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2nd International Conference on Statistics, Mathematics, Teaching, and Research 2017

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WELCOME SPEECH
Forewords from the Head of Committee

Assalamu Alaikum Warahmatullahi Wabarakatuh.
The honourable, Rector of Universitas Negeri Makassar (UNM) and all Vice Rectors, the Dean of Mathematics and Natural Sciences Faculty and all Vice Deans, all invited Speakers and Participants.

First of all, let us praise and thank to Allah Subhana Wata'ala, because his Blessings and Helpings, we are able to gather here to attend this conference.

Second, I would like to give our welcome to all delegates, speakers, and participants coming today in The Second International Conference on Statistics, Mathematics, Teaching and Research 2017 (2nd ICSMTR-2017) "Advanced Research for Statistics, Mathematics, Sciences and Education for Enhancing International Publications" organized by Mathematics and Natural Sciences Faculty, UNM.

This conference is conducted in two days from 9th to 10th of October 2017 in Grand Clarion Hotel Makassar. It involves: a keynote speaker, six invited speakers and approximately 300 parallel speakers coming form the West to East Indonesia and several countries.

Ladies and gentleman as, I previously said, the conference proudly invites keynote speaker and six invited speakers coming from several countries. Therefore, on behalf of the committtee, I would like to express my sincere thanks to them, specifically: 1) Directorate General of Research and Development Strengthening, Ministry of Research, Technology, and Higher Education; 2) Prof. M. Shaheed Hartley (University of Westen Cape, South Africa); 3) Prof. Ahmed A. Bahnassy (King Fahd Medical City, Saudi Arabia); 4) Prof. Madya Dr. Ahmad Johari Bin Sihes (Universiti Teknologi Malaysia, Malaysia); 5) Prof. Dr. Khairil Anwar Notodiputro, MS (Bogor Agricultural University, Indonesia); 6) Abbas Panakkal, Ph.D (Ma'din Academy Research Center and International Study, India); 7) Prof. Hamzah Upu, M.Ed. (Universitas Negeri Makassar, Indonesia) and 8) Prof. Muhammad Arif Tiro, Ph.D. (Universitas Negeri Makassar, Indonesia).

Next, I would like thanks to all sponshors and also thanks to all organizing committee who have been showing very good work and determination for the accomplishment of this conference. All of them working since the beginning of the planning stage and they are still here today for all of us, even though, they are very busy with their personal responsibilities.

On this occasion, I would like to apologize to all of you when there are some inconvenience during the conference.

Finally, I would like thanks to the speakers and participants listed in the 2nd ICSMTR 2017. Have a nice conference and also that you have a very pleasant stay in Makassar city. Thank you very much for attention. Assalamu Alaikum Warahmatullahi Wabarakatuh.

Head of Committee,

Prof. Dr. Syafruddin Side, M.Si.

Forewords from the Dean of Mathematics and Natural Sciences Faculty, Universitas Negeri Makassar

Your excellency Rector of Universitas Negeri Makassar
Honourable Vice Rectors and Dean of All Faculties
Honorable Keynote Speakers
Distinguished all invited speakers from outstanding universities
Distinguished all speakers and guests
All participants,
Ladies & Gentlement,

Assalamu'alaykum Warahmatullahi Wabarakatuh. My greetings for all of you. May peace and God's blessing be upon us all. *Alhamdulillah*, all praises be to the Almighty God, Allah *subhanahu wata'ala*.

It is my pleasure to welcome you all to the opening of The 2nd International Conference on Statistics, Mathematics, Teaching, and Research (2nd ICSMTR). I am delighted to see that the Mathematics and Natural Sciences Faculty has again organized the second conference that capitalize on our strength and built on our commitment to promoting Mathematics, Science, Teaching and Research.

I do hope that this conference would bring a great opportunity for all of us to strengthen our contribution to the advancement of our nation.

I would like to take this opportunity to thank the conference organizing committee for their diligent work. I would also like to thank participants, especially those of you coming from abroad, for joining us and sharing your valuable experiences. Should you find any inconveniences and shortcomings, please accept our sincere apologies.

Finally, let me wish you fruitful discussion and a very pleasant stay in Makassar.

Thank you,
Wassalamu'alaykum Warahmatullahi Wabarakatuh

Dean of Faculty of Mathematics and Natural Sciences
Universitas Negeri Makassar

Prof. Dr. Abdul Rahman, M.Pd.

Forewords from Rector of UNM

Bismillahirrahmanirrahim
Assalamu'alaikum Warahmatullahi Wabarakatuh

Your respectable, the high officials of State University of Makassar, the committee, the speakers, and the participants of conference.

It gives me great pleasure to extend to you all a very warm welcome, especially to our keynote and invited speakers who have accepted our invitation to convene the conference. ICSMTR is one of our educational activities that covers a wide range of very interesting items relating to statistics, mathematics, teaching and research.

