

Hydrogen transport using liquid organic hydrogen carriers (LOHC): integrated process design and analysis

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As global warming intensifies, countries around the world are making great efforts to reduce carbon emissions. As a result, carbon-free hydrogen energy is in the spotlight. Hydrogen is mainly liquified or compressed to transport it, but storage stability is low due to harsh conditions. Therefore, many studies have been conducted on liquid organic hydrogen carriers (LOHC), which can transport hydrogen stably. In this study, we designed an integrated hydrogen transport process from hydrogenation to dehydrogenation. Furthermore, by forming heat networks using pinch analysis, we reduced the total energy needed for the proposed process using energy efficiently. To comprehensively evaluate the proposed process, we conducted several analyses. Firstly, through techno-economic analysis, we figured out the economic feasibility of the integrated process. Additionally, failure rate analysis was conducted to obtain the realistic minimum selling price considering the actual operating hours. We also determined the environmental impact by conducting the life-cycle assessment. Finally, sensitivity analysis and uncertainty analysis were performed considering the uncertainty of the proposed process.