1) Lignocellulosic material, which composes most plant cell walls, quote – is a widely used source of biomass for energy production – unquote.
2) This kind of material is, quote – usually burned directly for heat and energy production or converted to other types of fuel – unquote. This is the case with the burning of wood for heat or as in this study, the conversion to ethanol.
3) Limited supplies of fossil fuels and recent international accords to counteract global warming have lead to an increased interest in biomass energy sources.
4) Lignocellulosic biomass has great potential as an energy source because it is widely available, renewable, and inexpensive.
5) Plant cell walls are composed of, quote – about 75 percent polysaccharides that could be used for ethanol production – unquote.
6) The process of turning biomass into ethanol fuel requires thee steps: quote – pretreatment of biomass, hydrolysis of cellulose to sugars, and fermentation of sugars to ethanol – unquote.
7) Pretreatment requires breaking down the, quote – biomass structure to gain access to the sugars from cellulose and hemicellulose – unquote.
8) Many pretreatment procedures have been attempted in the past which fall into three categories: biological, chemical, and physical or a combination thereof.
9) Unfortunately, quote – there is no ideal pretreatment method, ... the method must be adapted to each specific lignocellulosic biomass – unquote.
10) Biological pretreatments typically involve the use of fungi to, quote – degrade hemicellulose and lignin however, the method is ineffective due to low hydrolysis rate – unquote.
11) Physical methods usually involve grinding, pulverizing, or otherwise increasing surface area and often require use in conjunction with other pretreatments.
12) Chemical pretreatments can involve any number of substances used to breakdown the cell structure, but they are often prohibitively expensive on a large scale.
13) Prior investigations have also tested the effect of operating one of the primary pretreatments under a controlled environment of increased pressure and/or temperature, with promising results.
14) This test sought to analyze the effectiveness of explosive decompression as a means of pretreatment and to compare the effect of using Nitrogen and Air as the working medium.
15) The explosive decompression concept involves placing biomass under pressure significantly higher than standard atmosphere and allowing the working medium to impregnate the cells at high pressure. The pressure is then rapidly reduced back to atmospheric pressure. The drastic pressure change leads to cell rupture.
16) For this trial, Barley straw was dried to, quote – a moisture content less than 10 percent and ground ... to a particle-size 1 mm or less – unquote. It was then placed in multiple test environments containing either Nitrogen or Air at differing temperatures and pressures. The subsequent pretreated biomasses were then analyzed for glucose content and fermented into ethanol.
17) Results from the trails indicated that air was not well suited for explosive decompression. No positive benefit was observed when compared to the control sample.
18) Nitrogen, on the other hand, exhibited, quote – a sharp 218 percent increase in glucose yield – unquote, as temperatures were raised from 100C to 150C. At 150C, the Nitrogen offered, quote – 95 percent higher glucose yield than when using explosive decompression with compressed air or autohydrolysis – unquote.
19) The author concludes that explosive decompression with nitrogen gas can efficiently pretreat barley biomass for ethanol production which indicates that nitrogen explosive decompression may be viable for the lysis of other plant cells.

Publication: “Explosive decompression pretreatment: nitrogen vs. compressed air”. M. Raud, V. Rooni, and T. Kikas. PDF. 2016.

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