THE-INFLUENCE-OF-BAMBOO-LEAF-ASH-AS-A-CEMENT-SUBTITUTE-ON-THE-COMPRESSIVE-STRENGTH-OF-FLOWABLE-CONCRETE.pdf

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THE INFLUENCE OF BAMBOO LEAF ASH AS A CEMENT SUBSTITUTE ON THE COMPRESSIVE STRENGTH OF FLOWABLE CONCRETE

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ABSTRACT

Concrete plays important role in development of technology in construction in Indonesia, concrete offers advantages where constituent materials are easily available in various regions of Indonesia and price is cheaper than other construction materials, but concrete also has several problems, namely the constituent materials of concrete are made from non-renewable resources and in the implementation of ordinary concrete materials cannot optimally enter between reinforcement so that the strength of the structure is not optimal. use of flowable concrete with partial substitution of cement using bamboo leaf ash offers a solution to the problems encountered at the time of implementation. In this study,effect of using flow concrete with partial cement substitution using bamboo leaf ash will be examined and will be compared with normal flow concrete without a mixture of bamboo leaf ash, the method used is bamboo leaf ash which has been burned into powder, then combustion is carried out using a furnace with a temperature of 700°C for 2hours so that silica content is high and then divided into several variations of cement substitution, namely 0%,2.5%,6%,8.5%,10% and obtained an optimal increase in compressive strength in a mixture of 2.5% bamboo leaf ash with a value of 14.78 Mpa.

Keywords: *Flowable Concrete, Bamboo Ash Leaves, Compressive Strength.*

1. Introduction

The development in the field of construction in Indonesia is progressing very rapidly, the high level of infrastructure development makes the use of construction materials such as concrete in great demand by many people. Concrete is a type of artificial stone that is molded in certain locations while still in a liquid or viscous state, then hardens properly. Concrete is composed of a mixture of fine aggregate, coarse aggregate, and binder (Irfansyah et al., 2021). Concrete itself has advantages and disadvantages for its own advantages, namely it has a low price and can be molded according to what you want, while for the disadvantages of concrete, namely the difficulty of the concrete mixture to enter between the reinforcement during the concrete casting process (Rochmah et al., 2023). Concrete is a material that has a slump value of more than 19 cm to maintain natural cohesiveness in concrete, in flowing concrete it is necessary to pay attention to the composition of coarse and fine aggregates, this can risk to increase the risk of segregation and bleeding so that it can affect the compressive strength of concrete, while the use of fillers is used to avoid segregation and bleeding can be avoided (Sebayang et al., 2012).For the purpose of reducing bleeding and segregation in concrete, the addition of bamboo leaf ash will be investigated which will be used as a partial replacement for cement in concrete mixtures. (Hasri, 2020). Fallen bamboo leaves can be burned to ash, which contains useful silica compounds (Firmansyah & Sri Handoyo, 2022). Concrete consists of several ingredients that make up concrete which is made from a mixture of Portland Cement, Fine Aggregates, Coarse Aggregates, water and fillers or additives, this will be explained as follows:

1. **Portland Cement**

   Portland cement is a hydraulic cement produced through a clinker refining process consisting of hydraulic calcium silicates, by adding added ingredients in the form of gypsum (SNI 15-2049-2004, 2004). which consists of several ingredients such as Lime (CaO), Silica (SiO_2), Aluminum (Al_2O_3) and Iron Oxide (Fe_2O_3) and many more functions of Portland cement is as a binder between fine and coarse aggregates.

2. **Fine Aggregate**

   Fine aggregates or sand are mineral grains that are nearly spherical in shape with a grain size smaller than 4.75 mm or pass the standard no. 4 sieve (C33-03, 2002). The characteristics of fine aggregates used in the manufacture of concrete must be known in advance by testing the properties of fine aggregates. This is done in order to calculate the mix design with the planned compressive strength. Fine aggregate has several requirements such as not containing as much as 5% mud, and for organic content not exceeding 3%, fine aggregate has a function as a filler in the flow concrete mixture.

3. **Coarse Aggregate**

Coarse aggregate is aggregate that is retained on a 4.75 mm sieve (International, 2005). While based on (Wangsadinata, 1979) coarse aggregate is aggregate that has a grain size of more than 5 mm. which has several requirements such as the fineness modulus must be in the range of 5-7.1 which is according to the standard of grain variation, not easily broken and destroyed and does not contain 1% mud.