By taking participation of this conference, it is highly expected to all of us to share our research findings to society and continuously develop new ideas and knowledge. Those things are two significant steps in improving the quality of nations around the world, increasing our familiarity to each other, and even avoiding underdevelopment.

Furthermore, I would like to take this opportunity to express my heartfelt gratitude to all organizing committee for Faculty of Mathematics and Natural Sciences that primarily hosts this conference.

Finally, this is a great time for me to declare the official opening of the International Conference on Statistics, Mathematics, Teaching, and Research (ICSMTR) 2017.

I wish you a very enjoyable stay in Makassar
I warmly welcome you again, as in Makassar, we say "salamakki battu ri mangkasara"

Wassalamu'alaikum Warahmatullahi Wabarakatuh.

Prof. Dr. Husain Syam, M.TP
Rector of Unversitas Negeri Makassar

CONFERENCE SCHEDULE
The 2ndICSMTR
Faculty of Mathematics and Natural Sciences
Universitas Negeri Makassar

Clarion Hotel, Makassar, Indonesia, 9 – 10 October 2017

Day 1: Monday, 9 October 2017		
07.00 – 08.00	Registration	Jasmine Hall
08.00 – 09.00	Opening Ceremony Traditional Dance Doa National Anthem: Indonesia Raya Welcome speech: a. Head of Committee Prof. Dr. Syafruddin Side, M.Si. b. Dean of Math & Natural Sciences Faculty Prof. Dr. Abdul Rahman, M.Pd. c. Rector of Universitas Negeri Makassar Prof. Dr. Husain Syam, M.TP.	Jasmine Hall
09.00 – 09.45	Keynote Speaker Directorate General of Research and Development Strengthening, Ministry of Research, Technology, and Higher Education	Jasmine Hall
09.45 – 10.00	Coffee Break	Jasmine Hall
10.00 – 12.00	Invited Speakers 1. Prof. M. Shaheed Hartley, Ph.D. 2. Prof. Dr. Hamzah Upu, M.Ed. 3. Prof. Madya Dr. Ahmad Johari Bin Sihes	Jasmine Hall
12.00 – 13.00	Lunch & Pray	
13.00 – 15.30	Parallel Sesion 1	Parallel Rooms

15.30 – 16.00	Coffee Break	Parallel Rooms
16.00 – 18.00	Parallel Session 2	Parallel Rooms
Day 2: Tuesday, 10 October 2017		
08.00 – 10.00	Invited Speakers 1. Prof. Dr. Khairil Anwar Notodiputro, M.S 2. Prof. Ahmed A. Bahnassy, Ph.D. 3. Prof. Muhammad Arif Tiro, Ph.D. 4. Abbas Panakkal, Ph.D.	Jasmine Hall
10.00 – 10.10	Coffee Break	Jasmine Hall
10.10 – 11.30	Parallel Session 3	Parallel Rooms
11.30 – 12.00	Closing Ceremony	Jasmine Hall
12.00 – 13.00	Lunch & Pray	
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INVITED SPEAKER SESSION

Day 1: Monday, 9 October 2017		
10.00 – 12.00	Professor M.Shaheed Hartley, Ph.D. University of Western Cape, South Africa *Training, supervision and mentorship on a professional development journey from 2010 to 2017: A reflection by students and supervisors*	Jasmine Hall
	Professor Dr. Hamzah Upu, M.Ed. Universitas Negeri Makassar, Indonesia *The Effectiveness of Mathematics Learning Packages Based on Bilingual Approach.*	
	Professor Madya Dr. Ahmad Johari Bin Sihes Universiti Technology Malaysia, Malaysia *Transformation of Higher Education Curriculum to Meet the 4th Industrial Revolution Challenges*	
Day 2: Tuesday, 10 October 2017		
08.00 – 10.00	Professor Dr. Khairil Anwar Notodiputro, M.S Bogor Agricultural University, Indonesia	Jasmine Hall
	Professor Ahmed A. Bahnassy, Ph.D. King Fahd Medical City, Saudi Arabia	
	Professor Muh. Arif Tiro, Ph.D. Universitas Negeri Makassar, Indonesia *National Movement for Statistical Literacy in Indonesia: An idea.*	
	Abbas Panakkal, Ph.D. Ma'din Academy Research Center, India *Technological Trajectories and Epistemological Paradigms in Social Science Researches.*	

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FTIR, XRD and SEM Analysis of Microcrystalline Cellulose (MCC) Fibers from Corncorbs in Alkaline Treatment

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FTIR, XRD and SEM Analysis of Microcrystalline Cellulose (MCC) Fibers from Corncorbs in Alkaline Treatment

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Abstract. In this paper, we report the isolation method of cellulose, alpha cellulose and microcrystalline cellulose from corncorbs waste in alkaline treatment NaOH 4%,6%,8%,10%,12%,14% and 17% solution. Dewaxing, dehemiselulosa, delignifikasi and bleaching is the stage of cellulose isolation. The MCC particles were extracted by acid hydrolisis with 0.1N HCl. The 4% NaOH concentration provides the highest α-cellulose content (60%) with total yield MCC of 84.53%. SEM, FT-IR and X-ray diffraction analyzes are used to determine of the MCC. FTIR spectra showed that each MCC had -OH group, stretching of C-O on cellulose fiber I and cellulose II. C-0 bonds shows a change in rotation of glucose residue around the glycosidic bond into Cellulose II. SEM analysis showed that the concentration of 6% NaOH has a morphological structure such as cellulose standard. The 8% NaOH concentration yields a CrI value of 98%.

