

### Importance of aldehyde dehydrogenase activity on the production of 3-hydroxypropionic acid from glycerol by recombinant *Klebsiella pneumoniae*

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3-hydroxypropionic acid (3-HP) can be produced from glycerol via two enzymatic reactions catalyzed by a coenzyme B<sub>12</sub>-dependent glycerol dehydratase (GDHt) and aldehyde dehydrogenase (ALDH) in *Klebsiella pneumoniae*. To examine the effect of different ALDH activity on 3-HP production, three different ALDHs, AldH from *Escherichia coli* (EaldH), PucC from *K. pneumoniae* (PucC) and KGSADH from *Azospirillum brasilense* (KGSADH), were overexpressed and compared in various recombinant *K. pneumoniae* strains disrupted the genes encoding DhaT and YqhD. When the ALDH activity was measured, KGSADH showed the highest crude cell activity of 8.0 U/mg protein which was 2 and 4 times higher than that of PucC and EaldH. In a flask culture containing 100 mM glycerol, *K. pneumoniae*  $\Delta$ dhaT (KGSADH) resulted in the highest titer (64 mM). In bioreactor studies, the *K. pneumoniae*  $\Delta$ dhaT (KGSADH) showed the 3-HP production at > 16 g/L in 48 h with a glycerol carbon yield at > 40%. In comparison, the *K. pneumoniae*  $\Delta$ dhaT (PucC) produced only 11 g/L 3-HP in 48 h with a yield of > 23%.