4. **Bamboo Ash Leaf**

Bamboo is a local commodity that has been recognized in the community for a long time. Bamboo is a plant that is easily found in Indonesia, especially in Java, Bali, South Sulawesi and Sumatra. Bamboo is an Order Bambooidae plant with rapid growth and can be harvested at the age of 3 years (Yahya, 2018). Bamboo leaf ash has a high silica content in bamboo (Noverliana & Asmi, 2014), therefore bamboo leaf ash can be utilized as a filler material in concrete.

2. Methods

The following is a flow chart of this research which will be explained in the figure below:

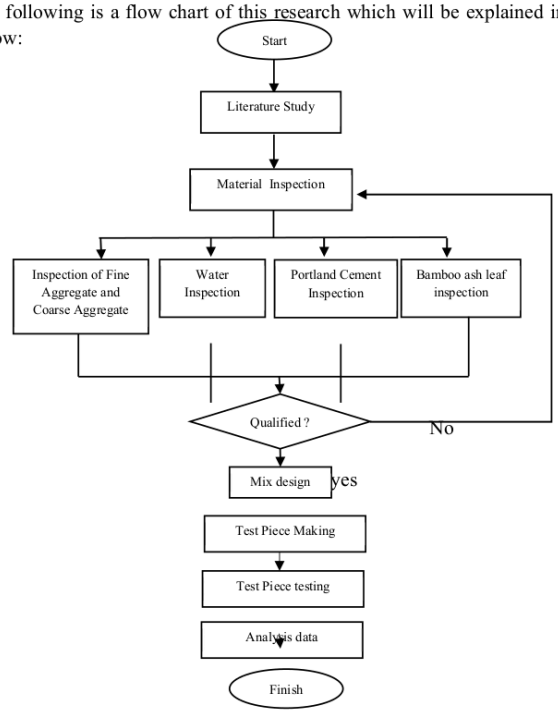

Figure 1 Flowchart of making flowable concrete specimens with variations of 0%, 2.5%, 6%, 8.5% and 10% as a partial replacement for cement.
Source: Writer, 2025

The research method used in this research is an experimental method with test objects, namely cylindrical concrete with a diameter of 15 cm and a height of 30 cm made by replacing part of the cement with bamboo leaf ash with percentage levels of use of 0%, 2.5%, 6%, 8.5%, and 10% of the total weight of cement with each percentage level totaling 3 test objects and will be tested for compressive strength at the age of 7 days, 21 days and 28 days.

Table 1 Number of Concrete Test Objects with Bamboo Leaf Ash Substitution

Composition	Total Test Specimens
BAL 0%	9
BAL 2,5%	9
BAL 6%	9
BAL 8,5%	9
BAL 10%	9

Source: Writer, 2025

With the planning of mixture proportions using the SNI 03-2834-2000 reference where the W / P content is 0.45

Table 2 Proportion of concrete ingredients per 3 test specimens

Composition	Pc	Fine Agg	Coarse Agg 5-10 mm	Coarse Agg 10-20 mm	Superplasticizer	Water	Bamboo Ash Leaf
BAL 0%	9,051	17,682	11,788	3,943	0,136	3,925	0,000
BAL 2,5%	8,982	17,597	11,731	3,924	2,701	3,927	0,230
BAL 6%	8,881	17,662	11,649	3,897	6,603	3,923	0,567
BAL 8,5%	8,805	17,378	11,585	3,874	9,476	3,928	0,818
BAL 10%	8,759	17,320	11,547	3,862	11,236	3,929	0,973

Source: Writer, 2025

The procedure at the time of making the test object using a cement mixer that refers to the regulations of SNI 2493 of 2011, the treatment of the test object carried out is to soak the test object for 7 days, 21 days and 28 days referring to the regulations of SNI 2493 of 2011, and the tested sample is given the same treatment, namely testing the compressive strength of concrete at the age of 7 days, 21 days and 28 days referring to SNI 03 1974 of 2011.

