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Syngas Fermentations - A More Efficient route to Ethanol and Biobased Products

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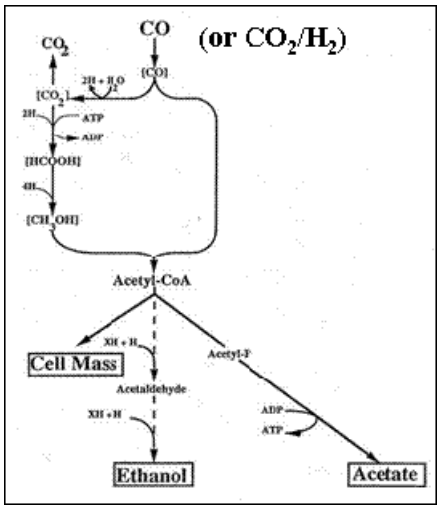
Bioethanol and biobased products have the potential to make a large impact on petroleum dependence. Conversion of corn grain and sugar cane to ethanol is growing rapidly in several regions of the world. There has been a lot of interest in producing cellulosic ethanol from agricultural residues to avoid competition with food. We report that an alternative pathway based on syngas fermentations could have an even larger impact than cellulosic ethanol. Syngas, also called synthesis gas, is a mixture of hydrogen, carbon monoxide, and carbon dioxide. Syngas is readily produced from biomass including agricultural residues, wood, and forest product residues. The advantage of syngas rather than cellulosic sugars, is that syngas also utilizes the lignin component of the biomass. Lignin, can account for up to half of the energy content in the biomass. Therefore, syngas fermentations could produce more ethanol than the cellulosic ethanol processes from the same quantity of biomass. We are developing the capabilities to produce ethanol and biobased products by syngas fermentations.

The work includes selecting, adapting, and engineering anaerobic bacteria, designing microbial support systems to optimize biocatalyst performance, and developing integrated process technologies to recovery the product from the fermentation. We include models of the benefits of syngas fermentation. Our models indicate that syngas fermentations offer significant economic advantages over cellulosic ethanol. In addition, syngas fermentations expand the available feedstock to include the forest product industries, and therefore, expand the regions that produce biobased feedstocks.



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