# Effect of Pretreatment Techniques on the Catalytic Conversion of Hazelnut Shells in to Chemicals Using $FeCl_3$ catalyst

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In recent years, the production of some value-added chemicals from renewable sources, such as biomass-derived carbohydrates, has gained interest. Lignocellulosic biomass, such as agro-industrial residues is potential sustainable feedstock to produce monomeric sugars for further conversion to bio-based chemicals. However, the presence of lignin makes the access of enzymatic or chemical catalysts to cellulose or hemicellulose difficult, thus reducing the efficiency of the hydrolysis, and further conversion of monomeric sugars into the chemicals. Therefore, an effective pretreatment method is necessary to liberate carbohydrates from lignin [1]..

The aim of this study was to investigate the effect of different pretreatment techniques (liquid hot water (LHW), acid and alkali) on the catalytic conversion of hazelnut shells using FeCl3 catalyst. For this purpose, raw biomass was pretreated with LHW (160°C, 15 min.), $H_2SO_4$ (120°C, 10 min, 0.5% $H_2SO_4$), NaOH (120°C, 30 min, 1.5% NaOH). Pretreated biomass was further converted into chemicals using 001 M FeCl3 catalyst at 180$^o$C. All the pretreatments and conversion reactions were conducted in the stainless steel reactor under $N_2$ atmosphere. Samples were taken from reactor for the analyses at certain time intervals (15, 30, 60, 90, 120 and 150 min). Compositions of liquid products (glucose, xylose, furfural, formic acid, levunilic acid and HMF) were analyzed by high-performance liquid chromatography (HPLC).

This study showed that different pretreatment methods have different impact on the catalytic conversion. Glucose and xylose amounts decreased with treatment time due to the conversion into other chemicals (such as HMF and furfural). Furfural productivity was decreased by all the pretreatments, because of the hemicellulose removal of pretreatments. HMF productivity was increased with all the pretreatment methods. Alkali pretreatment led to maximize the production of HMF. While HMF yield was 6.23 mg/unpretreated biomass, it was increased to 8.71 mg with alkali, followed by LHW (8.62 mg/g biomass) and acid (8.43 mg/g biomass) pretreatments at the same conditions. Major impact of the pretreatment methods was observed for the levunilic acid. Levunilic acid yield increased from 0.78 mg to 3.47 mg with LHW pretreatments.

**References**

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**Acknowledgement**: This study was supported by Anadolu University Scientific Research Projects Commission under the grant no: 1602F074