Other research procedures include several stages which will be explained below:

1. Licenses regarding laboratory use
2. Procurement of tools and materials such as cement, sand, gravel, bamboo leaf ash
3. Examination stage of test materials
4. Concrete proportion planning stage
5. The stage of making test objects
6. Test piece treatment stage

7. Stage of testing the compressive strength of the test object
8. Data analysis stage

For bamboo leaf ash, several procedures were carried out such as burning bamboo leaf ash to make it powder and sieved using a no200 sieve and passing the no 200 sieve, then a combustion procedure was carried out using a furnace for 2 hours then to find out the compounds in the bamboo leaf ash, a chemical compound test was carried out called the XRF test (X ray Fluoresence) This test was carried out at the central laboratory of minerals and advanced materials, State University of Malang (UM), Malang.

Compound	SiO2	P2O5	K2O	CaO	TiO2	V2O5	Cr2O3	MnO	Fe2O3	CuO	ZnO	SrO
Conc	63,4	2,1	3,82	15,0	1,12	0,05	0,051	0,34	13,4	0,088	0,11	0,15
Unit	%	%	%	%	%	%	%	%	%	%	%	%

Compound	Eu2O3	Re2O7
Conc	0,2	0,1
Unit	%	%

Figure 2 Compound levels in bamboo leaf ash that will be tested
Source: Writer, 2025

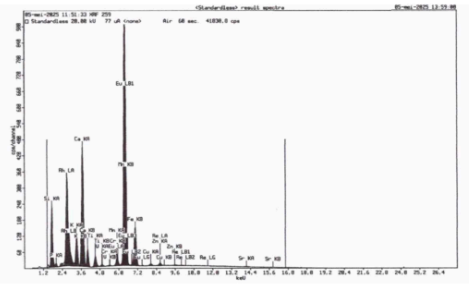

Figure 3 Bamboo Ash Leaf XRF Test Result
Source: Writer, 2025

5. Results

a) Slump Flow Test

The concrete batching plant is a concrete production equipment, which can reserve,Cement plant manufacture small mobile portable wet mix concrete batching plant , AJY50 and AJY75 belong to small mobile concrete batching plant, which can reserve,Cement plant manufacture small mobile wet mix concrete batching plant , AJY75 and AJY75 belong to large mobile concrete batching plant. According to ASTM C1017, flowable concrete is concrete that has a slump value of more than 19 cm, so in this test all concrete mixes have met the requirements to be flowable concrete..

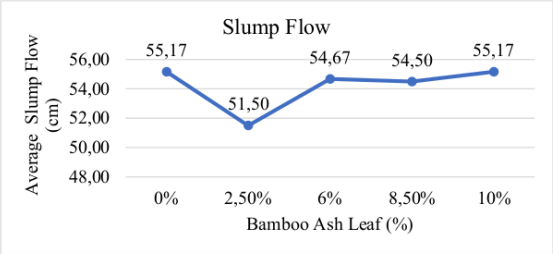

Figure 3 Slumpflow
Source: Writer, 2025

From the results of the slump test above, it is also concluded that the addition of bamboo leaf ash can result in a decrease in the slump value of flowing concrete, according to Mochammad Solichin and Susilo (2016) the use of bamboo leaf ash results in a slight decrease in the slump of fresh concrete when compared to normal concrete, the decrease in slump value indicates that the workability of concrete with the use of bamboo leaf ash is slightly lower than normal concrete which is very likely due to the absorption of some water by bamboo leaf ash due to its hydroscopic properties (absorbs water) while according to (Onikeku, 2019) the increase in slump value can be caused by several factors including:

i. Due to the presence of high SiO^2 and Ca0 compounds in bamboo leaf ash which can increase the workability of concrete mixtures.
ii. Bamboo leaf ash has finer particles that reduce internal friction and thus increase slumpflow.

b) Compressive Strength Test

We are a large-scale manufacturer specializing in producing various mining machines including different types of sand and gravel equipment, milling equipment, mineral processing equipment and building materials equipment, 52 Mpa and for the smallest compressive strength is in the mixture of 6% with a compressive strength of 10.53 Mpa while for the results of compressive strength testing of flowable concrete at the age of 28 days obtained the largest value in a mixture of 8.5% with a compressive strength of 21.43 Mpa and for the smallest compressive strength is in a mixture of 0% with a compressive strength of 16.63 Mpa.