1. Introduction

Corncob is lignocellulosic material consisting of 38.8%±2.5%, 44.4%±5.2%, hemicellulose and lignin cellulose 11,9% ± 2,3%. Cellulose is biodegradable and biocompatible which can be processed into product with economic value. Cellulose is unbranched macromolecule that consist of anhydroglucopyranose units which connected by the β-1,4-glycosidic bond. Each unit of anhydroglucopyranose has three OH groups [1].The original crystalline structure of cellulose polymorphs is known as cellulose I, when dissolved and crystallized in the form of a more stable crystal in a solution called cellulose II. Cellulose II powder is used as an alternative raw material in the field of industrial, pharmaceutical, health and biofuel production [4][20].

In application, degradation of cellulose structures is an important step because it must find a solvent that not reduce polimerization degree (DP) of cellulose [14]. Cellulose fibers are not homogeneous depending on the source of the fiber and solvent quality through opening the pore of the amorphous-crystalline region and breakdown hydrogen bonds [28][15]. Pretreatment technology is requiered in hydrolysis process [22][14] to change the intra-inter chain structure of the molecule by swelling and insertion of the chemical group [24]. Methods of cellulose pretreatment include acetylation, mercerization, peroxidation, benzoyilation, graft copolymerization. Bacterial media is the best method for surface modification of cellulose fibers that have been widely studied [12].

A study of lignocelluloses by various methods has been studied including hydrolysis using the enzyme NovozymesCellic® C-Tec2 and H-Tec+ in 10% NaOH [12] modification of cellulose dissolution in NaOH/ZnO by enzymatic treatment of xylanase and endoglucanase with pulp solubility from 29% -81% [8] the mercerization method using NaOH [6][34][16] KOH [3] NH3 solution [15]

NaOH/ H2O2/hypochlorite [21] NaOH/H2O2 [34] NaOH/NH3 [9] NaOH/Urea [26] (NaOH).NaOH is very effective to breaking lignin and glicosydic bond inlignocellulosic bio-conversion (HOO) and NaOH method [14,6,33] method of microwave oven with use KOH and NaOH 0.75% - 3% [3] NaOH 4%, 8%, 13%, 18% termination of lignin bonding and glycosidic polysaccharides [19-27]. The cellulose structure has a more open surface facilitating the interaction of the fibers [20] 12% -18% NaOH and NH3 forming cellulose II and cellulose-ammonia complexes [1] NaOH 4% cellulose II ± 50% and extractive 72% [21]. NH3 and NaOH altered the crystal-alomorph structure of cellulose II and IIII [8].

Cellulose can be made into MicrocrystalinCelullose or nanocellulose by strong acid hydrolysis [22][32] in the form of white, odorless, tasteless white crystalline powders.[32] Cornstarch cellulose (CPNs) with α-cellulose content 47.27% acording to Avicel® PH 101 [4-29] NaOH 4% yields 47.6% oxidized cellulose with NaClO 7.5 mmol/gr yields 36.5% alkaline cellulose nanofibrils (ACNFs) [11] MCC is synthesized using H2SO4, HCl and HBr [29] MCC is stronger and stiffer than amorphous cellulose or native cellulose [20]. The CRC (CrI) index of sugar palm obtained was 97.5% [17] CrI sample 83.46% [18] Cellulose-based nanoparticles (CPNs) of corncobs with KOH had CrI values 57.28% [2] with H2SO4 values CrI nanocellulose was higher at 60.2% [22]. In this research cellulose, α-cellulose and MCC will be isolated from corncob in alkali treatment with variation of NaOH concentration with 4%, 6%, 8%, 10%, 12%, 14 and 17%. Dewaxing, dehemiselulosa, delignifikasi and bleaching is the stage of cellulose isolation. The MCC particles were extracted by acid hydrolisis with 0.1N HCl ratio 1:2 and refluxed at 80 0C for ± 2 hours. The processing parameters like acid concentration, temperature, time and mechanical force were kept constant. The MCC particles were studied by FTIR, XRD and SEM analysis concentration.

2. Experimental details

2.1. Raw material
Corncob from Milango Village, Pohuwato District, Gorontalo Province, Indonesia. The reagents were of analytical grades, NaOH (reagent grade, 98%), HCl (ACS reagent, 37%), H_2O_2 (technical grade), $K_2Cr_2O_7$, H_2SO_4, Avicel 102 (technical grade), Ethanol (95% pa), Tholuena (95% pa), and distilled water used as solvent.

