Utilization of Corncob Cellulose Isolate (Zea mays) as Adsorbent of Heavy Metal Copper and Cadmium

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Abstract. This study aims to determine whether the cellulose result of isolation compounds from corn cobs can adsorb heavy metals Copper (Cu) and Cadmium (Cd), as well as to determine the ability of adsorption of cellulose result of isolation. The type of this research is experimental research in chemical laboratory. The method used is quantitative research. The sample used in this research is corn cob waste. The cellulose isolation stage of the corn cob consists of dewaxing, dehemicellulose, delignification and bleaching. Cellulose characterization through water content test, ash content, pH, solubility test, and using Fourier Transform Infrared (FTIR) instrument, Scanning Electron Microscope (SEM) and X-Ray Diffraction (XRD). The cellulose result of isolation was used as a heavy metal adsorbent of Cu and Cd using atomic absorption spectrometry. Based on the results of the research, it is found that cellulose result of isolation from corn cobs has the ability to absorb Cu and Cd heavy metals with adsorption capacity of Cu and Cd is 68.20 and 95.98 mg L⁻¹ g⁻¹.

Keywords. Isolation; Characterization; Cellulose; Adsorption; Heavy Metal; Corn cobs.

1. Introduction

Environmental pollution by heavy metals is one of the global problems that occurs in society. This is based on the magnitude of the negative impact of heavy metals on the environment, plants, and human health. Generally, heavy metal toxicity comes from industrial waste, particularly products from pesticides and industries involving heavy metals (eg Cu, Cd, Pb, Fe, and Zn) in the production process. Until now, prevention efforts have not been able to reduce levels of contaminated metal. Both types of heavy metals, Cu and Cd have a high toxic effect when their accumulation in the body exceeds the threshold limit.

Research by P. Ezegbirika et al. concluded that modifying agricultural waste to bind metal ions has a good adsorption capacity such as heavy metals Cu (II), Zn (II), Pb (II) [1]. Furthermore, study by Zheng Liuchun et al. modified cellulose from agricultural waste of corncobs indicates that cellulose has good potential as a metal ion adsorbent Cd²⁺ and Pb²⁺ [2]. In another study by Igwe j. C et al. also showed similar results, the adsorption process using maximum corncob cellulose material occurred at 495.9 mg/g for Zn²⁺ ions, 456.7 mg/g for Pb²⁺ and 493.7 mg/g ions for the ions Cd²⁺ [3].

Corn cob have a high content of cellulose fiber. Corn cobs contains cellulose about 44.9%. Cellulose is a compound that has a hydrophilic character because of the presence of hydroxyl groups in each
polymer unit. The nature of the cellulose functional groups or their derivatives may interact physically or chemically with heavy metals.

Adsorbents of corn cobs have several advantages, such as the availability of corn in large quantities so that it is easy to obtain, the preparation process is easy, and the cost is relatively cheap. P. Ezegbirika et al. also suggested that making corn cobs as heavy metal adsorbents is relatively easy to obtain because it is agricultural waste [1]. It has a high cellulose content and has a good capacity in binding heavy metal ions. Therefore, the researchers took the initiative to conduct research on the Utilization of Corncobs Cellulose Isolate (Zea mays) as Adsorbent of Heavy Metal Cu and Cd.

2. Materials and Methods

This research uses quantitative analysis in the form of laboratory experiment. Therefore, in the process, this research through several working procedures described as follows.

2.1. Corn Cob Preparation

The sample preparation stage consists of washing, drying, crushing and sifting. Corn cobs are weighed and mashed using a powder mill until it becomes a powder. Then, it was sieved using digital shaker 80 mesh. The corn cob powder was then dried in a 60°C oven for 3 hours to remove any moisture content that may remain in the powder.

2.2. Isolation of cellulose from corn cobs

First method is dewaxing, i.e. weighing and extracting process of corn cob powder using soxhletation method with ethanol solvent: toluene (1:2) for 4 hours. It was then washed with hot water to remove the remnants of organic solvent up to neutral pH. The soxhletated powder was then dried in 60°C oven for 2 hours. The extra-active cellulose free powder was then weighed using?

Second method is dehemicellulose, i.e. stage which aims to remove the hemicellulose content, the cellulose powder resulting from the dewaxing process each 5 g dissolved into 100 ml of 4% NaOH. It was then heated at 85°C for 2 hours and cooled for how long? Then it was filtered using a vacuum pump. The filtrate residue was washed with aquades up to neutral pH. The hemicellulose free powder was dried at 60-70°C for 6 hours. The result of dehemicellulose powder was then weighed using?

