windows 7 uses as the operating system. The programming languages used are Basic - Bascom AVR and Visual Basic 6.0. The trial was carried out by testing the dirty water filtering tool into clean water in accordance with expectations and design that the sensor can detect the level of clarity of source water and filtered water and displayed on LCD 16 x 2 and PC applications with percent size [7].

Chitosan is a versatile biopolymer which has specific structural characteristics. Work on biomaterials such

as chitosan has opened up new possibilities over the last few years to build water purification systems that are non-toxic in nature and have no residual environmental impacts. Chitosan's chemical composition clearly shows that it is a natural polysaccharide (a simple polymeric sugar) that is absolutely non-toxic to living organisms [8].

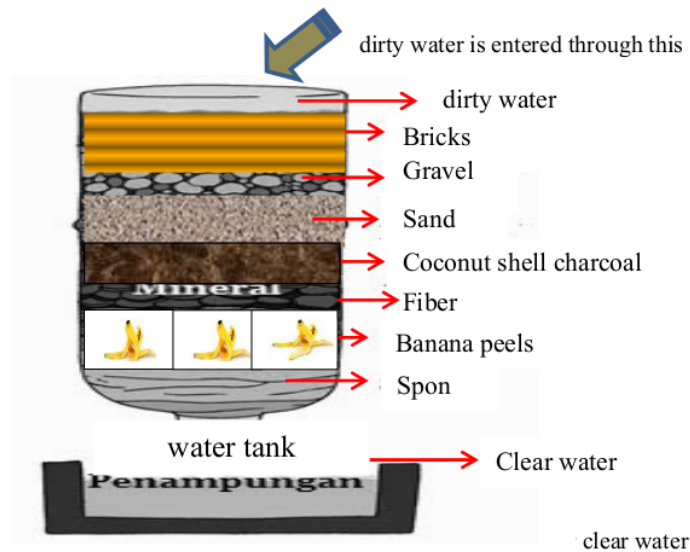
Volcanic ash and *Moringa oleifera* (*M. oleifera*) have been investigated as indigenous drinking water treatment materials based on problems identified at the water treatment plants in Kampala and Masaka in Uganda. At the Masaka National Water & Sewerage Corporation water treatment plant, coagulation experiments were carried out using swamp raw water and pilot filtration experiments carried out at Ggaba II (Kampala) water treatment plant [9].

Adopting nanotechnology and nanotechnology impregnates new ways to discover and implement water treatment and purification processes. Because of improved properties and characteristics of nano materials such as different surface area, the use of nanomaterials is encouraged for reactivity, electrical and optical properties. Due to the cost parameter, safe disposal and commercial availability, the use of nano materials is limited [10].

The purpose of this research is to purify water from dirty water with natural ingredients, namely by utilizing banana peel waste which has not been utilized properly. The benefits are huge because using banana peels that are generally thrown away become one of the materials for water purification.

## 2. Experimental Studies

The initial preparation is to collect all the materials needed to clear water from dirty water. These materials are: brick, gravel, sand, coconut shell charcoal, palm fiber, banana peels and sponges. The arrangement of materials in **Figure 1**, is placed in a 5 liter water gallon. Banana peels are placed in the lowest layer before the filter sponge. Banana peels are taken from green banana peels that are dried in the sun for 35 hours. After drying, the banana peel is cut into small pieces with a length of 20 mm and a width of 15 mm (**Figure 2**).



The weight and thickness of each material are as follows: (1) Bricks, weight 226.80 grams thickness 30 mm, (2) Gravel, weight 255.15 grams thickness 30 mm, (3) Sand, weight 396.89 grams thickness 35 mm, (4) Coconut shell charcoal, weight 400 grams thickness 30 mm, (5) Fibers, weight 17.01 grams, thickness 30 mm, (6) Green banana peels, weight 70.87 grams thickness 40 mm. Dirty water that is poured comes from river water and rainwater each of 1.5 liters.

The complete work flow diagram of this research is outlined in **Figure 3**. The resulting water standard is in accordance with the Bacteriological Requirements..



