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## The New Development Green Chemical Production Technology of Sinopec

### AUTHORS

Baoning ZONG / SINOPEC, RESEARCH INSTITUTE OF PETROLEUM PROCESSING, SINOPEC, BEIJING , 100083, BEIJING

### PURPOSE OF THE ABSTRACT

The paper introduced the new development green chemical production technology of Sinopec, including, caprolactam, hydrogen peroxide, propylene epoxide, and cyclohexanone, respectively. The capacity of Sinopec green caprolactam production technology is about 3.5 million ton and above half of capacity of the world in 2017. Sinopec also bring to success 100 kt/y commercial trial for hydrogen peroxide and propylene epoxide. As example, the green caprolactam ?CPL? production technology was introduced following. CPL is the monomer of nylon-6?it was firstly developed by DSM and BASF 1970's, which include the six technological process, benzene hydrogenation, cyclohexane oxidation, clclohexanol dehydrogenation, cyclohexanone hydroxylamine oximation, cyclohexanone oxime rearrangement, and CPL purification, respectively. CPL was most complicated among the all of chemicals production, and the C and N atom utilization was less than 80% and 60%, respectively. The green CPL production technology developed by Research Institute of Petroleum Processing Sinopec , the C and N atom utilization was close to 100%. New reaction for cyclohexanone production: For the commercial CPL technology, cyclohexone was synthesised by benzene hydrogenation, followed cyclohexane oxidation and clclohexanol dehydrogenation, respectively. The C atom utilization of the commercial process was about 80%. For Sinopec CPL technology, cyclohexone was synthesised by following 4 steps, benzene selectively hydrogenation to cyclohexene, catalytic distillation of esterification of cyclohexene and acetic acid to acetate cyclohexane, hydrogenation of acetate cyclohexane to cyclohexnol and ethanol, and clclohexanol dehydrogenation to cychexone, respectively. It was to be mentioned that the C atom utilization was closed to 100%(1). TS-1 zeolite integration with single-vessel continuous slurry bed for cyclohexanone ammoximation: For the commercial CPL technology, cyclohexanone oxime was synthesised by cyclohexanone hydroxylamine oximation, and hydroxylamine by NO<sub>x</sub> reduction, and NO<sub>x</sub> by ammonia oxidation, and so on. In Sinopec CPL technology, cyclohexanone oxime was direct synthesised by oxidation of cyclohexanone, NH<sub>3</sub> and H<sub>2</sub>O<sub>2</sub>, which integrated TS-1 zeolite and single-vessel continuous slurry bed, and H<sub>2</sub>O is only byproduct. On the other hand, this technology simplified the process, nearly 100% NH<sub>3</sub> utilization, 70% decrease plant investment, respectively(2,3). Silicalite-1 zeolite integration with moving bed for cyclohexanone oxime rearrangement: For the commercial CPL technology, cyclohexanone oxime Beckman rearrangement toke place in the concentrated sulfuric acid, and byproduced 1.6 time ammounium sulfate. In Sinopec CPL technology, Silicalite-1 zeolite integration with moving bed was used for the cyclohexanone oxime Beckman rearrangement, and without ammounium sulfate byproduct(4). Amorphous Ni alloy integration with magnetically stabilized bed for caprolactam purification: For the commercial CPL technology, CPL was purified by Raney Ni hydrogenation in tank reactor following the distillation. In Sinopec CPL technology, CPL was purified by the amorphous Ni catalyst and magnetically stabilized bed integration, and CPL purification was remarkable improved(5,6). The green chemical production technology developed by Research Institute of Petroleum Sinopec, in which hydrogen peroxide was used as oxygenant for caprolactam and propylene epoxide production, and H<sub>2</sub>O is only byproduct. The green caprolactam includes production technology the following innovation technologies: New reaction for cyclohexanone production; TS-1 zeolite integration with single-vessel continuous slurry bed for cyclohexanone ammoximation, Silicalite-1 zeolite integration with moving bed for cyclohexanone oxime rearrangement, and amorphous Ni alloy integration with

magnetically stabilized bed for caprolactam production technology is 3.5 million ton and above half of capacity of the world in 2017.

## FIGURES



**FIGURE 1**

Figure 1.

The world first 200,000 ton/a the green Caprolactam production plant in Sinopec

**FIGURE 2**

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## KEYWORDS

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