Third method is delignification. At this stage, 30 g of cellulose powder was dissolved into HCl 25% 120 mL, 10 mL H2O2 50 mL and 400 mL aquades. Furthermore, it was refluxed for 2 hours at 80°C. It was further filtered and washed to a neutral pH. Then, it was dried and weighed the weight of obtained cellulose.

Fourth, which is also the last stage in the process of cellulose isolation from corn cobs is bleaching. At this stage, the cellulose powder of the delignification stage was dissolved into 37 mL HCl solution 100 mL, H2O2 38% 150 mL and 100 mL aquades. Furthermore, it was refluxed for 2 hours at 65°C. After that, the filtering and washing up to neutral pH. Cellulose from isolation was conducted then it was weighted.

2.3. Cellulose Characterization

2.3.1. Water Content Analysis. In the water content analysis, corn cob powder as much as 5 grams put into a petri dish that has been known weight. It was then heated in an oven at a temperature of 100°C-110°C until the weight was constant and cooled within the desicators for 20 minutes and then weighed. The same thing was conducted over and over again until the weight was constant. The analysis was conducted using triplo (SNI-06-3730-1995). The water content was calculated by the following equation:

\[
Water\ Content = \frac{a - b}{c} \times 100\%
\]
where:
\( a \) = sample weight and petri dish before drying (g)
\( b \) = sample weight and petri dish after drying (g)
\( c \) = sample weight before drying (g)

2.3.2. *Ash Content Analysis*. In the analysis of ash content, 5 grams of corncob powder was put into a petri dish that has been known weight. Then, it was heated in a muffle furnace at 500 °C for 3 hours until white ash is obtained. Petri dishes were cooled in the desiccator and weighed. Measurement of weight to produce a constant weight. Final calculation of ash content

\[
Ash\ Content = \frac{a - b}{c} \times 100\%
\]

where:
\( d \) = sample weight and petri dish before drying (g)
\( e \) = sample weight and petri dish after drying (g)
\( f \) = sample weight before drying (g)

2.4. *pH Test*

The pH test was performed by dissolving the cellulose result of isolation into the aquades which was then measured using a pH meter.

2.5. *Solubility Test*

The solubility test was carried out by dissolving several grams of cellulose result of isolation into strong acid and strong base, such as concentrated HCl (37%), concentrated CH₃OOH (100%), concentrated HNO₃ (65%), concentrated H₂SO₄ (95% 97%), 17.5% NaOH and HClO₄.

2.6. *FT-IR Analysis*

The process of chemical compound analysis was carried out by using Fourier Transform Infra Red (FTIR). The \( \alpha \)-cellulose analysis using FT-IR was performed by mixing 0.2 mg cellulose with 2 mg KBr and formed into pellets. The pellet of the sample was then fed to the FT-IR instrument with \( \lambda \) 4000-400 cm⁻¹.

2.7. *SEM Analysis*

SEM analysis on \( \alpha \)-cellulose was carried out by freezing the cellulose powder over the aluminium to dry. Then, the sample was sprinkled with gold for 30 seconds using polaron. The analysis results were displayed in stereo scan.

2.8. *XRD Analysis*

The \( \alpha \)-cellulose XRD analysis was performed by heating cellulose powder and firing X-rays with wavelengths of 10-10 s/d 5-10 nm, having a frequency of 1017-1020 Hz and having 103-106 eV energy.

2.9. *XRD Analysis Cellulose Applications Isolation Result As Heavy Metal Ion Adsorbent Cu²⁺ and Cd²⁺*

2.9.1. *Preparation of Main Solvent for Cd(NO₃)₂ and Cu(NO₃)₂*

Preparing the parent solution of Cd(NO₃)₂ and Cu(NO₃)₂ each 1000 ppm with a volume of 500 mL. Next, Cd(NO₃)₂ as much as 1.0516 grams and Cu(NO₃)₂ as much as 1.476 grams was dissolved into 500 mL of aquades.

