Coal to acetylene - the pit stop fixes

Process innovations in the manufacturing of acetylene from coal by Tata Consulting Engineers has lead to lower costs, increased efficiency and ease of access to low-volume chemicals, says Mahesh Marve, senior vice-president and chief technology officer, Tata Consulting Engineers.

Coal, found in abundance in many countries, is a wonder feedstock for several major industries and utilities. During the early industrialisation era, coal was used as feedstock in the manufacture of most chemicals, which were derived through mainly the coal-to-acetylene route. However, the abundance of crude oil and natural gas has led to these replacing coal, and this proved beneficial for large-capacity production of polymers and petrochemicals despite the process being a complex one — a process using steam crackers. This production route requires significant unit sizes in order to realise economies of scale, and remain viable. It is indeed a good option when crude oil is available in plenty and at low cost.

Fit for purpose

In the case of relatively low volume, 'fit for purpose' chemicals, the crude oil and natural gas route may not be a viable option especially when such feedstock is imported and the 'mother' feed molecules are obtained from mega scale plants that require considerable capex outlay. The last decade has seen significant volatility in global crude oil prices. However, even at falling prices, dependence on imports for feedstock poses a risk especially when large production setups are built around such imports. For several countries like India, China, Australia, Indonesia, etc, coal as a feedstock is available in abundance and at low prices. It makes sound business sense to exploit this feedstock instead, with due processes plugged in for efficiency.

Mahesh Marve

Acetylene is a very versatile and reactive molecule and is known to be the 'mother of organic synthesis'; many chemicals can be derived from acetylene with relative ease. Manufacturing of relatively low-volume chemicals — for example VCM/PVC, VAM, acrylics, BDO, etc — can be potentially considered through the coal-acetylene route, which is a relatively low capex option more suited for distributed production. Further, this process facilitates the capture of the carbon content as a valuable chemical product and hence contains carbon emission.

The manufacture of acetylene from coal is a path-breaking production route for the Indian chemical industry.

A feasible option

The manufacture of acetylene from coal can be made efficient and cost-competitive through integrated process interventions at every stage of the production life cycle.

- Managing the quality of coal: Coal drying, coal beneficiation, de-ashing of coal, efficient coal handling, and feedstock management and coal conversion.
- Managing the conversion process: The process involves conversion of coal to carbide, carbide to acetylene, and conversion of acetylene to product molecule.
- Energy integration and optimisation.
- Plant and process efficiencies.
- Managing the carbon footprint: Coal ash management, carbon capture and re-utilisation.
- Effective project evaluation, design and execution through the entire project life cycle.

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