2.2. Isolation of cellulose
Corncob waste was cut into small pieces ± 2 cm, washed with aquadest and in oven temperature 60 0C-70 0C for 24 hours. The dried sample is blended and in the shaked to obtain corncob powder particles 180 micron by size. Cellulose isolation is a modified procedure [12-14] dewaxing stage: 50 gr of 180 micron corncob powder was soxhleted in ethanol : tholuene (2:1) for 4 hours. Sample was filtered and washed until neutral pH, then it was dried with oven at 60 0C for 8 hours. de-hemicellulose stage: 10 gr of 180 micron corncob powder was dissolved into 200 mL of 4%, 6%, 8%, 10%, 12%, 14% and 17% NaOH solution. The mixture was heated on hot plate at 1000C for ± 2 hours. Then it was filtered and washed until neutral pH, dried with oven at 60 0C. de-lignification and bleaching stage using H2O2 4% for ±1 hour at room temperature. Then sample was filtered and washed until neutral pH. It was oven-dried at 60 0C for 8 hours.

2.3. Production of alpha cellulose
Purification of α-cellulose was done by 5gr of cellulose dissolved in 500 ml of 17.5% NaOH at a temperature of 80^0C for 30 min. Furthermore the precipitate was filtered and washed until neutral pH, and oven-dried at 60^0C for 8 hours [12-14].

2.4. Production of microcrystalline cellulose (MCC)

The preparation of MCC modification of the analytical procedure [9,12,17]. α-cellulose product was hydrolysed with 0.1N HCl ratio 1: 2 and refluxed at 80 ^{0}C for ± 2 hours. The precipitate was filtered and washed with aquadest until neutral pH and oven-dried at 60 ^{0}C for 8 hours.

2.5. Characterization of MCC fiber

2.5.1. Fourier Transform Infrared (FTIR).
FT-IR spectroscopy analysis was used to determine the cellulose microcrystalline functional group were carried out using (Shimadzu IR-Prestige21, Instrumen Laboratories Brawijaya University, Malang). Bands were recorded in the region from 4000 to 500 cm^{-1}

2.5.2. X-ray diffraction (XRD).
Morphological changes in the crystalline structur of MCC fiber were analyzed using a hight-resolution X-ray difractometer (PANalytical, X´Pert HighScore, at Geologi Laboratories, Bandung). The crystallinity of MCC fiber was determined from X-ray diffraction curves based on the Segal Method (Segal et al, 1959) in Kyoung-Hwa Choi, et al, 2016)[16]. Crystallinity index (CrI) was calculated based on Eq.1

$$CrI (\%) = I_{002} - I_{Am}/I_{002} \text{ x } 100 \tag{1}$$

were I_{002} is the peak height at 22.4 (2θ) and I_{Am} is the peak height of amorphous cellulose to 19.5 (2θ).

2.5.3. Morphologycal characteristic.
SEM was used to examine the microscopic structure and the surface morphologyof MCC fiber. The instrument used was SEM-EDS JEOL JSM-6360LA, Japan, at Geologi Laboratories, Bandung.

3. Result and discussion

Effect of alkalin charge on the isolation of cellulose and α-cellulose levels. NaOH is a cellulose-swelling complex [14], improving particle dispersion to form alkali-cellulose by the reaction of Cel-OH + NaOH ↔ Cel-ONa + H$_2$O [21][16]. Alkali as a swelling of the cellulose chain (swelling) and penetrating the crystal lattice reacts with the OH group after breaking the hydrogen bonds producing the cellulose-alkali complex [21][24]. At the dewaxing stage, dehemicellulose, delignification, impurities such as extractives, lignin and hemicellulose decreases. Proteins, inorganic salts, fatty acids, resin acids, waxes, tannins and colored compounds are extracted in both solvents and alkalis. As the NaOH concentration increases, more and more short-chain carbohydrates are degraded [18][33]. NaOH 4% gives the highest α-cellulose content (60%). The swelling of inter-crystalline swell is followed by oxidative degradation which largely confined to the amorphous region of fiber ie the degradation of cellulose intercrystalline. Dissolution of extraactive compounds, hemicellulose and lignin molecules due to the breaking of aryl-ether bonds, carbon-carbon, aryl-aryl and alkali-alkali to obtain high purity cellulose. The higher the concentration of NaOH, the lower the content of α-cellulose will be, because strong degradation occurs through intracrystalline swelling, where the reactant penetrates the crystalline region [18][22][33].

Effect of hidrolisis charge on the yield of MCC. NaOH 4% concentration gives the highest yield of MCC (84.53%).The purity of α-cellulose and hydrolysis processes affects the MCC fibril structure. The hydrolysis level is influenced by the structural properties of the biomass substrate, such as cellulose crystallinity, surface area, DP and porosity [9]. During hydrolysis of HCl, Cl$^-$ ions will penetrate cellulose strands and hydrolyze the amorphous regions resulting in highly crystalline substrate with different CrI values [16] Concentration NaOH 10%-17% extensively alters the cellulose molecular structure and supramolecules of cellulose I into cellulose II with decreased crystallinity [9].