2.9.2. *Making Work Solvent Cd(NO₃)₂ and Cu(NO₃)₂*

Work solvent Cd (NO₃)₂ and Cu (NO₃)₂ were prepared each with 100 ppm and concentration of 100 mL with pH adjustment. Making work solvent was carried out by diluting 10 mL of Cd (NO₃)₂ and Cu (NO₃)₂ 1000 ppm to 100 mL.
2.10. Determination of Cellulose Adsorption Capacity Result of Isolation on Heavy Metal Ion Cu$^{2+}$ and Cd$^{2+}$

The determination of adsorption capacity, Cd (II) and Cu (II) 100 ppm were each taken as much as 50 mL and fed into the beaker. The dried cellulose powder was weighed with a mass of 1 gram, then mixed into a 100 ppm Cd (II) and Cu (II). Next, the mixture was stirred with a stirrer for 2 hours and then left to settle. Taken 0.1 mL standard solution and diluted to 10 mL. Concentration measurements using Atomic Adsorption Spectroscopy.

Referring to the final stage of the working procedure, SSA tools are required to calculate the concentration. Therefore, in this research data was analyzed by using SSA. The result of heavy metal adsorption is presented in tabular form which is further processed to obtain heavy metal adsorption capacity value.

The adsorption capacity is the ability of an adsorbent to absorb adsorbate. The adsorption capacity of cellulose towards Cd (II) and Cu (II) was calculated using the formula:

$$Q_0 = \frac{C_0 - C_1}{W}$$

Where:
- $Q_0$ = Adsorption Capacity (mg.L$^{-1}$.g$^{-1}$)
- $C_0$ = Mass of Cd and Cu before adsorbed (mg.L$^{-1}$)
- $C_1$ = Mass of Cd and Cu after adsorbed (mg.L$^{-1}$)
- W = Cellulose mass used (g)

3. Result and Discussion

3.1. Corn Cob Preparation

This study uses ± 500 grams of old and dry harvested corn cobs from the Milango Community Plantations Location, Wonggarasi, Pohuwato Regency, Gorontalo Province. The initial treatment for corn cobs is washing, drying, crushing and sifting. The results of the preparation of 80 mesh corn cobs powder was produced about 276.9 g with a yield of 55.38%.

3.2. Isolation of Cellulose from Corn Cob Waste Dewaxing

Dewaxing stage aims to eliminate the content of wax substances, dyes, fat, tannins and other organic substances [4]. At this stage, a number of 118.87 g samples were used with the Soxhletation method and 4 hours of heating process. The principle is to extract a compound continuously i.e. wax, fat, tannin and dye substances by using organic solvent ethanol: toluene (1: 2). At this stage, 90 g of extra-active substance free sample with yield of 75.71% was obtained.

3.3. Dehemicellulose

The dehemicellulose stage was performed to remove the hemicellulose compound. A sample of 90 g from dewaxing stage was mixed with 4% NaOH. Extraction using NaOH can remove hemicellulose [5]. The cellulose dissolution process begins with the degradation of fiber and fibril structures which will produce perfect disintegration and become individual molecules with unchanged chain lengths.

Degradation of supramolecular structure occurs with the swelling and insertion of chemical groups that will break the intramolecular bonds that cover the cellulose molecule. In the process of swelling and cellulosic fiber dissolution mechanism is highly dependent on the quality of the solvent. The addition of bubbles such as NaOH causes fibrous bubbles.

Wang argued that the concentration of NaOH should be higher than 10% for the initial transformation of the lattice from cellulose I to Na-cellulose II [6]. The reaction that occurs between NaOH and cellulose can be seen in Figure 1.
The dehemiselulosa process obtained 50 g sample with rendemen 55.56%.

3.4. Delignification

The delignification stage is the removal stage of lignin compound. At this stage 50 g of cellulose powder with HCl 25\% and 10\% H2O2 treatment was used. Hydrolysis process using HCl aims to produce microcrystalline cellulose fibers (pure cellulose). This is because HCl compounds can destroy amorphous regions of cellulose fibers and allow the grafting of chloride groups on the surface of cellulose capable of stabilizing electrostatic movements.

The process of degradation of cellulose chains by acidic catalysts is carried out by breaking the macromolecule chains to form low molecular products. The results obtained at the delignification stage are 30 g of lignin free sample with 60\% yield.

3.5. Bleaching

Bleaching stage (bleaching) was carried out using 37\% HCl, 38\% H2O2. Hydrogen peroxide (H2O2) is a widely used delignification agent and can remove lignin and hemicellulose without reducing cellulose fibers. The remaining lignin compound on the residue is removed through the addition of hot water. The addition of hot water also serves to remove hypochlorite and hemicellulose compounds.

Hemicelluloses are composed of short and branched chain glucose, and hemicellulose is more soluble in water. In the final stage of bleaching, cellulose produced by isolation was 25.87 g with a rendemen of 86.23\%.

