Immobilisation strategies for photofermentative based biological hydrogen production

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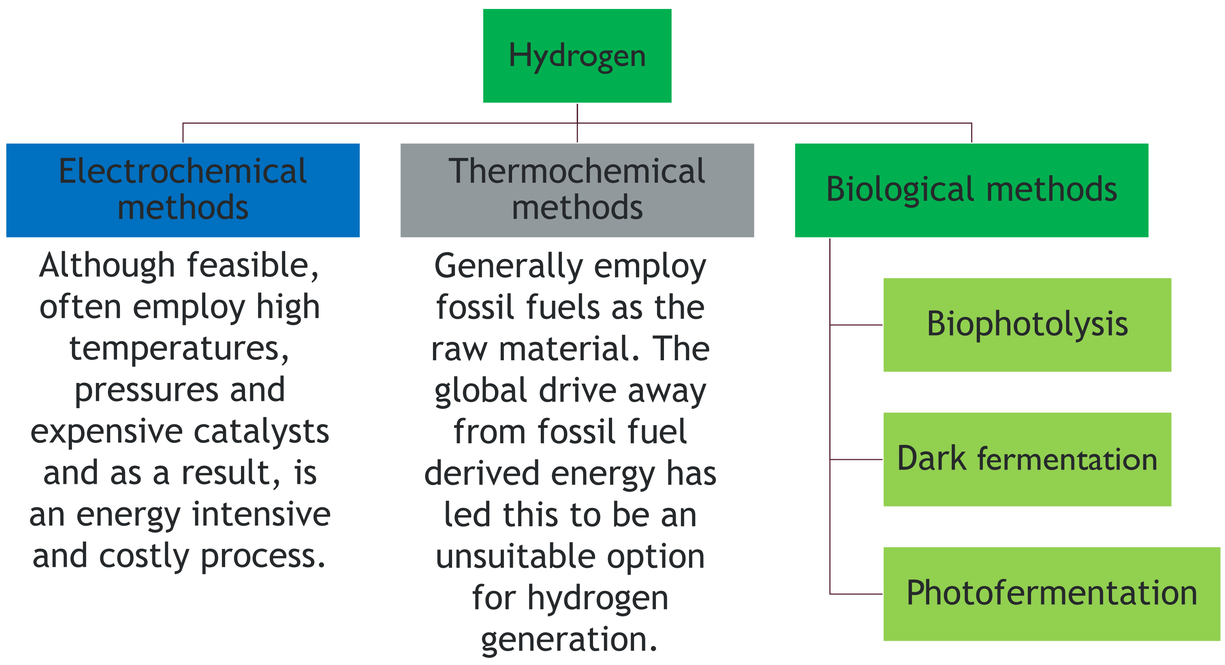
Hydrogen as an energy vector and commodity chemical

- Hydrogen contains 2.6 times more energy than methane, the hydrocarbon with the second highest energy density.
- Seen as a green energy source since water is the only by-product from the combustion process.
- Additionally, it is a valuable commodity chemical used for the manufacturing process of various other materials.
- We currently face challenges associated with its renewable production and storage.
- *R. palustris* is a purple non-sulfur bacteria with a robust and versatile metabolism capable of hydrogen production under specific conditions.

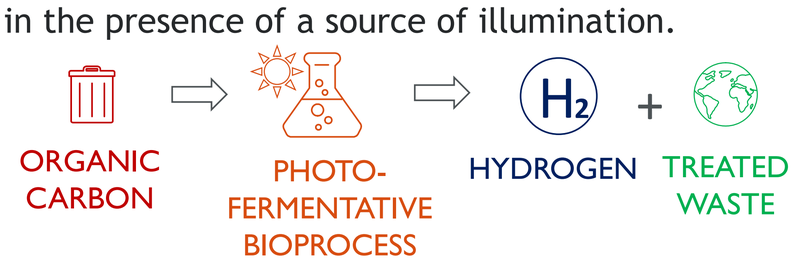
Methods of Hydrogen Production



Photofermentation seems to be a promising method of biological hydrogen production, exhibiting high solar and substrate conversion efficiencies to high purity hydrogen.

Photofermentation

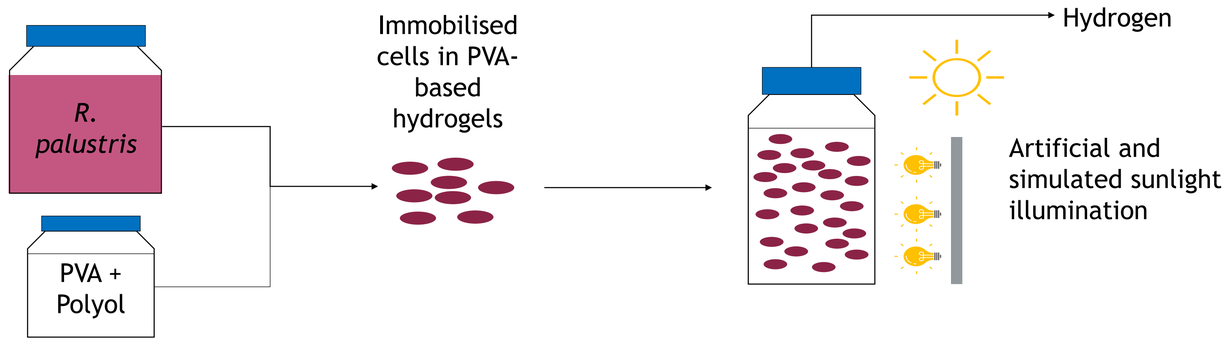
Photofermentation is the biological process where photosynthetic microorganisms convert organic carbon substrates into hydrogen and carbon dioxide in the presence of a source of illumination.

