The Use of Monoclonal Antibodies in Biomass Characterization and Quantitation

TECHNOLOGY CASE
1652

INVENTORS

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ADDITIONAL INFORMATION

Please, refer to the following links, for complete MAb characterization and reactivity data:

http://glycomics.ccrc.uga.edu/wall2/antibodies/antibodyHome.html

http://glycomics.ccrc.uga.edu/wall2/jsp/abIndex.jsp

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Introduction

Plant cell walls are the most abundant component of biomass. The plant cell wall, largely consisting of a mixture of complex polysaccharides, provides the starting material for the production of bio-fuels, such as cellulosic-ethanol. Biomass is also the most prominent starting material for the production of other "green commodities", such as long-chain alcohols, biodiesel, and biochemical of industrial interest such as succinate, pyruvate, amino-acids, solvents, etc., and from several processes such as (a) biomass fermentation, (b) biomass hydrolysis or (c) biomass torrefaction, to name a few.

In order to optimize bio-fuel production, a detailed understanding of plant cell wall structure and its alteration during normal growth and development is necessary. Furthermore, rapid high throughput screens for cell wall changes on a global scale would facilitate the development of less recalcitrant biomass (i.e., biomass with reduced levels of lignin and pectin, or with modified lignin/pectin structures that are less conducive to recalcitrance). Monoclonal antibodies (MAbs) that specifically recognize diverse cell wall polymers are powerful tools that can be applied to biomass characterization.

Also, QC of biomass to be used for the production of biofuels or other commodities is necessary given the susceptibility of biomass to have its composition changed during growth by several factors (climate, soil composition, irrigation practices, etc.). Processing of biomass needs to be adjusted according to the composition of the mixture of individual sugars present in each individual batch of biomass to be processed. Consequently, continuous monitoring and quantitation of biomass composition is essential for companies that use this starting material for the production of commodities such as biofuels. The technology described herein addresses this need.

Summary

UGA researchers developed a library of ~200 MAbs that recognize epitope structures characteristic of most major plant cell wall polysaccharides. These MAbs are monospecific with regard to the structure that they bind. They can provide temporal and spatial information about plant cell wall structures at the whole plant, tissue, cell, and sub-cellular levels and can be used to monitor and define changes in wall structure arising from developmental, environmental, and mutational influences. As importantly, MAbs can be used for qualitative and quantitative detection of carbohydrate epitopes in plant extracts. In this document, we describe how MAbs can be used for characterization of biomass materials especially with regards to monitoring changes in cell wall structure that might impact biomass recalcitrance.

Consequently, a method for the quantification of polysaccharides and a kit embodying such method are described in this document. This method/kit combination has a tremendous potential to impact research in biomass development and optimization and potential applicability in quality control for biomass utilization in the paper/pulp, biofuels and "green commodities" industry.

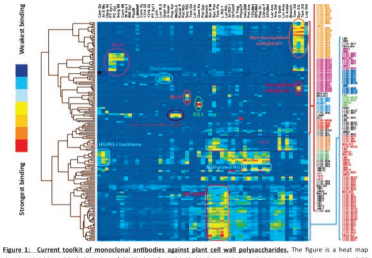
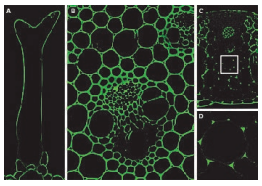
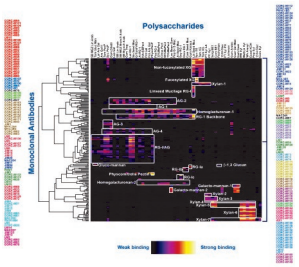


Figure 1: Current toolkit of monoclonal antibodies against plant cell wall polysaccharides. The figure is a heat map showing the hierarchical clustering of ELISA data from MCAb binding studies carried out using a diverse panel of 55





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