EVALUATING THE IMPACT OF TOXICITIES IN HEMICELLULOSIC HYDROLYSATES DURING BIOTECHNOLOGICAL VALORISATION PROCESSES

Lipova I., Axelrud Nunes A., Bonturi N., Lahtvee P.-J.
Tallinn University of Technology
e-mail: inna.lipova@taltech.ee

Transition of economy towards sustainability requires efficient use of available resources. Hemicellulose hydrolysate is an example of such substrate as it is byproduct of many agro-industrial sectors as ethanol, pulp and paper, beverages production and, until this day, no efficient utilization has been established. One of the promising approaches is to use hemicellulose hydrolysates as a main carbon source for microbiological production to obtain high-value products. However, hemicellulosic hydrolysates contain inhibitory compounds formed during the hydrolysis processes, namely, 5-hydroxy methylfurfural (HMF), acetic acid, phenols. We have identified a non-conventional yeast *Rhodotorula toruloides* as a potential cell fatory to valorise hemicelluosic hydrolysates while naturally producing significant amount of microbial lipids and carotenoids.

Our aim was to investigate the ability of *R. toruloides* to grow in media comprising hemicellulosic hydrolysates of birch wood as a main source of carbon with different concentrations of total sugars and inhibitors. Hence, 5 batches of industrially produced hemicellulosic hydrolysates (Fibenol OÜ, Estonia) by different evaporation levels were used as a carbon sourceand diluted to the final total concentration of sugars of 70, 85, 105, and 120 g/L. Optical density and CO_2 release were monitored together with sugar consumption and level of acetic acid.

The growth and sugar consumption of *R. toruloides* showed strong reverse correlation with the concentration of undissociated form of acetic acid (HAc) present in hemocellulosic hydrolysate ($R^2 = 0.8$). Additionally, HMF showed a significant, although not as strong inhibiting effect on the growth of *R. toruloides*. Increase of total amount of sugars in media did not show inhibitory effect in our studied concentration range.

Obtained results demonstrated an inhibitory effect of acetic acid on growth of *R. toruloides* with a threshold around 1 - 1.1 g/L of undissociated form of the acid. To avoid inhibitory effect of acetic acid, starting pH should be increased to 6.0 which will decrease concentration of undissociated acetic acid, hence, remove an inhibitory effect. The results obtained with this work established guidelines for the process development of both the hydrolysate production and the microbial cultivation steps.