# Production of butanol from cellulosic biomass

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## Introduction

To comply with the EU directive for biofuels, new technologies to enable sufficient supply of diesel-compatible biofuels from cheap biomass are needed. Besides the presently available, but expensive, biodiesel from vegetable oils, the most challenging option is the production of Fischer Tropsch biodiesel. This thermochemical conversion technology is specifically suited for large-scale application because of high investment requirements.
The fermentation of cellulosic biomass to butanol as an improved ABE (acetone, butanol, ethanol) fermentation, provides here an elegant alternative as bioprocesses can be cost effective in small-scale production units enabling local production.

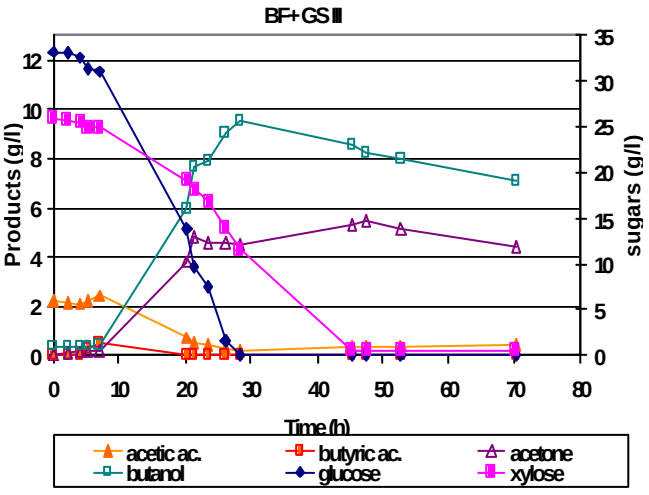


*Fig. 1 ABE fermentation by Clostridium sp. Common substrates are glucose, xylose, arabinose, mixtures of hexose and pentose sugars, starch and xylan.*

## Objective

The final objective is to provide biodiesel at a cost between fossil diesel and FAME, i.e. € 250-500/ $m^3$.


*Fig. 2 Cultures of C. beijerinckii wild type (wt) and transformants on basal medium with lichenan at 2% (w/v).*

## Approach

The key features of this new bioprocess include the use of cellulosic material as substrate, butanol as the only fermentation product and high cell-density fermentation with in-line product recovery.
Since the genome of *C. acetobutylicum* has been sequenced and analysed, there is now the opportunity to extend substrate utilisation from the current hexose, pentose and starch utilisation to include cellulose (Fig.2). Also, the metabolism can be modified to single product (butanol) formation, using the available genetic toolbox. Furthermore, in process technology, new procedures and materials (e.g. membranes) have been developed which allow extensive improvement of volumetric productivity and product recovery.

## Further research

Research on ABE fermentation is presently supported by the Bsik Programme which is supported by the Ministery of Economic Affairs, The Netherlands. A STREP, BioButanol, is in preparation for submission in EU FP-6.

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