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Remote, small-scale, 'greener' routes of ammonia production

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Abstract: 13

14 The techno-economic feasibility of low-carbon-based ammonia (NH₃) production has been explored in this study. Black coal and a eucalyptus-based biomass, available in the vicinity of 15 16 a carbon dioxide (CO₂) sequestration site, have been chosen as the two carbon-based feedstocks. The scale of the production of NH₃ has been chosen to match the production of a 17 18 bulk industrial Ammonium Nitrate/Fuel Oil (ANFO) explosives manufacturing facility. The production of NH₃ from any carbon-based feedstock implicitly involves a CO₂-removal step; 19 20 therefore, only CO₂ pressurisation to the supercritical state is required before transporting it 21 to the storage location. In order to gain a better understanding of the economic and 22 environmental trade-offs, two representative flowsheets have been modelled in Aspen Plus® 23 simulation software for the two feedstocks. A Natural Gas (NG)-based NH₃ process has also 24 been modelled for comparison. Material and energy balance data from the Aspen Plus® 25 simulation has been used to predict the economics and carbon footprint of NH₃ production 26 from different feedstocks. A cradle-to-gate Life Cycle Assessment (LCA) has been 27 performed to predict the environmental hotspots. Multi-Objective Optimisation (MOO), via. 28 a genetic algorithm, has been performed to generate Pareto plots that represent the minimum 29 cost of NH₃ production against different CO₂ footprints. For a similar CO₂ footprint, the coal-30 based NH₃ process has been found to be more economic than the biomass-based process. 31 However, the biomass-based process has the potential to be carbon negative by capturing the biogenic CO₂, which is not possible in a coal-based process. The cost of carbon capture in 32 coal-based NH₃ production has been estimated to be between 11-19 US $t CO_2^{eq}$, which is 33

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