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Potential Biotechnology Workhorses for Novel Bioproducts Production: *Pseudomonas taiwanensis* and *Vibrio natriegens*

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In recent years, availability of cost-effective technologies that could replace fossil-based production system meeting the industrial demands is quite challenging. With the advent of genetic engineering, remarkable changes have been brought to produce industrial bioproducts deploying microbial host production systems and efforts of strain improvement and modification of microbial metabolism through genetic modification has resulted in wider range of bioconversions.

Recent trends in systems biology have provided chance of extrapolating the success of these strategies from model to non-model organisms thereby rendering them as novel host production systems that could suit bio-based industries for meeting future demands of industrial biotechnology. The prospects and limitations in exploitation of these novel host systems for industrial applications are discussed in light of technical excerpts from Blombach et al., 2021.

Newer microbes exploited as host systems

The currently used system based on *Escherichia coli* and *Saccharomyces cerevisiae*, has relative advantage due to its wide usage and optimized growth and production conditions.

Proposed novel hosts including *Pseudomonas taiwanensis*, *Vibrio natriegens*, *Paenibacillus polymyxa* and *Bacillus methanolicus* can be exploited to meet industry preferred conditions of superior growth efficiency, handling ease and adaptation to various trophic levels.

The novel hosts system provided here would face uphill task and more efforts are needed to put them as biotechnological workhorses, to make them industry ready catalysts for meeting huge production demands.

Characteristics	*Pseudomonas taiwanensis*	*Vibrio natriegens*
Growth efficiency	▪ *P. taiwanensis* strain VLB120 grow at a rate of 0.6–0.7 h^{-1} in mineral glucose medium and compared to other Pseudomonads in succinate, can increase above 1 h^{-1}. ▪ Relatively low maintenance demand compared to *Gluconobacter oxydans*. ▪ Biomass yield around 0.5 g	▪ Generation time of 9.4 - 9.8 min. ▪ Growth rate (μ) of 1.48–1.70 h^{-1} in minimal medium with glucose. ▪ Biomass yield of 0.5 g CDW/g glucose with biomass specific glucose consumption rate of 3.5–3.9 g glucose/g CDW/ h. ▪ Ferments glucose to succinate, lactate, formate, acetate, and ethanol.

	CDW/g glucose, but can drop under solvent-stress conditions.	
Tool availability	▪ Yes, Systems- and synthetic-biology tools.	▪ Yes, Genetic, synthetic biology, and metabolic engineering tools.
Handling	▪ Obligate aerobe with no production of overflow metabolites. ▪ Growth rate affected by glucose dehydrogenase abundantly active in periplasmic space and can be regulated by suppression of *gcd* gene). ▪ Glycerol as alternative substrate in engineered aromatics-producing strains has benefits of higher yield.	▪ Ease of culturing in common liquid and solid complex media supplemented with sodium ions (Hoffart et al., 2017). ▪ Storage at 4°C for a long periods affects viability
Tolerance	▪ Highly tolerant to organic solvents with a log Po/w between 2.5 and 4 (Bitzenhofer et al., 2021). ▪ Can withstand oxidative stress.	▪ *V. natriegens* being marine bacteria tolerates sea salts. ▪ Has high tolerance to selenium and used for selenium nanoparticles biosynthesis.
Metabolic capability	▪ With wide carbohydrate spectrum, serves as important hosts for the biological funneling of complex mixtures into useful products (Utomo et al., 2020). ▪ Versatile metabolism can be potentially exploited for metabolic engineering and for whole-cell biotransformation.	▪ Uses wide array of substrates including carbohydrates, polyamines, amino, carboxylic and aromatic acids, alcohols, chitin monomers as well as starch (Thoma and Blombach 2021). ▪ Capable of fixing nitrogen and perform extracellular electron transfer

Conclusion

By deploying the genomic engineering tools, the limitation of the unconventional microbial hosts is being addressed through strain development to improve the metabolic capability and production efficiency of these host systems. Although this strategy is promising they still have up key questions regarding complex cellular traits that are to be engineered, how they can be integrated in the existing pipeline of production and its possible safety implications to fit in the industrial scale-up to be clearly understood before real-time applications.

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