##### Lignin extraction from Biomaterials (Alkaline extraction) (Irawin et al (2018) and Pandharipande et al. (2018)

25% wt of sodium hydroxide solution was prepared and reflux against materials. The ratio of samples to liquid is 1:20 (w/v). The reflux was conducted for 120 minutes at 170 oC. The liquor after reflux was mixed with distilled water in ratio 1:2 (v/v). 20% sulphuric acid was used to acidify the solution to ph of 2 at 60 oC. The samples is left for 24 hours, and filtered. The residue is washed with sulphuric acid and distilled water. Afterwards, the residue is dried for 26 minutes at 50-60 oC.

##### Lignin extraction from Biomaterials (Alkaline Hydrogen peroxide extraction) (Maruf et al. (2017)

1: 9 sample to solvent was recommended, for 3 hours at 100 oC, 1.5 % of hydrogen peroxide per volume of solvent. 2N of Sodium hydroxide was added till the Ph was 9. Solvent used is distilled water. After 3 hours, the filterate was filtered off the solid using a filter paper. Lignin was analysed by UV at wavelength of 280 nm.

##### Lignosulfonate synthesis

###### Peroxide-Sodium sulphate method (Li and Ge (2011)

10 g of lignin was poured into flask, stirred and temperature elevated to 50 oC for 30 minutes. Sodium hydroxide solution was added to raise the ph to 10. Subsequently, hydrogen peroxide was added dropwise to oxidise lignin. The reaction is maintained for 30 minutes and then formadehyde was added dropwise for hydromethylation for an hour. The solution was heated to 85 oC, and sodium sulphate was added to cause sulfonation for 2 hours. Finally, formaldehyde was added in drop to form copolymer for 2 hours. The reaction was cooled and ultra-filtered and dried overnight at 60 oC.

###### Sodiumbisulfite method (NAHSO4) (Ariestiana et al. (2019)

5 g of samples was added to 250 ml 0.3 M of NaHSO4, stirred and heated to 97 oC for 4 hours. The solution was filtered to achieve unreacted lignin (solid). The filterate is lignin and NAHSO4. The filterate was distilled at 100 oC till water was removed from the filtrate. 200ml of methanol solution was added to the dried filtrate and stirred for 30 minutes. Filtrate is dissolved lignin in methanol while residue is the NAHSO4. The filtrate was distilled at 70 oC.

**NEW (Setiati)**

The bagasse that has been sieved should be put on the flask and be directly refluxed inside sodium hidroxyde solvent with 2% concentration during five hours. The result of NaOH reflux is filtered, diluted, and acidized with sulfuric acid (H2SO4 98%) titration until pH=2 and set for at least eight hours until the sediment appears, then it should be filtered and dried in the oven at 70 oC. The obtained sediment is lignin. The lignin was further processed by using sodium bisulfit through sulfonation process for five hours at 100 oC. The result is processed through oven drying and heating until it formed brown powder . This powder is surfactant sodium lignosulfonate. The sulfonation results are validated by FTIR (Fourier Transform Infra Red), LCMS (Liquid Chromatograph Mass Spectrum) and NMR (Neutron Magnetic Resonance).

1. Put the bagasse inside neck flask, add natrium hydroxide until the bagasse submerged, be heated during five hours to T =

100°C

2. Separate filtrate of reflux NaOH, and dilute with water with 1:1 comparison

3. Titrate H₂SO₄, until pH = 2

4. Deposit the result of solvent titration H₂SO₄, minimum eigth hours

5. Filter and dry the sediment with oven or evaporator

6. Get the lignin composition through the result of FTIR tests

7. Put the lignin inside neck flask and add sodium bisulfite and heat during five hours in T = 100°C

8. Dry the sulfonation result with oven drying & heating until it gets the form like powder

9. Run FTIR tests to identify the component and lignosulfonate structure