Volume: 1, Issue: 1
Page: 51-58
2019

Journal of Scientific Reports

Effect of Chemical Activation on Coconut Shell Charcoal on the absorption of Laundry Waste

Ernasari & Suparno

Abstract

In this study, we want to see the effect of chemical activation on coconut shell charcoal to absorb laundry waste. Chemical activation uses HCL and H2SO4 with concentrations of 10%, 15% and 20% for each activator. The research was conducted by activating coconut shell charcoal in chemistry and physics. Chemical activation is done by soaking the charcoal into HCl and H2SO4 solutions for 24 hours after which physical activation is carried out by oven-burning charcoal at a temperature of 200 oC for 60 minutes. Activated coconut shell charcoal mixed with laundry waste and then stirred using a magnetic stirrer for 60 minutes for the absorption process. After that the laundry waste from the absorption results tested by pH, TDS, Viscosity, clarity and detergent content. The results showed that for all absorption, the best clarity was obtained at a concentration of 20% in HCl and H2SO4 solutions of (37 and 57) Lux. The best impurity particle absorption was indicated by a concentration of 15% with pH values of HCl (7.4) and H2SO4 (6.7), viscosity of HCl (110.93) N / m3 and H2SO4 (116.53) N / m^3. While the maximum TDS value is indicated by the concentrations of HCl 10% (321) ppm and H2SO4 in concentration of 15% (309) ppm. While the results for the best detergent content are shown by 15% HCl concentration which is 0.4248 mg / L.

IJSB
Accepted 07 May 2019
Published 30 August 2019
DOI: 10.5281/zenodo.3381592

Keywords: Chemical Activation, coconut shell, charcoal, absorption, laundry waste.

About Author

Ernasari (Corresponding Author) Department of Physics Education, Postgraduate Program, Yogyakarta State University, Jl. Colombo No. 1 Yogyakarta, Indonesia.

Suparno, M.App.Sc., Ph.D, Lecturer in Physics Education, Yogyakarta State University, Jl. Colombo No. 1 Yogyakarta, Indonesia.

Introduction

In everyday life clean water is a very vital requirement for the community, but until now the problem of clean water is still found in both urban and rural areas. One of the causes of the problem of clean water is the large amount of waste originating from households and from industries that are disposed of directly into the environment without passing through the waste treatment system. One example of waste that pollutes the environment is detergent waste. Where detergent waste has ahigher pH. Waste from the laundry is thrown away into the environment so that it can turn off the elements in the soil and threaten plant growth, if discharged into the river will make the pH of the river water become unbalanced and threaten the life of living things inside it. The problem of clean water can be a serious problem if it is associated with population growth in Indonesia, which also means increasing demand for clean water and also increasing the volume of household waste originating from settlements. If it is not handled properly, the problem of household waste can be a potential threat to the quality of water and a serious threat for the environment. Apart from detergent waste originating from households, there are currently many laundry industries. Laundry is one of the businesses engaged in services that are growing very rapidly. Laundry can produce large amounts of detergent waste for one wash. This is supported by Ciabatti (Nasir, 2013), saying that the water needs for the laundry industry are on average 15 L to process 1 kg of clothing and produce around 400 m^3 of liquid waste per day. So that 60% - 70% of the water used will be wastewater. Usually this waste is collected in one container. A collection of various detergent wastes in large volumes increases the level of detergent. When the wastewater is thrown into the environment, it can cause a large amount of pollution as well as soil, plants, water quality and other living things. Seeing the impact of pollution that is so large, it is necessary to have detergent wastewater treatment, especially those from laundry industries, to minimize environmental pollution and reuse waste into usable clean water. Efforts to process liquid waste before being discharged into a water body or to another place are actions that really need to be considered. The obstacle that often occurs in waste treatment systems is the amount of construction, operational and maintenance costs, and sometimes certain expertise is needed to run the waste treatment system. For this reason, it is necessary to look for alternative designs for a waste treatment system that is simple and easy to apply on a household or individual scale by utilizing existing resources in Indonesia, in line with the importance of increasing public awareness of the importance of environmental health (Haryati *et al*, 2015). Based on data obtained from Setyobudiarso (2014) the level of acidity (pH) of detergent waste ranges from 10-12, where the acidity that can be tolerated by human skin is 6-9. With such high acidity, certain techniques and materials are needed to neutralize the pH of detergent waste so that water from detergent waste is not disposed into the environment but can be reused. One of the efforts to refine laundry waste can be done with an absorption system. Absorption is the process of trapping particles or absorbers by porous / absorbent materials (Saputra & Suparno, 2016)