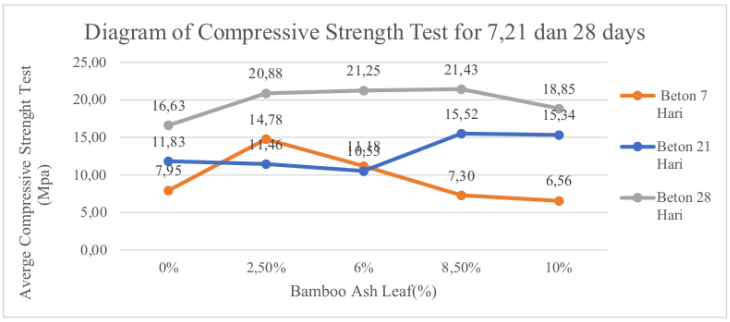

Figure 5 Diagram of Compressive Strength Test for 7,21 and 28 days
Source: Writer, 2025

According to (Onikeku, 2019) At the age of 7 days of concrete there is a decrease in compressive strength in the concrete mixture of partial substitution of cement ha this is due to the nature of bamboo leaf ash which has the property of increasing the age of concrete in the long term (Long Term Strength) which pozzolan such as bamboo leaf ash tends to develop more so that it can increase strength at the age of 28 days or more therefore at the age of 7 days the compressive strength with a mixture of bamboo leaf ash tends to decrease for compressive strength, then for the age of 21 days and 28 days there is an increase in the strength of concrete with a mixture of bamboo leaf ash, this is because the properties (long term strength) of bamboo leaf ash begin to react, so that it can increase the compressive strength of concrete.

From the results of the concrete compressive strength test above, the most optimal result is obtained, namely a mixture of 8.5% with a compressive strength value of 21.45 Mpa. The compressive strength with a mixture of 2.5% to 8.5% is suitable for use as a partial substitute for cement in flowable concrete because it can increase the compressive strength of concrete which continues to increase at every age of concrete, this happens because SiO2 is Pozzolanic which means the high content of SiO2 and CaO compounds that react and form new compounds, namely calcium silicate hydrate (CSH) which is the main component in contributing to concrete strength, The increase in concrete strength is also due to the increase in density contained in the concrete cavity cavity that has been filled by bamboo leaf ash so that it fills the concrete pores between cement and aggregate so that it makes the concrete more compact and dense so that it makes an increase in concrete.

To get the average compressive strength of all concrete ages, it is necessary to convert different concrete ages, so to get a 28-day concrete age conversion, it will be explained in the table below:

Table 3 Conversion for different Concrete Age

Concrete Age	3	7	14	21	28	90	365
Ordinary Portland Cement	0,4	0,65	0,88	0,95	1	1,2	1,35
Portland Cement with Early Strength Concrete	0,55	0.75	0,9	0,95	1	1,15	1,2

Source: Writer, 2025

After calculating the average compressive strength by converting to the age of 28 days, the results of compressive strength after conversion are obtained and the average calculation of the most optimal results for the compressive strength of concrete is at 2.5% concrete mix with an average compressive strength of 18.56 Mpa, which will be more clearly explained in the graph below:

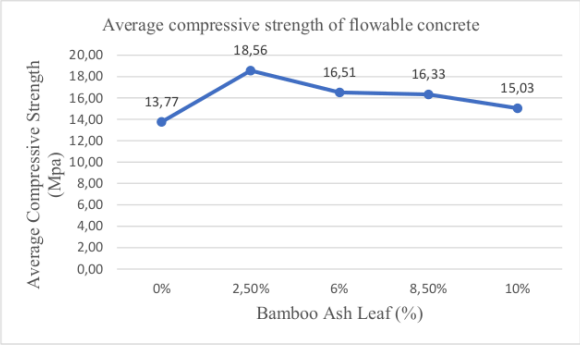

Figure 6 Diagram of Compressive Strength Test
Source: Writer, 2025

in this study, it is in line with previous research (Firmansyah & Sri Handoyo, 2022) which says that concrete mixtures with a percentage of 0%, 2.5% 6%, 8.5% and 10% with partial cement replacement using bamboo leaf ash with superplasticizer can increase the compressive strength of concrete, while in research (Faturohman Hidayat et al., 2021) the addition of too much bamboo leaf ash can also reduce the compressive

strength of concrete this is due to the absence of an adhesive reaction between cement and bamboo leaf ash.