3.1. Infrared spectroscopy
FT-IR spectra of the MCC fiber and their intermediate products are shown in Figure 1.
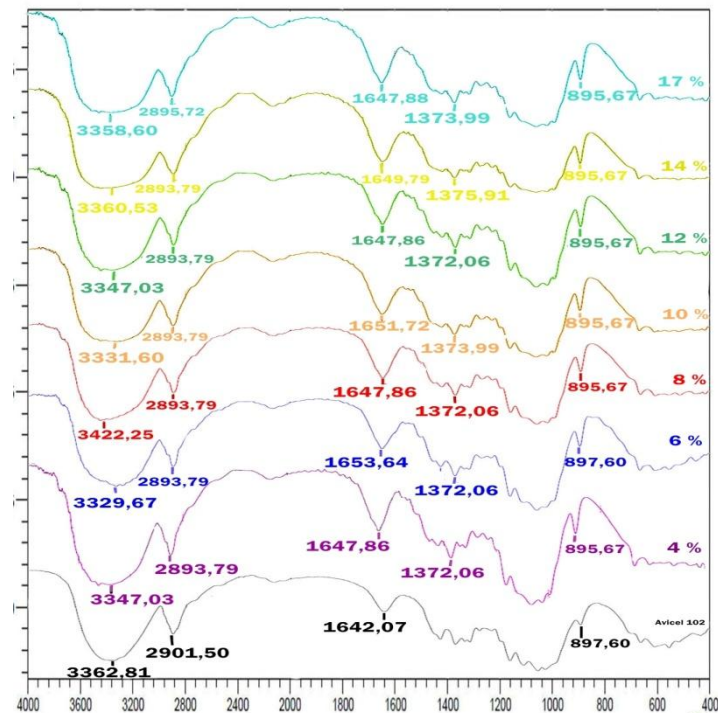
Figure 1. FT-IR Spectra of MCC fiber

Spectra at 4000-2995 cm-1, 2900 cm-1, 1430 cm-1, 1375 cm-1, and 900 cm-1 indicate crystal and amorphous regions. There are structure changing of celluolose I to cellulose II with NaOH 6%, which is showed by stretching OH at 3331 cm-1, 3347 cm^{-1}, 3360 cm-1 and stretching C=O at 1642-1649 cm^{-1}. The characteristics of the glycosidic group of C-O, C-O-C, and C-OH bonds with concentration variations were seen at 1161.83 cm^{-1}. The formation of alkali-cellulose is reinforced by stretching of C-O and C-C groups at 1063-1065 cm^{-1}. For NaOH 4% and 6%, there are sharp peak at 897 cm which typical for β-glycosidic linkages of cellulose I. Cellulose with NaOH ≥6%, showed peak shifts at 998 cm^{-1}, 995 cm^{-1}, 895 cm^{-1}. This is indicate occurrence of cellulose crystal structure II. This peaks correspond to cellulose spectrum [29].

3.2. X-ray diffraction (XRD)

X-ray diffraction spectra of MCC fiber and their intermediate products are shown in Figure 2. The XRD analysis results (Fig.2), gives the amorphic form data at 2θ=14.6^0(4%), 12.1^0(6%), 11.9^0(8%), 19.5^0(10%), 12.2^0(12%), 12.1^0(14%), 12.3^0(17%) and the crystal is read at 2θ=22.4^0(4%), 21.9^0(6%), 21.8^0(8%), 19.8^0(10%), 21.8^0(12%), 21.8^0(14%), 19.7^0(17%). NaOH 4% showed typical diffraction pattern of cellulose I with angle diffraction angle 2θ ie 14.84^0, 20.20^0, 22.63^0. Increasing the concentration of NaOH (≥4%) will decrease intensity and diffraction pattern formed two new crystallinity peaks ie crystal structure II at angle 2θ=12,5^0 and 21.68^o [9][31] micro-fibril swelling, degradation and formation of new crystal lattice [33] NaOH 17.5% during the α-cellulose isolation process [5]. The highest crystal structure produced on MCC due to the removal of amorphous alpha cellulose region with acid hydrolysis and 8% NaOH concentration yields a degree of crystallinity (CrI) of 98%. It is interesting to note that the MCC in the present case shows doublet in the intensity of the main peaks corroborating the coexistence of cellulose I and cellulose II allomorphs. The large different spectra between MCC with cellulose and alpha celluloseresults in the appearance of two significant peaks indicating the highly crystalline structure of MCC. High crystallinity indicates an ordered compact molecuar structure, whenthe crystalline cellulose content is high, these two peaks are more pronounced [7].
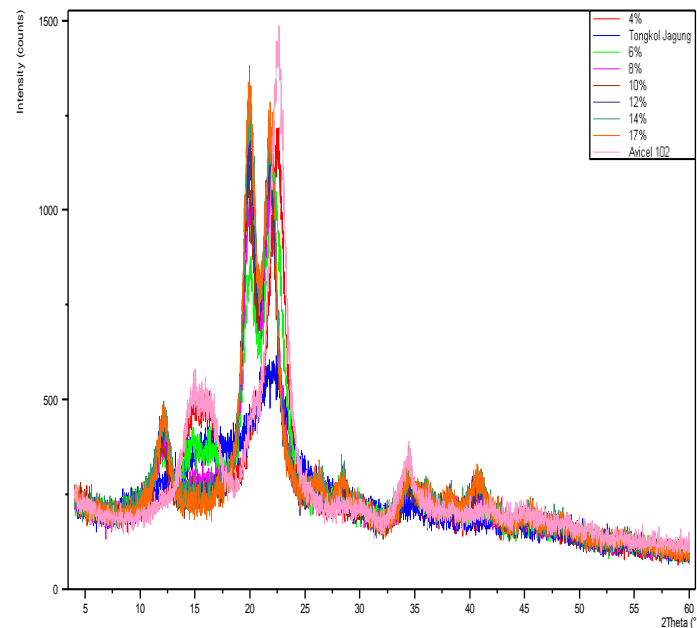
Figure 2. XRD Spectra of MCC fiber

