A NOVEL CO-CULTURE SYSTEM FOR ETHANOLIC FERMENTATION FROM LIGNOCELLULOSIC SUGARS

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Co-culture of specific microbes that exploits their native capabilities of metabolizing different sugar components (glucose or xylose) from lignocellulosic hydrolysates is a promising alternative to the use of a single recombinant strain. Co-culture has the potential to simultaneously ferment both glucose and xylose to produce ethanol. Recently, research on using different co-culture systems for lignocellulosic ethanol fermentation has drawn significant interest, mainly due to their flexibility, tunability and increased resistance to environmental stress. However, up to now, very limited research has been done to investigate the dynamic properties and interactions of co-culture strains due to the lack of effective co-culture equipment and dynamic modeling tool.

In this work, we have developed a novel co-culture system for the efficient and simultaneous conversion of mixed glucose and xylose to ethanol by *Saccharomyces cerevisiae* and *Scheffersomyces stipitis*, respectively. The developed two-chambered co-culture bioreactor enables the confinement of each strain to allow the separate control and monitoring of the cell growth, as well as the independent control of optimal oxygen condition for each strain. With the developed co-culture bioreactor, we were able to conduct systematically designed experiments to investigate the properties of the co-culture system by manipulating different operating parameters, such as OUR, feed rate, and feed concentration. In addition to this, an unstructured dynamic model was developed to describe the kinetics of the co-culture system, as well as the interactions between the two strains.