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Evaluation of microtiter plate as a high-throughput screening platform for beer fermentation

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Abstract:

Downscaling the anaerobic fermentation in a microtiter plate (MTP) facilitates high throughput screening (HTS) applications. This study investigates the impacts of MTP configurations (scale, shaking, and cover) on the *S. pastorianus* beer fermentation compared to that in the shaking flask (SF) and European Brewing Convention (EBC) tube regarding fermentation performances and flavor attributes. The lager strains in MTPs accelerated cells reproduction and vitalization, sugar consumption, and glycerol accumulation. The microscale beer fermentation was closer to the SF but differed greatly from EBC tube fermentation depending on the MTP configurations. The downscaling from 2 mL to 0.2 mL in MTP increased the cell growth rate and vitality but did not change the maximum cell density. The shaking MTP did not promote early growth but sustained significantly higher cell numbers at the later fermentation stage. More than 1.5-folds acetaldehyde and higher alcohols, yet less than half esters, were obtained from the MTP and SF fermentations relative to that in the EBC tube. The air-tight MTP cover, as compared to the gas-permeable cover, not only balanced the above volatile flavors but also maintained integrity to the endogenous carbon dioxide pressure during beer fermentation. Additionally, fermentative activities were reduced by excluding air in either the material or the headspace of MTP. Hence, MTP configurations influenced *S. pastorianus* beer fermentation. These influences were partly attributed to their impacts on air accessibility. Conscious of the impacts, this study helps interpret the minimized fermentation and sheds light on the development of MTP based HTS platform for anaerobic cultivations.

Keywords: yeast, fermentation, microtiter plate (MTP), high-throughput screening (HTS), flavor, beer