SIIC057

A COMPARATIVE STUDY OF HYDROTHERMAL TREATMENT FOR VALUE-ADDED PRODUCT FROM VARIOUS TYPE OF BIOMASS

Aida Nadiah Hazeli[1] and Dr Siti Sabrina Mohd Sukri[2]
[1]Faculty of Chemical Engineering, Universiti Teknologi MARA Pulau Pinang, 13500 Permatang Pauh, Pulau Pinang Malaysia
[2] Faculty of Chemical Engineering, Universiti Teknologi MARA Pulau Pinang, 13500 Permatang Pauh, Pulau Pinang Malaysia

**Corresponding author: sabrina715@ uitm.edu.my*

Abstract:
Biomass is an abundance waste in Malaysia which comes from the plant residue, agricultural waste and forestry. İt is also known as potential feedstock that can be utilized into value-added products. However, the presence of lignin in lignocellulosic biomass must be depolymerized before cellulose and hemicellulose are converted into simple sugars. Therefore pretreatment is required to alter the structure. Different pretreatment would gives different result of composition. The objective of this study was to compare the efficiency of different pretreatment on producing value-added product from various biomass. In addition, to find a low cost, efficient and enviromentally friendly pretreatment technique in producing high yield of value-added products. Basically, in this comparative study showed that percentage of lignin and hemicellulose are reduced after pretreatment. For instance, the results of pretreated bagasse with hydrothermal treatment showed 29.2% lignin from 31% and 5.4% hemicellulose from 48%. This is due to the lignin removal and hence the hemicellulose is easily hydrolyzed. However, the cellulose composition increase after pretreatment because of the solubilization of hemicellulose enhanced the enzyme accessibility of cellulose. The composition of lignocellulosic was analyzed by using the standard procedure National Renewable Energy Laboratory (NREL). Besides, the the SEM images showed that most of the lignin and hemicellulose content decreases as there was a changes on the biomass surface. It implied that all the pretreatment has done its job until the value-added product is produced. However, as referred to the goal, hydrothermal treatment does not require any chemical or catalyst and can save cost as well compared to chemical pretreatment. Therefore, hydrothermal treatment is the most convenient method for the conversion of valuable product.

***Keywords*:**
Hydrothermal treatment; value-added product; lignocellulosic biomass; lignin; hemicellulose

Objectives:

- To compare the efficiency of different pretreatment on producing value-added products from various type of biomass.
- To find a low cost, efficient and environmentally friendly pretreatment in producing high yield of value-added products.

Methodology:

Raw material was prepared physically such as washing,

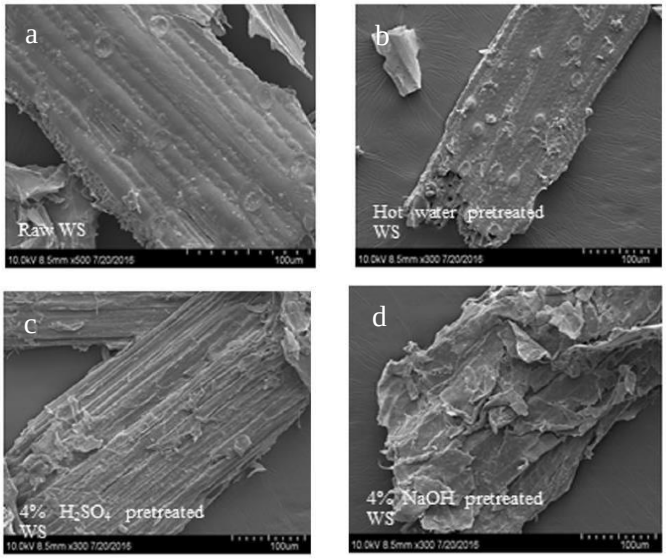
Undergo different pretreatment which are hydrothermal treatment, acid and alkali .pretreatment.

Value-added product was analyzed using UV-Vis Spectrometer.

Structural changes before and after pretreatment was analyzed using Scanning Electron Microscopy (SEM)

Results:

SEM images of structural changes before and after pretreatment



Results of different pretreatments on value-added product yield.			
Wheat straw	Hydrothermal	121°C/60 min	38.15% glucose recovery, 20.11% xylose recovery
	Acid	0.4% (w/v) H_2SO_4 140°C/60 min Subsequent: Enzymatic hydrolysis 50°C/120 h	- Solid fraction: 25 g/L glucose, 69.1% sugar recovery - Liquid fraction: 13.26 g/L xylose, 53.8% xylose recovery, 1.31 g/L acetic acid, 0.35 g/L furfural
	Alkali	1% NaOH 121°C/90 min Subsequent: Enzymatic hydrolysis 55°C 30 h	Solid fraction: 57.33% cellulose, 14.33% hemicellulose, 11.7% lignin 350.03 mg reducing sugar/g substrate

Conclusion:

In conclude, different pretreatments have their advantages and disadvantages. Based on the comparative analysis, lignin was efficiently extracted by alkaline pretreatment compared to acid pretreatment that was more effective in hemicellulose hydrolysis. Nevertheless, hydrothermal pretreatment removes most of hemicellulose in the biomass. From the comparison discussed and SEM images, it can be observed that the majority of the biomass' lignin and hemicellulose content decreases while the content of cellulose increases after pretreatment. It indicates that all the pretreatment has done its job until the biomass produces the value-added product further. In addition, pretreatment which yields high sugar or other products would be better. However, the goal of pretreatment other than alter the lignocellulosic structure is to meet a method which is more conventional in term of low cost and environmentally friendly which was hydrothermal pretreatment. In this study, the objectives were achieved as to compare the efficiency of different pretreatment on producing value-added product from various biomass and to find a convenient pretreatment technique for the product yield.