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The degradation compounds formed during pretreatment when lignocellulosic biomass is processed to ethanol or other biorefinery products include furans, phenolics, organic acids, as well as mono- and oligomeric pentoses and hexoses. Depending on the reaction conditions glucose can be converted to 5-(hydroxymethyl)-2-furaldehyde (HMF) and/or levulinic acid, formic acid and different phenolics at elevated temperatures. Correspondingly, xylose can follow different reaction mechanisms resulting in the formation of furan-2-carbaldehyde (furfural) and/or various C-1 and C-4 compounds. At least four routes for the formation of HMF from glucose and three routes for furfural formation from xylose are possible. In addition, new findings show that biomass monosaccharides themselves can react further to form pseudo-lignin and humins as well as a wide array of other compounds when exposed to high temperatures. Hence, several aldehydes and ketones and many different organic acids and aromatic compounds may be generated during hydrothermal treatment of lignocellulosic biomass. The reaction mechanisms are of interest because the very same compounds that are possible inhibitors for biomass processing enzymes and microorganisms may be valuable biobased chemicals. Hence a new potential for industrial scale synthesis of chemicals has emerged. A better understanding of the reaction mechanisms and the impact of the reaction conditions on the product formation is thus a prerequisite for designing better biomass processing strategies and forms an important basis for the development of new biorefinery products from lignocellulosic biomass as well.

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