Indonesia is a tropical country and of tropical plants that can grow is coconut. Coconut shells have been used in the medical field, traditional odor absorbents are carried out and sedimentation agents in water purification. In addition, coconut shell charcoal can be used as an absorbent to absorb detergent waste. Because according to Hoque in Setiawati & Suroto (2010) activated carbon from coconut shell has several advantages over other materials, high levels of hardness so it is easier in the handling, its surface area is above 1500 m^2/g, high absorption, low ash and high purity. This is supported by Anggorowati (2005) who said that activated charcoal is one type of porous carbon which has a large absorption capacity and is

generally used in purifying solutions. For better results, charcoal needs to be activated chemically and physically. Chemical activation aims to destroy ash particles that clog the pores so the carbon surface can be expanded, and physical activation aims is to remove water trapped in carbon pores through the evaporation process. This is supported by Purnawan *et al* (2014) the ash content of activated carbon can be reduced by certain treatments. One treatment that can be done is by chemical and physical activation. Carbon pores will be more open when activation so that the surface area of carbon will be greater which causes more molecules to be adsorbed. Chemical compounds that can be used as activator materials are HCl and H2SO4. The use of acid activators is because these acids are strong dehydrating agents that can improve the development of pores in the carbon structure. Based on the things described above, the researchers came to think of utilizing coconut shell charcoal by first activating using HCL and H2SO4 as detergent waste absorption.

EXPERIMENTAL SECTION, RESULTS AND DISCUSSION

2.1 Activator Making

The activator used in this study was 40% HCl and H2SO490% from the initial concentration. The concentration variations of each acid were made, namely 10%, 15% and 20% by diluting it with distilled water to produce every concentration of 200ml. Calculations used to dilute existing acid solutions using equations:

N1V1 = N2V2

With N1 is the initial concentration or Concentration of concentrated acid solution, V1 is the concentrated volume of acid to be diluted, N2 is the concentration of the acid solution after dissolving and V2 is the volume of solution after being diluted as much as 200ml. After knowing the initial volume from the calculation results, the next step is to dilute by filling a 1L size flask with 100ml distilled water, then adding concentrated acid as much as the calculated volume slowly while stirring the solution with a glass stirrer until the solution is cool if the volume hasn't reached 200ml then the solution is slowly added by using distilled water.

2.2 Activated Coconut Shell Charcoal

The making of activated charcoal in this study uses two stages of activation, namely chemical activation and physics activation. The first step in making charcoal is to look for raw materials for coconut shell charcoal. Coconut shell charcoal is then ground using a manual grinder until the size becomes like coffee powder. After grinding, the next step is sifting the charcoal using a 100 mesh size sieve, and then the charcoal is ready to be activated. For chemical activation uses HCl and H2SO4 with concentrations of 10%, 15% and 20%, respectively. This chemical activation step is to soak the charcoal in an acid solution for 24 hours. This immersion is useful to destroy the ash particles that clog the pores so that it expands the surface of the carbon. After the immersion process is over then the charcoal is separated from the acid solution and washed using RO water with the aim that the charcoal is neutral from acidic properties. After chemical activation, continued with the activation of physics. The purpose of this physics activation is to remove water trapped in carbon pores through the evaporation process so as to expand the surface of the field of absorbing charcoal. Physics activation is done by oven-burning charcoal at 200oCfor 60 minutes. In oven, charcoal is closed again using aluminum foil to avoid the oxidation process.

2.3 Absorbsi Process and Water Testing

In the absorption process, detergent and charcoal waste from the activation results are mixed into the magnetic stirrer. This process lasts 60 minutes for each sample. After this process, the mixture of charcoal and waste water is separated using a filter. This water is ready to be used for testing. Broadly speaking, the study of the use of dark shell activated charcoal with HCl and H2SO4 as detergent waste absorption discusses the analysis of water quality carried out with the conditions of the initial detergent wastewater before treatment and detergent wastewater quality after absorption using several physical and chemical quality parameters.
The parameters studied were pH testing using pH meter to determine detergent pH and water pH from absorption, TDS (Total Dissolved Solid) testing using TDS meter to determine the number of particles dissolved in water, viscosity testing using RedWood's Viscometer to determine water viscosity, test water clarity using LUXmeter and the tests of levels of detergent in aqueous solution before and after absorption.