6. Discussion

a) Uji Slump Flow

In the results of the slump flow test, it was concluded that bamboo leaf ash can reduce the results of the slumpflow test which is caused because bamboo leaf ash has hydroscopic properties where bamboo leaf ash can absorb some water so that it allows a decrease in the size of the slumpflow in the bamboo leaf ash mixture, but in the 10% mixture in the concrete flow slump flow in the mixture has the same results as the 0% mixture without bamboo leaf ash, this can be possible because the bamboo leaf ash in the mixture did not burn completely at the time of making bamboo leaf ash powder.

b) Uji Kuat Tekan

In the results of the compressive strength of flowing concrete, it is concluded that flowing concrete with the addition of bamboo leaf ash can increase its compressive strength compared to concrete without mixture, this is also in line with previous research (Firmansyah & Sri Handoyo, 2022) which said that concrete mixtures with a percentage of 0%, 2.5% 6%, 8.5% and 10% with partial cement replacement using bamboo leaf ash with superplasticizer can increase the compressive strength of concrete, while in research (Faturohman Hidayat et al., 2021) the addition of too much bamboo leaf ash can also reduce the compressive strength of concrete due to the absence of an adhesive reaction between cement and bamboo leaf ash, 2021) the addition of too much bamboo leaf ash can also reduce the compressive strength of concrete, this is due to the absence of an adhesive reaction between cement and bamboo leaf ash.

7. Conclusion

The use of bamboo leaf ash used as a partial substitute for cement can affect the compressive strength of concrete and after testing it can be concluded that:

1. The use of bamboo leaf ash in flowable concrete can increase the compressive strength of concrete at a certain percentage level.
2. The maximum content weight result is found in the 2.5% mixture which has a content weight of 2552.9 kg/cm3.
3. The maximum compressive strength at the age of 7 days is found in a mixture of 2.5 Percent which is 14.78 Mpa, at this age bamboo leaf ash has not been able to react with cement because bamboo leaf ash has the property that the longer the age of the concrete, the stronger it will be for its compressive strength (long term strength).
4. The maximum compressive strength for the age of 21 days is found in a mixture of 8.5%, which is 15.52 Mpa, while for the age of 28 days of concrete, the maximum

compressive strength result is 21.43 Mpa, this occurs in a concrete mixture with a variation of 8.5%.

8. Acknowledgement (Times New Roman, 14pt, Bold, 1.15 lines spacing)

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realizes that this paper is far from perfect and there are still many mistakes and shortcomings in it. For that, it is hoped that criticism and suggestions from readers Then if there are many mistakes in this paper, please apologize profusely.

References

Agusta, R., & Juara, A. (2020). Pengaruh Penggunaan Abu Bambu Sebagai Pengganti Sebagian Semen Dan Batu Kapur Sebagai Pengganti Sebagai Agregat Kasar Terhadap Kuat Tekan Beton. *Teras Issn 1693-380x*, *10*(2), 38–51.

Artaningsih, N. K. (2012). Pemanfaatan Bambu pada Konstruksi Bangunan Berdampak Positif bagi Lingkungan.

ASTM C29-78. (1997). *Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate. In Department of Distance.*

ASTM C-33. (1986). *Standard Specification for Concrete Aggregates. United States : American Standard Testing and Material.*

ASTM C117-76. (1995). *Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing. In Department of Distance.*

ASTM C128-73. (2001a). *Standart Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate. In Department of Distance.*

ASTM 136-06. (2012). *Standard Test Method for Sieve Analysis of Fine and Coarse Agregates. In Department of Distance.*

ASTM C566-71. (1997). *Standard Test Method for Total Evaporable Moisture Content of Aggregate. In Department of Distance.*

ASTM C131-71. (1997). *Standard Test Method for* ASTM C566-71. (1997). *Standard Test Method for Total Evaporable Moisture Content of Aggregate. In Department of Distance. Department of Distance.*

ASTM C191-08. (2008). *Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle. In Department of Distance.*

ASTM C40-23. (2008). *Standard Test Method for Organic Impurities in Fine Aggregates for Concrete. In Department of Distance.*

ASTM C187-23. (2008). *Standard Test Method for Amount of Water Required for Normal Consistency of Hydraulic Cement Paste. In Department of Distance.*

Faturohman Hidayat, T., Herlina, N., & Al-Huseiny, S. (2021). Akselerasi: Jurnal Ilmiah Teknik Sipil Pengaruh Penambahan Abu Arang Bambu Sebagai Bahan Tambah Pada Semen Terhadap Kuat Tekan Beton Normal. *3*(1).

