

# Effect of sequential hydrothermal and alkaline solution pretreatments on enzymatic hydrolysis of hazelnut shells

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*Abstract*— Hydrothermal and alkali pretreatments were applied to hazelnut shells to investigate the effect of the individual and sequential combinations of these two pretreatments on the enzymatic hydrolysis of the biomass. Sequential pretreatments were found to be more effective in altering the chemical composition and improving the digestibility of the biomass compared to single pretreatments. The effectiveness of the process was influenced substantially not only by utilization of sequential pretreatments but also by the order they were applied. Liquid hot water (LHW) pretreatment ensured mainly the solubilization of hemicellulose, while alkali pretreatment resulted in an effective removal of lignin. Combinations of these two pretreatments resulted in efficient elimination of both lignin and hemicellulose components of the biomass. Treating high lignin containing hazelnut shells firstly with an alkaline solution and then with LHW pretreatment exhibited an effective removal of lignin and then improved solubilization of hemicellulose by keeping cellulose recovery as high as 79%. Moreover, upon enzymatic hydrolysis, samples undergone Alkali+LHW pretreatment displayed highest glucose production (153 mg/g substrate) and highest glucose recovery (53.23%).

*Keywords*— *Alkali pretreatment, Lhw pretreatment, Biomass, Sequence pretreatment, Enzymatic hydrolysis*