2.4 The Effect Of Absorbition Of Waste with Activated Coconut Shell Charcoal On PH, TDS and Overcrowding

After treatment and testing, the results are as follows:

Table 1. The results of measurements of pH, TDS and clarity of waste before and after treatment

Activator	percentage (%)	pH	TDS (ppm)	Clarity (LUX)
-	-	11,2	349	1
HCl	10	9,1	321	11
	15	7,4	344	34
	20	6,2	404	37
H_2SO_4	10	8,6	371	25
	15	6,7	309	30
	20	5,9	383	57

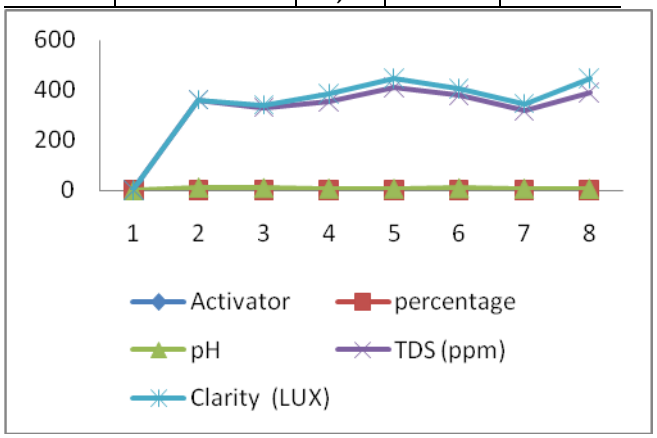

Fig 1. Graphic The results of measurements of pH, TDS and clarity of waste before and after treatment

In detergent liquid waste contained alkali (base) compounds derived from surfactants (Linear Alkyl Benzene Sulfonate / LAS) so that it can increase the pH of the liquid. Naturally, if the pH of detergent wastewater before treatment is 11.2, this number has exceeded the pH of water, of course this will cause pollution and facilitate the absorption of toxins in persistent gills so that accumulation occurs.

After a series of experiments with coconut shell charcoal absorption with activator HCl and H2SO4, based on table 1 and Figure 1 coconut shell activated carbon HCl and H2SO4 with a concentration of 10%, 15%, and 20% in this process the pH solution with different concentrations of 10% HCl is9.1, 15% HCl is 7.4 and 20% HCl is 6.2 while 10% H2SO4 is 8.6, 15% H2SO4 is 6.7 and 20% H2SO4 is 5.9. It can be seen in the addition of the concentration of coconut shell carbon with HCl and H2SO4 solutions, the pH of the wastewater solution tends to decrease. The alkalinity of alkali compounds in Laundry wastewater comes from detergents containing anionic surfactant (Alkyl Benzene Sulfonate / ABS, Linear Alkyl Benzene Sulfonate / LAS) and non-ionic ingredients. HCl or H2SO4. The pH of clean water in this study is 7.70. Other than the pH, it is also obtained the amount of solids dissolved in water. Based on table 1 with the absorption material activator used, namely coconut shell activated carbon HCl and H2SO4 with a concentration of 10%, 15%, and 20% in this process the results were the amount of dissolved solids with 10% HCl concentration of 321 ppm, 15% HCl at 344 ppm, and 20% HCl at 404 ppm, while 10% H2SO4 at 371 ppm, 15% H2SO4 at 309 ppm and H2SO420% at 383 ppm. Can be seen in HCl solution the higher the concentration, the less absorption of dissolved solids in wastewater, in contrast to H2SO4 at a concentration of 15% has decreased. This is due to the addition of the concentration of activated carbon, there will be a higher absorption and adsorption process. At 10% concentration of HCL and H2SO4 activators decreased and increased solids, those are 321ppm and 371 ppm, this is because there are still many pollutants in detergent waste so that high absorption occurs, 15% concentration of HCL and H2SO4 activators decreases 344 ppm and 309 ppm, opposite of the concentration of 10%, while 20% concentration of HCL and H2SO4 activator has increased to 404ppm and 383 ppm. Decreased TDS at concentrations of 10% and 15% not as much as 20%, because it almost meets the maximum point in the process of absorption of shell activated carbon coconut. In the clarity test using Luxmeter based on table 1 with the concentration of HCl activator and H2SO410%, 15%, and 20% in this process it appears that the efficiency of detergent water clarity used is influenced by the concentration of coconut shell activated carbon, where the greater the concentration of carbon is used the value of clarity of absorption is getting higher. This is because coconut shell activated carbon functions as a water purifier. This is in accordance with the theory which states that activated carbon is a good material in carrying out the absorption process. If we look at HCl activators and H2SO4 the best concentration at 20% for (37 and 57) Lux, these two activators at a concentration of 20% have a significant difference, because H2SO4 is a strong acid so that the ability to destroy ash trapped in pores is stronger. Carbon pores and expands the field of carbon sequestration.