3.3. Scanning Electron Microscopic (SEM)

Figure 3 shows themicroscopic structure and surface morphology of MCC fiber.
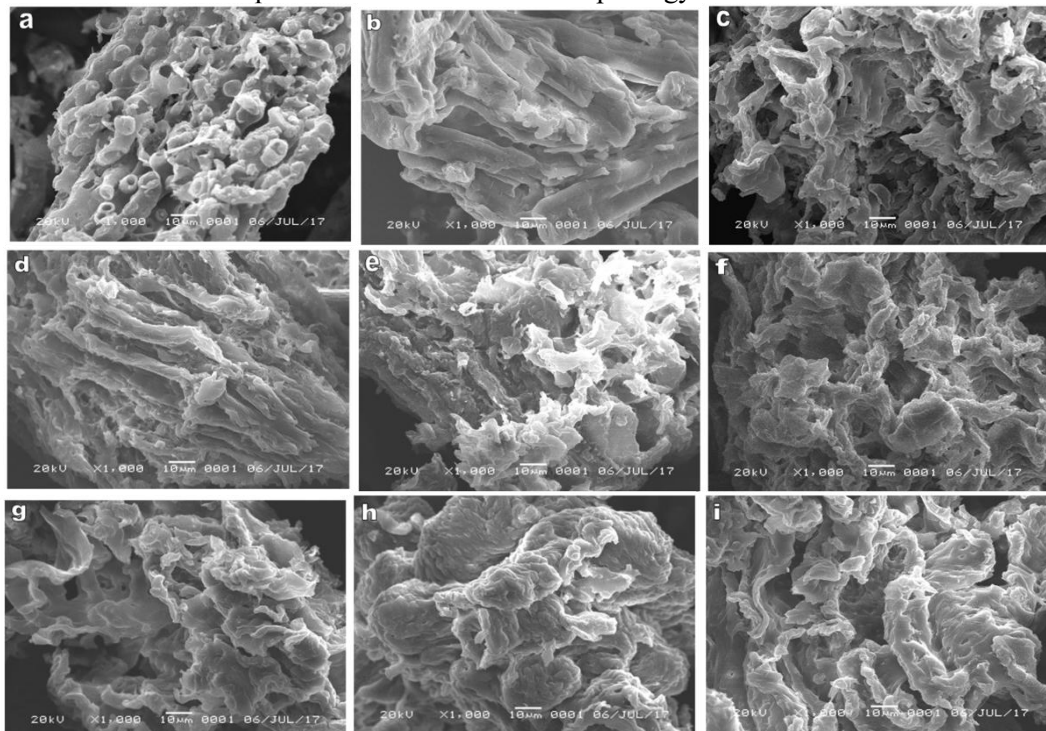
Figure 3. Photo SEM (a) Corncorb, (b) Avixel 102, (c) NaOH 4%, (d) NaOH 6%, (e) NaOH 8%, (f)NaOH 10%, (g) NaOH 12%, (h) NaOH 14%, (i) NaOH 17%.

Micrographic SEM reading (Fig.3) NaOH 6% has a surface structure similarity with Avicel 102. The 8%, 10%, 12%, 14% and 17% NaOH concentrations illustrate the porous (vascularular) texture of the macrofibril shape and the unequal distribution of macrofibrils in cellulose suggest that

mercerization causes fibrillation and fiber damage to small pieces that increase surface area.In this case, after macrofibrils werehydrolyzed and rinsed, the volume of amorphous cellulose was occupied by water molecules that were then removed;the remaining macrofibrils contain large amounts of naked microfibril bundles.

