Potential of a probiotic yeast in lignocellulosic bioethanol production

To develop fuels that can support the worlds growing energy demand and at the same time have low negative environmental impact is crucial for the future wellbeing of the world. A promising fuel is bioethanol that is produced from agricultural waste or forest residues by living organisms.

Yeast is a small organism that probably most people have used, maybe to get the perfect texture of a cake or to make an alcoholic beer. It is the capability of the yeast to ferment, or in other words, convert sugars into ethanol or alcohol as we normally call it, that makes the yeast useful in a variety of applications. We have evaluated a yeast's potential to convert sugars in plants into ethanol, which further can be used as a fuel.

During the last decades, the global energy demand has increased as well as the awareness that fossil fuels greatly contributes to a global climate change. Alternative fuels that both support this growing energy demand and have a lower environmental impact, have therefore received interest. An example is bioethanol, which is ethanol that is a product of the biological fermentation process that occurs with yeast. It is derived from sugars in plants or plant-derived material, which is called biomass. Today, bioethanol is predominately produced from sugar cane and corn. However, this may not be desirable for ethanol production due to its primary use as food and animal feed. Therefore, lignocellulosic biomass, which is a non-food competitive biomass constituted of agricultural waste and forest residues, has received attention. However, the complexity of lignocellulosic biomass requires new solutions to develop a process which is competitive with bioethanol production from sugar cane and corn. A problem is the lignocellulosic inhibitors, which are formed during the break-down of the sugars in the biomass. They reduce the fermentation capacity of yeast and consequently the efficiency of production. A solution to increase the production efficiency is the use of enzymes to release sugars from the biomass and at the same time let the yeast ferment. But this poses some limitations, due to higher optimal temperatures for enzyme activity than of yeast. To overcome this problem, heat tolerant yeast could be used. High acidity during the fermentation could also contribute to a more efficient process, as it reduces the risk of contamination.

We studied a probiotic yeast, which when eaten can provide health benefits such as reducing diarrhea. This probiotic yeast has been proven to be able to withstand high acidity and temperatures – just as in our stomachs. We wanted to investigate if these abilities of the yeast could be advantageous for bioethanol production from lignocellulosic biomass. For this purpose, the probiotic yeast was exposed to different levels of acidity and temperatures, as well as lignocellulosic inhibitors. A yeast that is frequently used in bioethanol production was used for comparison. The results did not display any differences between the two yeast species when they were exposed to an acidic and hot environment. Neither did the probiotic yeast strain show higher ability to cope with lignocellulosic inhibitors. In conclusion, this probiotic yeast does not distinguish itself as more promising for bioethanol production under the examined circumstances.