2.5 Effect Of Absorbsi Waste with Active Charcoal On Viscosity

Viscosity is an important quality factor for liquid and semi-liquid (thick) or pure products, this is a measure and control to determine the quality of the final product (Lestari, 2004). Viscosity measurements carried out in this study using RedWood's Viscometer with 50ml of measured waste volume, 100 Volt voltages, and measured until the water temperature reaches 80oC. After reaching this temperature the water is flowed down the viscometer and the time is measured until 50ml of water runs out. From the results of the time obtained, then the viscosity value is calculated using the equation:

$$\gamma = (0{,}0026\,x\,t) - \frac{1{,}175}{t}\,x\,10^{3}$$

With γ is the viscosity of the solution in Nm / s^2 and t in seconds is the time required for 50ml water to flow outside the viscometer. The results of the measurements are shown in the following Table 2:

Table 2. Results of measurements of waste viscosity before and after treatment

Activator	Percentage (%)	Detergent content (mg/L)
-	-	340,2500
HCl	10	0, 5412
	15	0,4248
	20	0,4111
H_2SO_4	10	0,6712
	15	0,6244
	20	0,5714

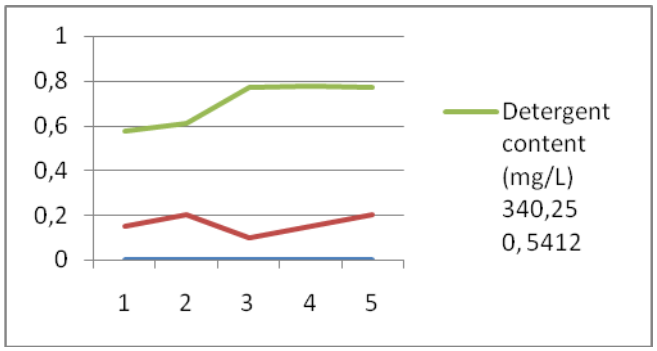

Fig 2. Graphic Results of measurements of waste viscosity before and after treatment

In Table 2 and Figure 2 with absorption material activator used, HCl and H2SO4 with a concentration of 10%, 15%, and 20%, the results obtained in the form of highest viscosity analysis on HCl activator in concentration of 10% with 118.73 N / m^3 and the lowest at 15% with 110.93 N / m^3. While the highest H2SO4 activator was in concentration of 10% with 116.59 N / m^3 and the lowest at a concentration of 15% at 114.36 N / m^3. It can be seen that the coconut shell activated carbon has a absorption capacity of detergent levels in higher Laundry liquid wastes. Water that has more detergent content will be more watery and the type will increase. This will cause the water to flow faster so that it has a low value of viscosity. However, in this absorption process, every increase in the concentration of absorption material will result in unstable values obtained in the water content so that the viscosity value rises and falls. From table 1, it can be seen that the best results of detergent absorber which causes changes in water viscosityoccurred in 15% HCl concentration of 110.93 N / m^3 and H2SO4 of 114.36 N / m^3.

2.6 the Effect Of Absorbsi Waste with Activated Coconut Shell Charcoal On Detergent Content

Based on DIY Regional Regulation No. 7 of 2016 the maximum level of detergent contained in waste is 5 mg / L. In this research, the content of deterrent in laundry waste was carried out before being treated and the absorption of waste using activated coconut shell charcoal. The results of the detergent content test are shown in the following table 3:

Table 3. Test results for detergent levels before and after treatment

Activator	Percentage (%)	Time (sekon)	Viscosity (Nm/s²)
-	-	60,43	137,674
HCl	10	54.03	118,73
	15	51.45	110,93
	20	53.14	116,05
H_2SO_4	10	53.32	116,59
	15	52.58	114,36
	20	53.30	116,53

Based on table 3 and Figure 3 , laundry liquid waste contains340.2500 mg / L detergent. The content is far beyond the total amount allowed by the government. This can be harmful to the environment. While after absorption using activated coconut shell charcoal the value of detergent content in waste is reduced significantly, namely in the absorption results using activated coconut shell charcoal with concentrations of 10%, 15% and 20% HCl respectively (0.5412; 0.4248 ; 0.4111) mg / L. While the results using H2SO410%, 15% and 20% respectively (0.6712; 0.6244 and 0.5714) mg / L. From these results it can be seen that the decrease in detergent content in the waste absorbed using activated coconut shell charcoal with HCl activator is greater than the H2SO4 activator. This can be seen in table 3 which shows the content of detergent after treatment at HCl concentration of 0.4248 mg / L while at H2SO4 concentration of 0.6244 mg / L from acid concentration of 15%.