4. Conclusion

The MCC particles were studied by FTIR, XRD and SEM analysis. FTIR spectra showed that each MCC had -OH group at wave number 3422, 3331, 3347, and 3360 cm^{-1}.The C-0 bond at 1635 cm^{-1}, 1642-1649 cm-1 shows the different stretching of C-O on cellulose fiber I and cellulose II and C-0 bonds at 1161.83 and 1063-1065 cm^{-1}. 995-895 cm-1 shows a change in rotation of glucose residue around the glycosidic bond into Cellulose II. SEM analysis showed that NaOH 6% had a standard pore cell surface structure. Acid hydrolysis and NaOH concentration increase the CrI of MCC. I_{002} is the peak height at 22.4(2θ) and I_{Am} is the peak height of amorphous at 19.5(2θ). The highest crystal structure produced on MCC due to the removal of amorphous alpha cellulose region with acid hydrolysis and 8% NaOH concentration yields a degree of crystallinity (CrI) of 98%.

Acknowledgments

References

[1]   Hermin S, Sutriyo, Hasty R S and Dianah R 2017 Preparation of microcrystalline cellulose from water hyacinth powder by enzymatic hydrolysis using cellulose of local isolate *JyoungParm* 99(1)

[2]   A ElOudiani,.Y Chaabouni, S Msahli, F Sakli 2011 Crystal transition from cellulose I to cellulose II in NaOH treated *Agave americana* L. fibre. *Carbohydrate Polymers* 86(3)

[3]   Boonyisa W, Apanee L and Sujitra W 2012 Characterization of corn cobs from microwave and potassium hydroxide pretreatment *J. of Chemical, Molecular, Nuclear, Materials and Metallurgical Engineering* 6(4)

[4]   Chukwuemeka P A, Augustine O O and Robin D R 2011 Physicochemical properties of maize cob cellulose powders reconstituted from ionic liquid solution *Springer Science Cellulose* DOI 10.1007/s10570-011-9631-y

[5]   Chukwuemeka P A and Augustine O O 2012 Physicochemical, spectroscopic and thermal properties of microcrystalline cellulose derived from corn cobs *Int. J. of Recycling of Organic Waste in Agriculture* DOI: 10.1186/2251-7715-1-9

[6]   C E Maepa, J Jayaramudu, J O Okonkwo, S S Ray, E R Sadiku and J Ramontja 2015 Extraction and characterization of natural cellulose fibers from maize tassel *Int. J. of Polymer Analysis and Characterization* 20(2)

[7]   H Nasution, Yurnaliza, Veronicha, Irmadani and S Sitompul 2017 Preparation and characterization of cellulose microcrystalline (MCC) from fiber of empty fruit bunch palm oil *Applied Science and Engineering Conference IOP Publishing IOP Conf. Series: Materials Science and Engineering* 180 012007 doi:10.1088/1757-899X/180/1/012007

[8]   Heléne A, Ambjörnsson.,2013. *Mercerization and enzymatic pretreatment of cellulose in dissolving pulps* Dissertation Karlstad University Faculty of Health, Science and Technology Department of Engineering and Chemical Sciences ISSN 1403-8099. ISBN 91-7063-499-4

[9]   Ashutosh M, Rui K, M E Himmel and David K J 2011 Effects of alkaline or liquid-ammonia treatment on crystalline cellulose: changes in crystalline structure and effects on enzymatic digestibility *Biotechnology for Biofuels* 4(41) DOI: 10.1186/1754-6834-4-41

[10]   Jeannie S, Irvan K and Haznan A 2017 Kinetic studies of cellulose enzymatic hydrolysis from pretreated corn cob *AIP Conf. Proc.* 1803 020014

[11]   Jin G and You-Lo H 2017 Alkaline cellulose nanofibrils from streamlined alkali treated rice straw *ACS Sustainable Chem. Eng* 5(2) pp 1730–1737

[12]   Josephine C H L, FuiKiew L, Sinin H, Md Rezaur R, Mohamad R, Md Faruk H and Md Mizanur R 2015 Synthesis and characterization of cellulose from green bamboo by chemical treatment with mechanical process *J. of Chemistry* ID 212158 6 pages

[13]   Keikhosro K and Mohammad J T 2016 A critical review on analysis in pretreatment of lignocelluloses: Degree of polymerization, adsorption/desorption, and accessibility *J. Bioresource Technology* 203 pp 348-356

[14]   Kihlman 2013 Cellulose dissolution in an alkali based solvent: influence of additives and pretreatments *J. Braz. Chem. Soc.* 24(2) ISSN 0103-5053

[15]   Kuzmina 2013 *Preswelling of cellulose pulp for dissolution* Institute of Biopolymers and Chemical Fibers, Lodz, Poland

[16]   Kyoung-HwaChoi, Ah Ram K and Byoung-UkCho 2016 effects of alkali swelling and beating treatments on properties of kraft pulp fibers *J. Bioresources* 11(2) pp 3769-3782

[17]   Maulida L, Mari B H, Muhammad H S G, Mora S and Hidayatul A 2016 Effect of microcrystalline cellulose (mcc) from sugar palm fibres and glycerol additionon mechanical properties of bioplastic from avocado seed starch (Persea americana mill) *Full Paper Proc.* 331(3) pp 1-10 ISBN 978-969-670-957-2

[18]   Md Ziaul K, Zaira Z C, Sharifah B A H and Md Eaqub A 2014 Statistical optimization for acid hydrolysis of microcrystalline cellulose and its physiochemical characterization by using metal ion catalyst *Materials* **7** 6982-6999 DOI:10.3390/ma7106982 ISSN 1996-1944.

