Genetically Modified Organisms

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Can biofuels finally take center stage?

GM techniques offer the potential to increase the efficiency of biofuel production.

The report sets out the potential for converting lignocellulose into biofuels for transport (ethanol and biodeisel). Lignocellulose forms the woody part of plant cells. Dry wood typically consists of 40–50% cellulose, 25% hemicelluloses and 25–30% lignins and has evolved to resist biodegradation. Moulds insects, ruminants and some bacteria have evolved to convert lignocellulose into useable glucose in their digestive processes.

Converting lignocellulose into the feedstock for fermentation would require that woody material be degraded into fermentable forms or forms which are easily converted into fuel feedstock in chemical processes. At present, this degradation is achieved very slowly using enzymes (cellulases). These enzymes are expensive and produce a range of different sugars from the feedstock.

Attention is focussed on producing GM microorganisms which degrade lignocellulose, which can tackle the degradation products and which produce ethanol or ethyl esters as the primary metabolic by-products. The GM technology required to incorporate lignocellulose enzymes into microorganisms is beginning to emerge. Most likely these microorganisms would produce the enzymes in fermentation plants but another possibility would be to add the GM bacteria directly to wood pulp.
Comment
Developing new microorganisms that produce cellulases is clearly risky if they are viable outside the industrial process. Cellulase producing organisms are already ubiquitous in the environment. A new source would need to be highly virulent if it were to make a significant impact on wood degradation.

Less immediately risky would be the development of plants (e.g. algae) with more facile lignocellulose degradation [but such plants could promote the evolution of novel lignocellulose consuming organisms.]

Although ethanol production from sugar cane is much more facile, wood can be grown in much more diverse environments and provides a more direct rout to other forms of fuel.