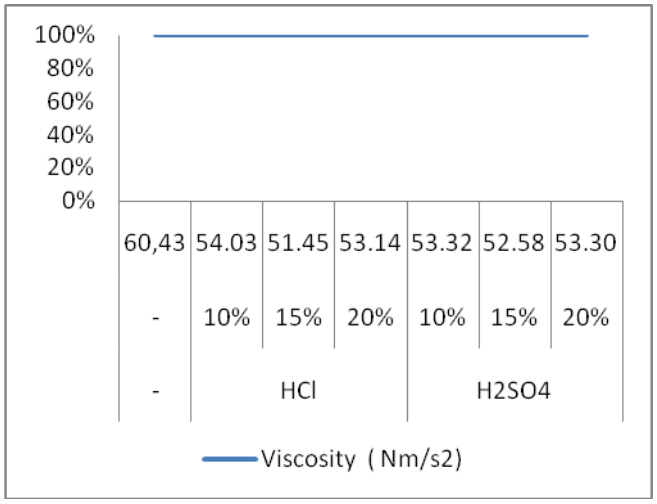

Fig 3. Graphic Test results for detergent levels before and after treatment

CONCLUSION

Based on the research that has been done, it can be concluded that coconut shell charcoal that has been activated using HCl and H2SO4 can be used to absorb laundry waste so that it improves the quality of waste water. and 57) Lux. The best impurity particle absorption was indicated by a concentration of 15% with pH values of HCl (7.4) and H2SO4 (6.7), viscosity of HCl (110.93) N / m3 and H2SO4 (116.53) N / m3. While the maximum TDS value is indicated by the concentrations of HCl 10% (321) ppm and H2SO4 at a concentration of 15% (309)

ppm. While the results for the best detergent content are shown by 15% HCl concentration which is 0.4248 mg / L.

References

Jurnal Penelitian Hasil Hutanmanejemen teknologi XVI, program studi MMT-ITS .

BLHJogja. Peraturan Daerah DIY no 7 tahun 2016. 25 Januari 2018. http://blh.jogjaprov.go.id/po-content/uploads/Perda-No-7-tahun-2016-ttg-Baku-Mutu-Air-Limbah.pdf

Infolaborat. Membuat Larutan Asam Klorida / HCl berbagai Konsentrasi. 20 september 2017. http://www.infolaborat.com/search/label/larutan%20solution%20chloride%20asam%20klorida%20pekat%2037%25%20acid%20acide

Nasir, S. (2013). Aplikasi Filter Keramik Berbasis Tanah Liat Alam Dan Zeolit Pada Pengolahan Limbah Hasil Proses Laundy. *Jurnal Bumi Lestari*, Volume 13 No.1 45-51.

Prasetyowati, Rita. (2015). Uji Viskositas Pemakaian Pelumas Mesin Kendaraan Bermotor *Viscosity* Test *Of Vehicle Engine Oil.* Jurnal Sains Dasar, 42-48.

Pujiono, & mulyati. (2017). Potensi Karbon Aktif Dari Limbah Pertanian Sebagai Material Pengolahan Limbah Air. *Jurnal Wiyata*, Vol. 1 No. 1.

Purnawan, Dkk.(2014). Penurunan Kadar Protein Limbah Cair Tahu Dengan Pemanfaatan Karbon Bagasse Teraktivasi (Protein Reduction Of Tofu Wastewater Using Activated Carbon Bagasse). *Jurnal Manusia Dan Lingkungan* , Vol. 21, No.2.

Saputra & Suparno. (2016). Teknik Penyaringan Limbah Cair Laundry Dengan Menggunakan Sistem Fas (Filtrasi, Absorbsi Dan Sedimentasi). *Jurnal Fisika* , Volume 5, Nomor 4.

Setiawati & Suroto. (2010). Pengaruh Bahan Aktivator Pada Pembuatan Karrbon Aktif Tempurung Kelapa. *Jurnal Riset Industri Hasil Hutan*, Vol.2. No.1 21-26.

Setyobudiarso, Y. (2014). Rancang Bangun Alat Penjernih Air Limbah Cair Laundry Dengan Menggunakan Media Penyaringan Kombinasi Pasir-Arang Aktif. *Jurnal Neutrino* , Vol. 6, No.2.

Cite this article:

Ernasari & Suparno (2019). Effect of Chemical Activation on Coconut Shell Charcoal on the absorption of Laundry Waste. ***Journal of Scientific Reports,*** 1(1), 51-58. doi: https://doi.org/10.5281/zenodo.3381592

Retrieved from http://ijsab.com/wp-content/uploads/1005.pdf

Published by