Using *Corynebacterium glutamicum* to Produce Chemicals from Biorenewable Feed Stocks

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Introduction

Microbial fermentation is regarded as a sustainable method for producing chemicals from lingo cellulosic biomass, which contains complex carbon sources such as glucose, xylose, and menthol as well as other non-renewable fossil fuels. Among them, superior non-food sustainable carbon substrates that can be successfully produced for microbe based bio production include xylose, methanol, arabinose, glycerol, and other alternative feed stocks. A model gram positive bacterium called *Corynebacterium glutamicum* has undergone significant engineering to manufacture amino acids and other compounds. Recently, *C. glutamicum* has also been developed to widen its substrate spectrum in order to lower production costs and prevent competing for human meals. *C. glutamicum* can rapidly catabolize a variety of carbon sources by enhancing endogenous metabolic pathways or constructing heterologous ones. This review sums up current developments in *C. glutamicum* metabolic engineering toward a wide substrate spectrum and diversified chemical synthesis. Utilizing complex hybrid carbon sources obtained from lignocellulose biomass indicates the future path for renewable feed stocks used in industries other than food.

Description

Due to its capacity to secrete amino acids, which are commonly utilised as medications or health products, *Corynebacterium glutamicum* has been extensively employed for bio based chemical manufacturing. The annual market value of these amino acids and the compounds they give rise to is in the billions. The creation of modified strains with improved production performance is a developing area that has drawn many researchers. Particularly, due to the quick advancement of gene editing and fermentation manipulation techniques, the majority of amino acids, including L-glutamate, L-lysine, L-arginine, L-valine, and L-ornithine, have reached industrial scale synthesis. Applications that profit from the use of biologically safe *C. glutamicum* include human nutrition, food additives, and medication manufacturing.

In addition to producing useful products like amino acids, *C. glutamicum* has also undergone substantial modification to create a wide range of other goods, such as bulk chemicals, natural goods, polymers, proteins, and biofuels. This rapid progress has benefited from the depletion of fossil fuels and the anthropogenic climate change brought on by the emission of harmful gases from the breakdown of oil, which has historically been the primary source of produced chemicals. However, *C. glutamicum*'s bio based manufacture of metabolites requires significant amounts of glucose, which is produced during the hydrolysis reaction of starch, making humans and *C. glutamicum* competitors for food. For the cultivation of industrial model strains, it is crucial to utilise alternate renewable carbon sources, such as agricultural wastes, industrial wastes, and others. The focus of study has recently switched to the bio based generation of metabolites from renewable non-food feed stocks. The most recent developments in exploiting alternate C-resources, such as xylose, arabinose, methanol, glycerol and mannitol, to make high-value compounds using *C. glutamicum* are outlined here.

Conclusion

A summary of non-food carbon sources for *C. glutamicum* fermentation culture and chemical output was provided. Xylose, methanol, arabinose, glycerol, mannitol, N-acetyl glucosamine, cellobiose, and cellulose hydrolyses are just a few of the feed stocks that can be used to make bio based compounds. The issue of food competition between industrial fermentation and human nutrition is anticipated to be resolved by microbial fermentation employing these substrates. However, there are still a lot of technological obstacles in the way of these carbon sources' actual use. To meet the needs of industrial fermentation, C. glutamicum's resistance to hazardous substances including methanol and cellulose hydrolyte needs to be further improved. Fermentation inhibitors, such as furfurals and phenolic aldehydes produced during cellulose's dilute acid hydrolysis, constitute a significant barrier to cellulose conversion. For the fermentation cultivation of *C. glutamicum* and chemical production, non-food carbon sources were compiled. These feed stocks, which also include cellobiose, methanol, arabinose, glycerol, mannitol, N-acetylglucosamine, and cellulose hydrolyzates, offer different and renewable substrates for the production of bio based compounds. It is anticipated that microbial fermentation employing these substrates will reduce the issue of food competition between industrial fermentation and human nutrition. The practical implementation of these carbon sources still faces numerous technical obstacles, though. In order to meet the demands of industrial fermentation, *C. glutamicum's* resistance to hazardous substances like methanol and cellulose hydrolyte needs to be further improved. Important factors limiting cellulose conversion include fermentation inhibitors such furfurals and phenolic aldehydes produced during the dilute acid hydrolysis process of cellulose. Due to the high specific proportion of these substrates in oceans, using marine biomass as mannitol, mannose and trehalose is one option. Meanwhile, the use of rice straw hydrolyte will be crucial in industrial fermentation in the future, encouraged by the growth of sea rice and sand rice.

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