Firmansyah, A., & Sri Handoyo, S. (2022). Pengaruh Penggunaan Abu Daun Bambu Sebagai Pengganti Semen Terhadap Kuat Tekan Beton Sebagai Pendukung Bahan Ajar Mata Kuliah Teknologi Beton. In *Menara : Jurnal Teknik Sipil* (Vol. 17, Issue 1).

Hardya, B., Suharto, I. H., & Faqih, N. (2021). Penambahan Abu Daun Bambu Sebagai Substitusi Material Semen Dan Serat Serabut Kelapa Sebagai Bahan Tambah Terhadap Kuat Tekan Beton. *3*(11), 1–9.

Hasri, H. (2020). *A Synthesis Nanosilica Of BambooS Leaf (Bambusa Sp.) By Using Hydrothermal Method*. *Jurnal Kartika Kimia*, *3*(2), 96–100. Https://Doi.Org/10.26874/Jkk.V3i2.56

Hilmi, R. Z., Hurriyati, R., & Lisnawati. (2018). Analisis Pengaruh Kelembaban Benda Uji Terhadap Kuat Tekan Dan Kuat Tarik Belah Beton Mutu Tinggi Dengan Metode Destructive Dan Non Destructive Tests (Compression Testing Machine Dan Hammer Tes*Ttitle*. *3*(2), 91–102.

Irfan, M. A., Rochmah, N., & Teknik, F. (2023). Pengaruh Penggunaan Serbuk Kayu Sebagai Bahan Tambah Terhadap Kuat Tekan Beton Alir *1,2*. 1621–1629.

Irfansyah, M. H., Rakhmawati, A., & Arnandha, Y. (N.D.). Studi Analisis Beton Mutu Tinggi Scc (Self Compacting Concrete) Menggunakan Campuran Limbah Marmer Dan Superplasticizer.

Nura Diana, A. I., Fansuri, S., & Deshariyanto, D. (2020). Penambahan Abu Daun Bambu Sebagai Substitusi Material Semen Terhadap Kinerja Beton. *Paduraksa: Jurnal Teknik Sipil Universitas Warmadewa*, *9*(2), 172–182. Https://Doi.Org/10.22225/Pd.9.2.1788.172-182

Nurani Rahmawati, D., & Sriyati, S. (2024). Kajian Etnobotani Tanaman Bambu Dan Pemanfaatannya Di Kampung Gombong Nyiru Kabupaten Bandung Barat Sebagai Implementasi Etnopedagogi Materi Biologi Pada Kurikulum Merdeka. *Biodik*, *10*(2), 64–79. Https://Doi.Org/10.22437/Biodik.V10i2.33674

Putro, D. S., Jumari, & Murningsih. (2014). Keanekaragaman Jenis Dan Pemanfaatan Bambu Di Desa Lopait Kabupaten Semarang Jawa Tengah. *Jurnal Biologi*, *3*(2), 71–79.

Rochmah, N., Sutriono, B., Beatrix, M., Mathias, L., Studi, P., Sipil, T., Teknik, F., Surabaya, K., Timur, J., & Alir, B. (2023). Pengaruh Limbah Abu Genteng Sebagai Bahan Tambah. *11*(1), 23–28.

Sebayang, S., Widyawati, R., & Habibie, M. (2012). Pengaruh Abu Terbang Terhadap Sifat-Sifat Mekanik Beton Alir Ringan. *Jurnal Teknik Sipil Ubl*, *3*(April), 247–256.

(Dendrocalamus Asper) Dan Bambu Wulung (Gigantochloa Atroviolacea) Dengan Perlakuan Ekstraksi. *Jurnal Ilmu Kehutanan*, *14*(1), 84. Https://Doi.Org/10.22146/Jik.57476

Yasrin, Alimuddin, & Pangabean, A. S. (2020). Pembuatan Silika Gel Dari Abu Daun Bambu Petung (Dendrocalamus Asper (Schult. F) Backer Ex Heyne) Dan Aplikasinya Untuk Adsorpsi Ion Cd (Ii). *Jurnal Atomik*, *2020*(2), 107–113.

Siskawati & Sukenti, K. (2021).Kajian Etnobotani Jenis-Jenis Bambu Sebagai Bahan Perlengkapan Rumah Tangga Dan Konstruksi Di Kabupaten Lombok Barat. Prosiding Seminar Nasional Pmei Ke V Seminar Nasional Perhimpunan Masyarakat Etnobiologi Indonesia.

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