3.6. Cellulose Characterization

3.6.1. Water Content Determination. Determination of water content is intended to determine the water content contained in cellulose result of isolation from corn cobs. The water content test process was conducted in accordance with SNI-06-3730-1995 with 3 times repetition. The results of the water content test showed the average value of cellulose water content of the isolation is 6.9\%.

The value of moisture content obtained is lower when compared with the water content according to the theory of 9.6\%. The low water content contained in corn cobs is caused by the long drying time, the longer the drying process is carried out, the more water is wasted. So the resulting water content is lower.

The water content in a compound can affect the adsorption ability of an adsorbent. high low water levels indicate much less water that covers the pores of the adsorbent. The lower the water content the more places in the pores can be occupied by adsorbat so that adsorption runs optimally [7].

3.6.2. Determination of Ash Content. Ash content aims to determine the mineral content contained in corn cobs. The ash content test process was conducted using triplo in accordance with SNI-063730-1995 with 3 times repetition. The data of the ash content of the average samples was obtained at 1.7\%. When it was compared with ash content according to the theory, the value of cellulose ash content from the isolation is higher. This is likely due to the not optimal carbonation process.
3.7. pH Test
The pH test was performed using pH-Meter. The pH test was performed to express the degree of acidity or alkalinity possessed by a substance. The result of pH test showed that cellulose of isolation had pH = 7. Related with these results, Ohwoavworhua et al. mentioned that proper microcrystalline cellulose has a pH range of 5-7.5 [8].

3.8. Solubility Test
The solubility test of the compound was performed to determine the characteristics of cellulose qualitatively. Basically, cellulose is insoluble in water, acid solution, dilute alkali, organic solvents such as benzene, alcohol, ether and chloroform. The result of cellulose solubility test can be seen in Table 1.

| Solvent                  | Cellulose Isolation Results |
|--------------------------|----------------------------|
| HCl concentrated (37%)   | Not dissolved              |
| CH₃COOH concentrated (100%) | Not dissolved             |
| HNO₃ concentrated (65%)  | Not dissolved              |
| H₂SO₄ concentrated (95-97%) | Not dissolved            |
| NaOH 17,5%               | Not dissolved              |
| HClO₄                    | Not dissolved              |

Table 1. Solubility Test of Cellulose Powder Results
3.9. **FT-IR Analysis**

Functional group analysis was performed by FTIR test. In this test, a comparative Avicel 102 (standard cellulose) was used. Proper cellulose will show the main absorption at wave numbers 3344, 2884, 1426, 1316, and 1024 cm\(^{-1}\) indicating the presence of OH groups, hydrogen bonds, C-H alkanes, C-O ether bonds, and alcohols [4]. FTIR results can be seen in Figure 2. Based on the analysis of FT-IR data in Figure 2, an absorption peak indicates the presence of several functional groups in cellulose. The functional groups obtained in the sample can be seen in Table 2.

| Functional Group | Wave Number (cm\(^{-1}\)) |
|------------------|---------------------------|
|                  | A  | B   | C   |
| Regang O-H       | 3347 | 3422 | -   |
| Regang C-H       | 2903 | 2897 | 2899 |
| Regang C-C       | -   | -   | 1069 |
| Regang C-O       | -   | 1744.29 | -   |
| Regang H-O-H     | -   | 1647 | 1649 |
| Regang C-O-C     | -   | 1161 | 1163 |

Based on the results of the IR spectra analysis (Table 2), shows that the holocellulose has a significant absorption at 1744.29 cm\(^{-1}\) corresponding to the stretching of the C-O group from the C=O group. At the delignification stage, this absorption peak is lost by the presence of alkali (NaOH) treatment to produce corncob powder nanoparticles. The loss of wave peak 1744.29 cm\(^{-1}\) shows that the acetyl group xilan is removed almost completely by treatment with 4% NaOH at the delignification stag (Figure 3).

The OH-group with a wavelength range of 3347 cm\(^{-1}\) has a shift in the width of the absorption peak to 3422 cm\(^{-1}\) in the de-hemicellulose process. This suggests that there has been an interaction of OH-groups from the polar group in the intra-hydroelectric and intermolecular-bonding reactions. This data is reinforced by the occurrence of a symmetrical C-H stretching uptake of CH\(_2\) and CH\(_3\) groups in the 2903 cm\(^{-1}\) to 2897 cm\(^{-1}\) wave range.

