Modified Expression of Genes Significantly Reduces Recalcitrance of Lignocellulosic Biomass

TECHNOLOGY CASE

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PATENT INFORMATION

Patent Pending

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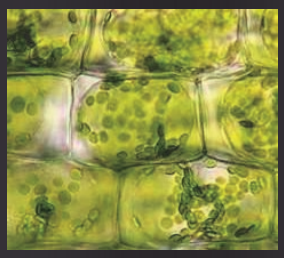

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Introduction

Biomass is a renewable resource that has shown promise to replace petroleum based fuels, while reducing green house gas emissions. The plant cell walls, which are the dominant component of feedstocks, contain polysaccharides such as cellulose, heteroxylans, and glucomannans that can ultimately be converted to fuel. However, the production of biomass-based fuels has not been cost competitive relative to oil or other energy resources. A key challenge is cell walls have built up a natural protection (or recalcitrance) that makes the process of converting polysaccharides to fermentable sugars inefficient.

Summary

Researchers at the University of Georgia have has discovered a way to modify plant genes in order to improve the efficiency of converting biomass into biofuels. The researchers have developed a method for identifying candidate plants that can be modified to be more amenable to the conversion process. The present invention includes methods for altering the expression of any of the coding regions encoding relevant polypeptides.

This invention seeks to improve the plant to fuel conversion by modifying the genes of plants to then make the saccharides easier to process. Specifically, the researchers have shown that biofuel crops can be manipulated via genetic transformation or directed breeding to produce plants that have non-functional copies of a very important gene associated with certain tranferases . The expression of these genes in plants contributes to lignocellulosic recalcitrane to saccharification. Mutant plants engineered to have no functional copies of one member of the gene family produce secondary side walls that contain glucuronoylan with much reduced levels of 4-o-methyl-glucuronic acid and much higher levels of un-methylated gluronic acid.

Furthermore, lignocellulosic material from mutant stems show differences in resistance to enzyme catalyzed saccharification when compared to lignocellulosic material prepared from the steps of wild type plants. As result, biofuel plants lacking such genes or that have reduced levels of their expression will provide improved lignocelluslosic feedstock for the cost-effective production of liquid biofuels.

Two different techniques were successfully employed to alter the expression of the corresponding coding region, supporting the versatility of the technology.

Advantages and Some Potential Applications

- Includes methods for generating and/or identifying biofuel plant lines containing heteroxylans with altered side chain structure.
- The present invention includes diverse methods for altering the expression of any of the coding regions encoding relevant polypeptides, thus enhancing the applicability of the technology in different plant species.
- Biomass that are candidates for these modifications include, but are not limited to, hardwoods such as birch, poplar, aspen and cottonwood, as well as softwoods including fir, pine, willow and spruce.

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