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Advantages of Green Fuels from Thermochemical rather than Electrochemical Production

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Hydrogen and Methanol are both green fuels that can be produced either thermochemically or electrochemically. Hydrothermal Gasification is a process that uses wet feedstock, eliminating the energy intensivity of drying waste biomass feedstock prior to processing. Hydrothermal Gasification comprises multiple simultaneous thermochemical classes of chemical reactions including: hydrolysis, decomposition, depolymerisation and repolymerisation, deamination, water-gas shift reaction, methanation and hydrogenation. Companies working to deploy methanol at large voluemtric scale as a fuel for the global maritime industry often endorse two main technical routes of production – either electrolysed hydrogen and carbon captured carbon dioxide conversion into methanol, or methane/biomass gasification via Fischer–Tropsch to synthetic fuels and methanol. E-methanol has been computationally modelled to determine at what size of production plant methanol derived from electrolysis becomes cost-effective. 32 methanol production scenarios from either large-scale e-methanol plants or very large-scale e-methanol plants were modelled with an e-methanol price between €200 and €500/ton (i.e. comparable with petroleum-based methanol) and an electricity cost of €30 or €40/MWh. The study concludes that only 1 of 32 of the large plants and only 6 of 32 of the very large-scale plants will achieve a positive net present value within a 20-year period1. PuriFire Labs has developed a unique thermochemical approach for the conversion of carbon-based waste into methanol including industrial waste heat recycling potential. Our independent mass energy balance analysis inducates significant cost and energy savings compared to incumbent methanol production pathways. We maximise hydrogen and carbon dioxide composition in outputs from hydrothermal gasification to achieve the optimal stoichiometric ratio to go directly into methanol production.

Biography

Matthew Pearce's early entrepreneurial work formed a company to use solar power to convert organic matter in a high pressure environment into useful products such as fish feed and bio-crude via hydrothermal liquefaction (HTL). Following his PhD in algal biofuels from Cranfield University, Matthew developed a specific design and filed for a patent of a version of the hydrothermal liquefaction reactor design. The business plan pivoted from solar as the sole source of thermal energy, to include multiple other sources of thermal energy and the business changed names to become Purifire Labs. The company intended to utilise their core patented technology to make biocrude using waste plastic as a feedstock, but lacked sufficient market traction for this use case, given atmospheric carbon emissions and life-cycle analysis considerations. Another factor was that biocrude is difficult to use without post-production petroleum refining. Further experimentation and market research, finally settled on the HTG + methanol synthesis route.