**Figure 2** Green banana peels  
(a) Green banana peels  
(b) Green banana peels that are dried in the sun  
(c) Green banana peel is cut into small pieces

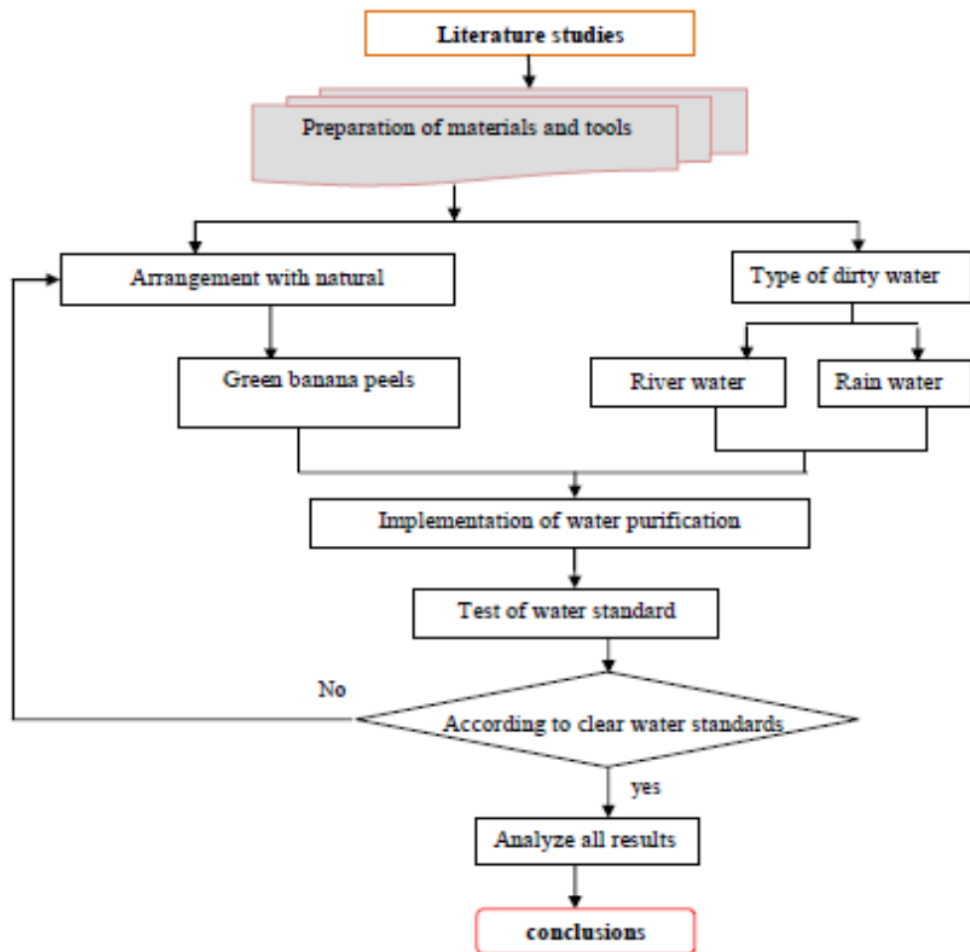


Figure 3 Flow chart of studies

### 3. Result and Discussion

#### 3.1 Water Filtration Results

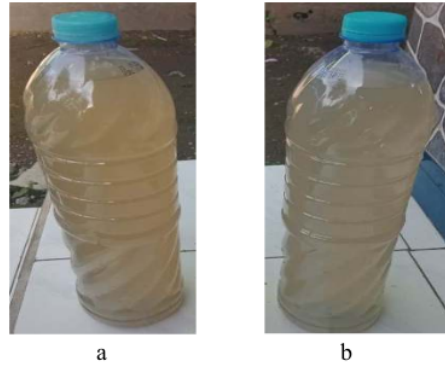
The composition of river and rain water filter material into clear water is shown in **Figure 4**, while river water and rain water before filtering are shown in **Figures 5a and 5b**.

River water from Balongbendo Sidoarjo village in the upstream portion with water quality is not too turbid and has lower chemical / biological content. Though rainwater is taken in March 2020 at 4 -5 pm.



