Effect of reaction conditions on the lifetime of SAPO-34 catalysts in methanol to olefins process – A review

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ABSTRACT

There is a rising demand for light olefins production to meet the increase in human population, burgeoning transportation network and rapid pace of industrialization. Methanol-to-olefins (MTO) conversion process is the most preferentially-selected route to synthesize olefins even though obtaining the high selectivity remains a challenge to this day. Methanol is industrially-produced via two-steps catalytic routes, viz. gasification of coal to syngas followed by syngas conversion. Due to the abundance of methanol, conversion of methanol to light olefins (ethylene and propylene) or polyolefins (polypropylene and high-density polyethylene) is most desired. Although, natural gas or syngas routes are well established and implemented at industrial level but still direct or indirect transformation of methanol to petrochemicals gained core interest. Significantly, the use of molecular sieves as a catalyst support or directly as a catalyst has been an area of active commercial developments for the past two decades. The engineered molecular sieves possess specialized topographical structure that can efficiently reduce the rate of coke deposition, enhance mass transport and improve the catalytic performance, viz. lifetime and olefins selectivity for methanol to olefins reaction. In this regard, the SAPOs molecular sieves are highly selective for the synthesis of ethylene and propylene. Among them, SAPO-34 molecular sieves exhibit the best performance for the MTO process. The current review highlights the importance of SAPO-34 supported catalysts in terms of lower chain hydrocarbon (C_2–C_4) selectivity, lower paraffinic and aromatic by-products ratio, catalyst stability, and renderability. In addition, the conditions causing the SAPO-34 catalysts deactivation such as coking, crystal size, water content, pressure metal incorporation, acid site strength, and influence of process conditions on triglyceride-based feeds are also thoroughly reviewed.

KEYWORDS
MTO; SAPO-34; Coking; Deactivation; Acidic strength

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