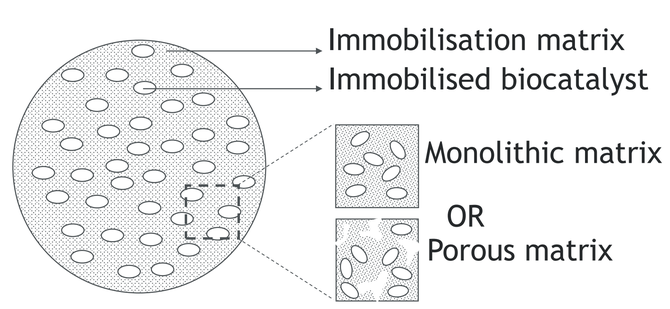


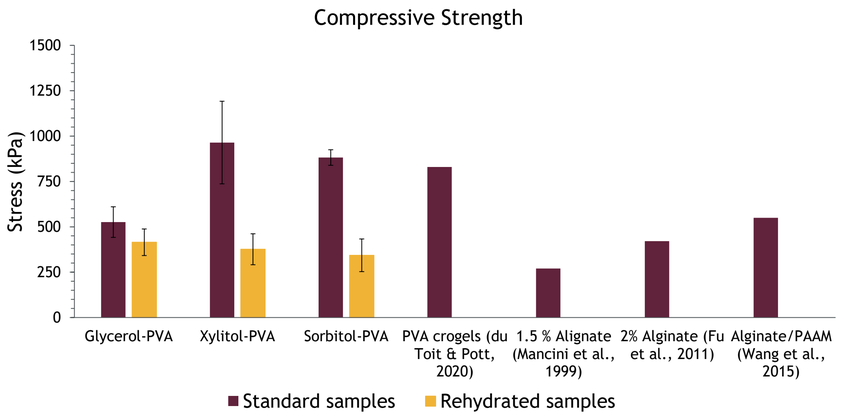
Areas of research and current limitations:

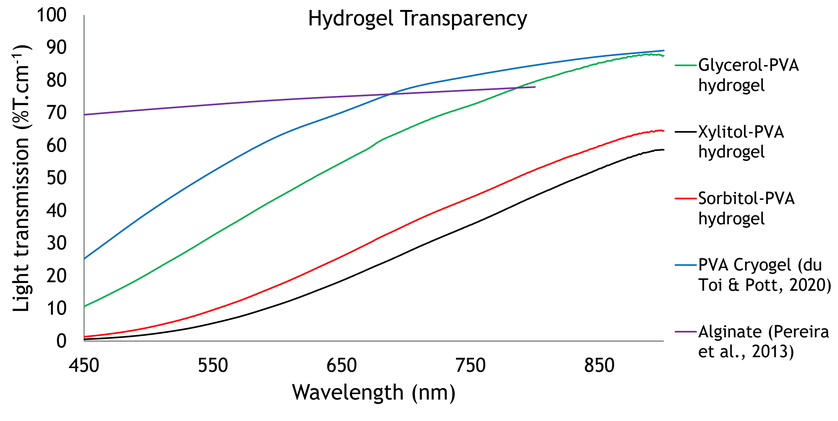
- Current limitations associated with cell washout and mutual shading have limited the cultivation and application of photosynthetic microorganisms.
- Microbial immobilisation is a promising solution, but advanced immobilisation materials are required.

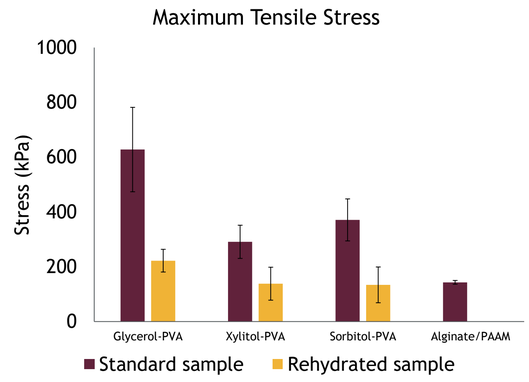
Results and Discussion









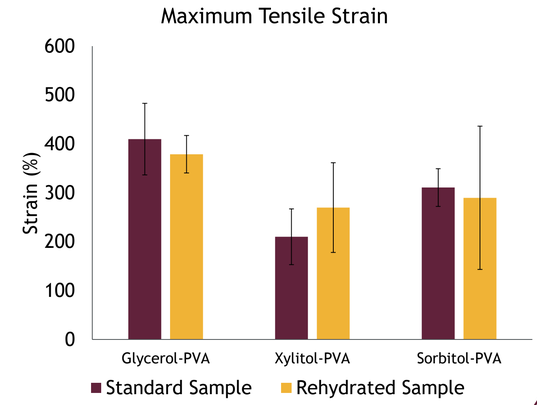


R. Palustris has been previously immobilised in materials and employed in photobioreactors to produce hydrogen. These materials do not satisfy the physical property requirements as an immobilisation material or may impose economic limitation on their large-scale application. The development of these novel PVA-based hydrogels aim to satisfy these physical properties without the use of cytotoxic gelation chemicals or harsh conditions to induce gelation, whilst being an economically attractive option for large-scale processing.

Gelation was induced through the addition of various polyols including:

- Glycerol
- Xylitol
- Sorbitol

It was confirmed that the addition of polyols induced gelation through physical crosslinking methods rather than chemical crosslinking.



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