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A novel phosphotransferase system enzyme-IIA homologue inhibits 1, 3-propanediol production through binding to glycerol kinase in *Klebsiella pneumoniae*

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1,3-Propanediol (1,3-PD) recently has been used in various industry fields, such as the synthesis of biodegradable polyesters, polyurethanes and polyethers. Besides the chemical methods 1,3-PD can be produced through fermentation processes of glycerol in certain bacteria, including *Klebsiella pneumoniae*. Glycerol is metabolized fermentatively through two parallel pathways: The reductive and oxidative pathways. The oxidative pathway leads to the production of DHAP, while the reductive pathways leads to 1,3-PD production. Aerobically, glycerol could be up taken into bacterial cell through either by direct diffusion or glycerol facilitator protein (GlpF), then it is phosphorylated by glycerol kinase (GlpK) to become Glycerol-3-P (G3P), for being further metabolized. In Enterobacteriaceae, Phosphotransferase System (PTS) protein Enzyme-IIA^{Glc} (also called Crr, for catabolite repression resistance) was found to be the central regulator of carbon metabolism. Unphosphorylated Crr protein can bind to GlpK to inhibit its function. In our study, we found that KPN00353, a novel KpEIIA, could inhibit 1,3-PD production in *Klebsiella pneumoniae* by direct binding to GlpK. Based on the protein-protein interaction site prediction, amino acid residue Histidine-65 (His-65) is predicted to be the important residue for KpGlpK-KPN00353 binding. We then mutated this histidine residue to aspartate (H65D), glutamate (H65E), arginine (H65R) and glutamine (H65Q) to reveal the importance of His-65 residue of KPN00353 in its interaction with KpGlpK. We found that the mutated H65Q of KPN00353 has the weaker binding to KpGlpK compared to wild type KPN00353, while other mutations cause the stronger binding of KPN00353 and KpGlpK. Furthermore, we found that the stronger the binding of KPN00353 and KpGlpK, the lower the production of G3P and 1,3-PD in *Klebsiella pneumoniae*.

Biography

Novaria Sari Dewi Panjaitan is pursuing his PhD and underwent training in molecular microbiology field, specifically in *Klebsiella pneumoniae* and has published a paper regarding his recent studies about a novel gene *KPN00353*, encoding a protein homologue of enzyme II-A^{Glc} in Phosphotransferase Phosphoenolpyruvate System (PTS) in *Klebsiella pneumoniae*.

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