Short Ozonation of Lignocellulosic Waste as Energetically Favorable Pretreatment

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Abstract:

Lignocellulosic waste (here municipal trimming) is a promising sustainable feedstock for ethanol production, but require costly and polluting pretreatment, often resulting toxic byproducts. Ozonation is a nonpolluting, effective pretreatment method, but is commercially unused due to the high energy required for the production of the high ozone doses assumed needed. Our results demonstrate low-dose ozonation (15and 90 min, accumulated TOD=318 and 1114 mgO3/L) of water-submerged waste could result in effective high enzymatic saccharification efficiency (31%, 42%, respectively, of the cellulose fraction converted to glucose) compared to non-ozonized sample (12%) although only 20% to 40% of the lignin was degraded, respectively. These results suggest ozonation could offer an effective and feasible pretreatment method, showing that there is no need for delignification (as opposed to the common hypothesis) for high sugar release. In addition, the ozonation process was accompanied by changes in absorbance, mainly at 280 nm, making it a useful tool for process monitoring. Net calculated energy balance was positive for all ozonation regimes, with increased process efficiency at lower ozone doses. Furthermore, ozonation can be generated on-site and on demand, enabling decentralized pretreatment operated near the feed source thus overcoming transportation costs.