[19]   Motaung T E and Mtibe A 2015 Alkali treatment and cellulose nanowhiskers extracted from maize stalk residues *Materials Sciences and Applications* **6** pp 1022-1032

[20]   M Pointner, P Kuttner, T Obrlik, A Jäger and H Kahr 2014 Composition of corncobs as a substrate for fermentation of biofuels *J. Agronomy Research* 12(2) pp 391–396

[21]   Nor F J, Jamaludin K, Nur F Y, Muslyza C H and Iffah I M 2014 Effect of alkali treatment on mechanical and physical properties of oil palm frond-polypropylene matrix *Int. J. of Latest Research in Science and Technology* 3(6) pp 150-154 ISSN 2278-5299

[22]   Nor F M Z, Salma M Y and Ishak A Preparation and characterization of cellulose and nanocellulose from pomelo (Citrus grandis) Albedo *J.of Nutrition & Food Sciences* 5(1) 1000334 ISSN: 2155-9600

[23]   Oluwasina O, Lajide L and O B 2014 Microcrystalline cellulose from plant wastes through sodium hydroxide-antraquinone-ethanol pulping *Bioresource* 9(4) 6166-6192

[24]   Patrick N and Céline C 2011 Cellulose swelling and dissolution as a tool to study the fiber structure *Member of the European Polysaccharides Network of Excellence* (1) BP 207 06904 Sophia Antipolis, France

[25]   Qianqian W, Weiwei, Xia L, Jianzhong S, Jing H and Mingxiong H 2016 Comparative study of alkali and acidic cellulose solvent pretreatment of corn stover for fermentable sugar production *Bioresources* 11(1)

[26]   Saba H, Yumei Z and Huaping W 2015 Role of ionic liquids in dissolution and regeneration of celluklose *Modification of Chemical Fibers and Polymer Materials* Donghua University Shanghai Sci. 40 (2015) 215-226

[27]   Sun B Z, Peng, Gege, Duan L, Xu, Aihua and Li X 2015 Pretreatment by NaOH swelling and then HCl regeneration to enhance the acid hydrolysis of cellulose to glucose *Bioresource Technology* **196** pp 454-458

[28]   Shuai Z, Wen C W, Fa X and Jian-Yong Y 2013 Swelling and dissolution of cellulose in naoh aqueous solvent systems *Cellulose Chemistry And Technology* 47 (9-10) pp 671-679

[29]   Samit K, Yuvraj S N and Jugmendra S U 2010 Studies on characterization of corn cob based nanoparticles *Adv. Mat. Lett.* 1(3) pp 246-253

[30]   Sherif S Z H 2017 Microcrystalline cellulose: the inexhaustible treasure for pharmaceutical industry *Nanoscience and Nanotechnology Research* 4**(**1**)** pp 17-24

[31]   Syed 2012 *Cold caustic extraction of spruce sulfite dissolving pulp* Faculty of Technology and Science Department of Chemical Engineering Karlstad University.

[32]   Suvachittanont S and Ratanapan P 2013 Optimization of micro crystalline cellulose production from corn cob for pharmaceutical industry investment *J. of Chemistry and Chemical Eng.* 7(12) pp 1136-1141.

[33]   V P Arthanarieswaran, A. Kumaravel and S S Saravanakumar 2015 Physico-chemical properties of alkali-treated *Acacia leucophloea* Fibers *Int. J. of Polymer Analysis and Characterization.* 20(8) pp 704-713

[34]   Yesim Y, Onur Y, Emir Z H and Berrin B 2013 Effect hydrogen peroxide concentration and temperatur on alkali pre-treatmen of sunflower stalks for fermentable sugar *ISESCO Journal of Science and Technology* 12(21)

[35]   Yiying Y 2011 *A comparative study of cellulose I and II and fibers and nanocrystals* Louisiana State University and Agricultural and Mechanical LSU Master's Theses Graduate School, Agricultural and Mechanical College in Partial Fulfillment of the Requirements for the degree of Master of Science in The School of Renewable Natural Resources.

[36]   Y Cao, S Sakamoto and K Goda 2014 *Effects of heat and alkali treatments on mechanical properties of kenaf fibers* Department of Mechanical Engineering, Yamaguchi University, Yamaguchi, Japan.