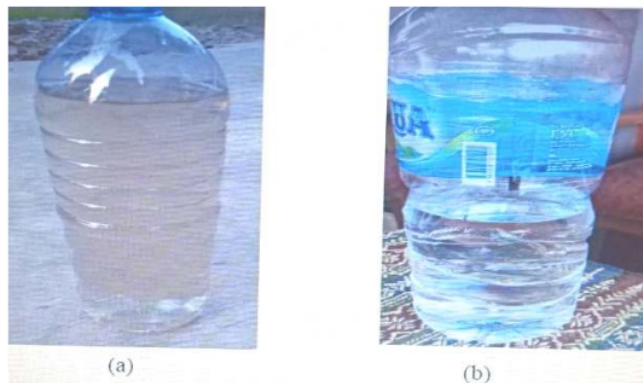


**Figure 4** Composition of water filter



**Figure 5** (a) River water  
(b) Rain water

The time needed for river water and rainwater that is still turbid (as much as 1.5 liters) until it becomes clear water takes 04.25 (4 minutes 25 seconds), and the smell of fresh banana peels. Clear water from the filtering results is reduced to only 0.90 liters (**Figure 6a, b**).



**Figure 6** Result after purifying water  
(a) River water  
(b) Rain water

### 3.2 Water Test Results

The results of river water and rain water after undergoing filtering (Figure 6a, b) were tested in the examination of the quality of drinking water physically, and bacteriologically tested at the Environmental Quality Laboratory, the results are shown in **Table 1**.

**Table 1.** Quality test of drinking water physically and bacteriologically

No.	Parameter	Maximum Level	Unit	Analysis Results				Analysis Method
				River Water	Criteria	Rain Water	Criteria	
<b>A. Physically</b>								
1.	Smell	-	-	Fresh smell	Fulfill	Fresh smell	Fulfill	-
1.	Total Disolved Solid (TDS)	500	Mg/L	200	Fulfill	190	Fulfill	Gravimetri
2.	Turbidity	5	Scala NTU	6	Not eligible	3.3	Fulfill	Turbidimetri
4.	Taste	-	-	-	Fulfill	-	Fulfill	-
5.	Temperature	3	$^{\circ}\text{C}$	25	Not eligible	25	Not eligible	Thermometer
6.	Color	15	Unit PtCo	4	Not eligible	-	Fulfill	Spektrofotometri
7.	Electrical Conductivity (DHL)	-	mmhos/cm	250	Fulfill	325	Fulfill	Conductivitymeter
8.	pH	6.5-8.5	-	7.2	Fulfill	6.8	Fulfill	pH meter
<b>Bakteriologi</b>								
1.	Total Koliform	0	MPN/100mL	40	Not eligible	22	Not eligible	

Based on the results of the analysis of two samples namely river water and rainwater that have been physically examined, and bacteriology.

#### River water

- the physical examination meets the quality requirements except for the turbidity, temperature, color results exceeding the quality requirements.
- Bacteriologically there are total coliforms exceeding the maximum requirements

#### Rain water

- the physical examination meets the quality requirements except for temperatures that exceed the quality requirements of the maximum standard value.
- Bacteriologically there are total coliforms exceeding the maximum requirements

The color of turbid water still occurs in river water, this condition is caused by the possibility that in the river water there is still iron in the water in the form of  $\text{Fe}^{2+}$  ions, then the iron in the water reservoir interacts with free air so that it is oxidized to  $\text{Fe}^{3+}$  ions and yellow. It is possible that the amount of banana peels given for river water filtration is more than rainwater, in order to neutralize Fe ions.

While the pH levels for both types of water have met the requirements, but for bacteriological examination has not yet passed.

#### **4. Conclusion**

The conclusion of this study that using Green banana peels that are generally thrown away become one of the materials for water purification for rainwater and river water, also can be used as cleaning water because the pH meets all requirements but cannot be used as clean water because bacteriologically all samples do not meet the drinking water quality requirements according to the decision of the Minister of Health of the Republic of Indonesia in 2010. Recommended for chemical



tests are needed to determine the content contained in water samples and research is also carried out to be able to convert clear water into water that is ready to drink.

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