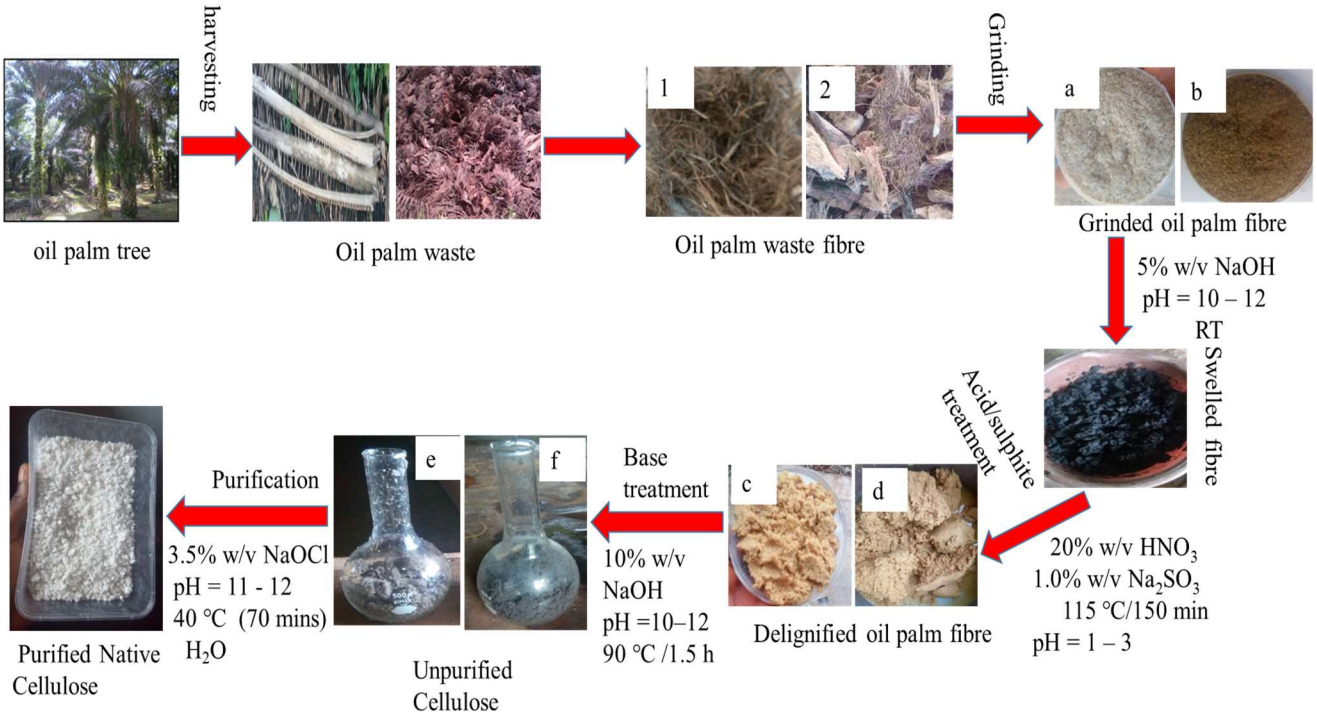


Fig S1. Detail extraction processes of cellulose from oil palm empty fruit bunch, OPEFB, and oil palm frond, OPF, (oil palm waste) (1) oil palm frond fibre, (2) oil palm empty fruit bunch fibre, (a) grinded OPEFB fibre, (b) grinded OPF fibre, (c) OPEFB pulp, (d) OPF pulp, (e) OPEFB cellulose and (f) OPF cellulose

1. Extraction of Cellulose

The samples (OPF and OPEFB fibres) were pre-treated according to Abdul Khali et al. [1] with little modification. The OPEFB fibre was pre-treated by added NaOH (300 mL; 5 w/v%) to 20 g OPF fibre. The mixture was stirred with glass rod and left for 3 h at ambient temperature before filtered and washed with water 7 times. The fibre was hydrolysed by 2 w/v% HCl (200 mL) at 98 ºC for 1.5 h. It was filtered and further hydrolysed by 3 %w/v NaOH (200 mL) at 101 º C for 2 h 10 min. To the pre-treated fibre, 20 w/v% nitric acid (200 mL) and 1.0 w/v% anhydrous sodium sulphite (200 mL) were added and heated at 115 °C for 150 min before filtered and washed with distilled water. The fibre was hydrolysed further by 10 wt % sodium hydroxide (200 mL) at 90 ºC for 1.5 h. The pulp was filtered and washed with distilled water and bleached by sodium hypochlorite (100 mL) at 40 ℃ for 70 min. The extracted cellulose from OPEFB (NCB) was washed with distilled water six times before washed with 1.5 wt% NaOH (200 mL) followed by distilled water five times and air dried for 72 h. OPF was treated in a similar manner. The isolated cellulose from OPF was denoted NCF.

2. Cellulose Extraction

The pre-treatment stage ensures removal of wax, hemicellulose, extractive and the disruption of lignin structure while the extraction process leads to the isolation of native cellulose from OPEFB and OPF fibres. During delignification, acid-sulphite solvent penetrates into the fibre lamella to aid delignification from the primary wall which proceed rapidly from the outer to the inner cell wall layers. The delignification promotes cleavage of ether bonds and removal of lignin polymer. The rate of delignification depends on a number of factors such as absorption of solvent, temperature, rate of agitation and solvent concentrations [2]. The alkaline treatment removed hemicellulose, residual lignin and promotes pulp uniformity as a result of high swelling capabilities [3]. The Sulphite also enhances the brightness of the pulp. The bleaching process removed residual lignin via oxidation.

References

[1] H. Abdul Khali, Y. Davoudpour, M. Islam, A. Mustapha, K. Sudesh, R. Dungani, M. Jawaid, Production and Modification of Nanofibrillated Cellulose Using Various Mechanical Processes: A Review. Carbohydr. Polym. 99 (2014) 649–665. http://dx.doi.org/10.1016/j.carbpol.2013.08.069.

[2] S.M. Ajayi, S.O. Olusanya, K.O. Sodeinde, E.G. Olumayede, O.S. Lawal, A.E. Didunyemi, M.O. Atunde, D.P. Fapojuwo, 2022. Application of hydrophobically modified cellulose from oil palm frond in Pickering emulsions stabilization. Carbohydr. Polym. Technol. Appl. 4, 100248. https://doi.org/10.1016/j.carpta.2022.100248.

[3] S.M. Ajayi, S.O. Olusanya, K.O. Sodeinde, A.E. Didunyemi, M.O. Atunde, D.P. Fapojuwo, E.G. Olumayede, O.S. Lawal, 2023. Hydrophobic modification of cellulose from oil palm empty fruit bunch: Characterization and application in Pickering emulsions stabilization. Carbohydr. Carbohydr. Polym. Technol. Appl. 5, 100282. https://doi.org/10.1016/j.carpta.2023.100282.