The delignification stage increases the uptake of the symmetric C-H stretching of the CH\(_2\) and CH\(_3\) groups to 2899 cm\(^{-1}\). At a strong absorption de-hemicellulose stage at 1647 cm\(^{-1}\) indicates the occurrence of stretching of H-O-H groups in amorphous regions with alkaline treatment. In the de-lignification stage an increase in the absorption intensity is indicated by the shift of the wave number 1649 cm\(^{-1}\), this indicates that on the amorphous region the water molecule is absorbed by the crystals of cellulose fibres.

**Figure 3.** Results of X-Ray Diffraction Analysis
This condition indicates that the lignin content in the sample is reduced and remained the cellulose. This data is supported by the absorption peak at 1375 cm\(^{-1}\) describing the vibration of the C-H group in cellulose. Finally, a sharp peak of the \(\beta\)-glycosidic relation between the sugar units at 897 cm\(^{-1}\) with increased intensity indicates an increase in cellulose crystallinity. The spectrum shows that the functional group in the spectrum is the cellulose polysaccharide structure.

3.10. SEM Analysis

The morphological structure of cellulose compounds isolated results was analyzed using SEM (Scanning Electron Microscope) in this study. Results of SEM analysis (a) Corncobs, (b) NaOH 4% and (c) Standard cellulose Avicel 102 can be seen in Figure 4.

![SEM analysis result]

Based on SEM analysis (Figure 4), the cellulose result of isolation with 1000 times magnification of the actual size, has a particle size of 10 \(\mu\)m, irregular shape and uneven surface texture. The effect of adding 4% NaOH in cellulose isolation process from corncobs showed an increase in the outer surface area of the cellulosic morphology structure and has many micropores compared to morphological structure of corn cobs.

When compared with cellulose standard (avicel 102), the alkali treatment with 4% NaOH has not been able to degrade the cellulose supramolecule structure, i.e. the swelling and insertion of the NaOH chemical group that will break the intramolecular bonds and cover cellulose molecules.

3.11. X-Ray Diffraction (XRD) Analysis

X-Ray Diffraction analysis is used to determine the composition of phases or compounds in the material as well as crystallinity. Cellulose is a powder composed of two phases, i.e. the amorphous phase and the crystal phase as with high purity and degree of crystallinity [9]. The high degree of crystallinity in a compound indicates that the composition of atoms in the compound is regular. Results of XRD analysis of corncob powders, cellulose result of isolation, and standard cellulose can be seen in Figure 4.

Based on the results of XRD analysis in Figure 4, it was found that the cellulose result of isolation contains crystalline phase and amorphous phase with high degree of crystallinity. The higher the intensity and the narrower the half-peak width (FWHM) obtained, it means that the higher the crystallinity degree of a compound. This condition can be seen from the difference of the sharp peak between corn-cob powder early with cellulose result of isolation using 4% NaOH, at 100% intensity of the strongest corn-cob powder was appeared at the angle 2\(\theta\) (0) i.e. 22.61170 with height peak 67.2 and width half peak 0.8160, while on cellulose result of isolation was emerged the strongest peak specific at 2\(\theta\) i.e. 22.49920 with peak height 564.71 with half width 0.57120 peak.

XRD analysis showed that cellulose result of isolation from corn cobs had higher degree of crystallinity than corn cob powder. A high area of crystallinity is shown by the emergence of sharp peaks, while the amorphous area is marked by a wide peak. Based on the XRD data, it is known that the atomic particles of corn cobs have a location that is less neat (amorphous phase).

The results of the isolation of cellulose of XRD analysis when compared with standard cellulose (Avicel 102) has the same result with peak at 2\(\theta\), i.e. 22.62690, with a peak height of 722.95 and a half-
width of peak 0.81600. Based on these findings, it can be seen that cellulose result of isolation with 4% NaOH treatment has a high crystallinity phase similar to the standard cellulose of Avicel 102.

3.12. Cellulose Applications Isolation Result As Heavy Metal Ion Adsorbent Cu²⁺ and Cd²⁺

The adsorption capacity of cellulose result of isolation towards heavy metal ions Cu²⁺ and Cd²⁺ was analyzed using atomic absorption spectrometry (SSA). In the adsorption process is done with 2 types of adsorbents, i.e. cellulose result of isolation from corncobs and standard cellulose (Avicel 102) as a comparison.

