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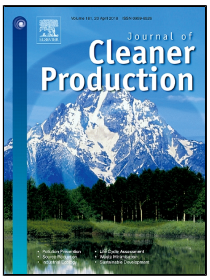

Dual-objective chemical production planning by graphical-tabular Pinch Analysis for sustainable methanol industry in China

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Dual-objective chemical production planning by graphical-tabular Pinch Analysis for sustainable methanol industry in China

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Abstract

The overall top-layer design for chemical production, carbon emission and production cost is significant for the sustainable development of chemical industry. Industrial structure adjustment and low-carbon technology retrofit are generally served as the alternatives for policymakers and plants to simultaneously meet the energy demand and carbon emission limit. To further extend the practical application of Carbon Emission Pinch Analysis (CEPA) for low-carbon methanol production planning on the supply side, this paper presents four scenarios for the methanol industry in 2020 in China. A graphical method of Chemical Production Pinch Analysis (CPPA) combining with the first-order and single-variable grey model (GM(1,1)) is conducted to analyze the interaction between energy demand and carbon emission. A two-step tabular method is also proposed to search the optimal planning for achieving the minimum production cost and CO_2 emission. The results show that the coal-to-methanol route would continually dominate the major share of methanol supply and CO_2 emission in the overall methanol industry due to the energy structure of China. Options of developing biomass-methanol technology, shifting the production share from coal to low-carbon routes and retrofitting with CO_2 capture and storage (CCS) in coal-methanol plants could be considered to simultaneously achieve the targets of energy supply, carbon emission constraint and minimum production cost.

Keywords: Chemical production planning; Methanol; CO_2 emission constraint; GM(1,1); Minimum cost

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