The result of atomic absorption spectrophotometer analysis towards heavy metal ion adsorption Cu²⁺ and heavy metal ion Cd²⁺ by corncobs cellulose and standard cellulose at 100 ppm solution concentration can be seen in Table 3.

| Analysis Result   | Adsorption Capacity (mg.L⁻¹g⁻¹) |
|-------------------|----------------------------------|
|                   | Cu²⁺   | Cd²⁺   |
| Avicel 102        | 69.66  | 98.59  |
| Corn cobs cellulose | 68.20  | 95.98  |

Based on the data in Table 3 above, it is known that cellulose result of isolation from corncob waste has a good adsorption ability as an adsorbent. It is seen from the value of the adsorption capacity toward heavy metal ions Cu²⁺ and Cd²⁺, respectively for 68.20 mg.L⁻¹.g⁻¹ and 95.98 mg.L⁻¹.g⁻¹ while the value of the adsorption capacity using Avicel 102 (standard cellulose) to Cu²⁺ and Cd²⁺ metal ions respectively were 69.66 mg.L⁻¹.g⁻¹ and 98.59 mg.L⁻¹.g⁻¹.

The heavy metal ion adsorption processes Cu²⁺ and Cd²⁺ occur physically and chemically. Physically, Cu²⁺ and Cd²⁺ metal ions enter through the pores of the adsorbent surface. Chemically, the adsorption process of heavy metal ions Cu²⁺ and Cd²⁺ on the cellulose isolation adsorbent occurs through ion exchange mechanism. The ion exchange mechanism takes place through three stages: (1) deprotonization of functional groups, (2) perfect ionization of Cu (NO₃)₂ and Cd (NO₃)₂ in water to form heavy metal ions Cu²⁺ and Cd²⁺, and (3) adsorption of dissolved metal ions by adsorbents [10].

The Hydroxyl (-OH) group is one of the active groups that plays an important role in the adsorption process. The cation exchange mechanism occurs due to the exchange of Cu²⁺ and Cd²⁺ cations replacing the H⁺ ions present in the adsorbent. The ion exchange occurs because of the electrostatic forces between the cation and the negatively charged of functional group. The hydroxyl functional group (-OH) on the adsorbent is deprotonized, so the functional group is negatively charged, which is highly reactive in absorbing heavy metal ions Cu²⁺ and Cd²⁺.

Based on the results of SSA analysis, it is known that the adsorption capacity of cellulose result of isolation towards heavy metal ions Cd²⁺ is higher than heavy metal ion Cd²⁺. This is indicated by the results of data processing (Table 3) heavy metal cadmium of 95.98 mg.L⁻¹.g⁻¹ and copper 68.20 mg.L⁻¹.g⁻¹. The value of adsorption capacity indicates heavy metal ions Cd²⁺ tends to be more easily absorbed by insulating cellulose compared with Cu²⁺ heavy metals. This condition is caused by the Cd²⁺ metal ion having a relative molecular mass (Mr) that is higher than the relative molecular mass of Cu²⁺ with a Mr value of 236.4 gr/mol for metal ions Cd²⁺ and 187.5g/mol for metal ions Cd²⁺, so that the Cd²⁺ metal ion falls faster (up) onto the adsorbent surface than the Cu²⁺ metal ion.

The size of the ionic radius of an atom also affects the adsorption process power. The Cd²⁺ ion has an ionic radius greater than Cu²⁺ ions, so it has a relatively small electrostatic force and can weaken the ability of Cd²⁺ ions to attract surrounding water molecules. Weak ability of Cd²⁺ metal ions to attract water molecules, ultimately causing the hydration radiation possessed to become smaller and increasing the movement of Cd²⁺ metal ions in the water, so that the Cd²⁺ metal ion is more easily up to the surface of the adsorbent.

In addition, the atomic number of heavy metal cadmium (Cd) of Cd (NO₃)₂ is greater than the heavy metal copper (Cu) of Cu (NO₃)₂, which actually shows the number of protons possessed by Cd²⁺ greater.
than Cu$^{2+}$. The large number of protons in Cd$^{2+}$ causes the appeal and effective core charge of Cd$^{2+}$ to become larger, thereby ease the Cd$^{2+}$ metal ion in inducing non-polar cellulose and forming an electrostatic attraction.

4. Conclusions
The cellulose isolation stage consists of water dewaxing, dehemiselulose, delignification, bleaching and purification. Cellulose isolates can be used as adsorbents for Cd and Cu metals. The ability of adsorption of cellulose from corn cob in adsorbing Cu and Cd metal ions is 68.20 mg L$^{-1}$ g$^{-1}$ and 95.98 mg L$^{-1}$ g$^{-1}$ at concentration 100 ppm.

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