Direct synthesis of chloromethyl ethylene carbonate *via* CO_2 utilisation using a novel Zr/ZIF-8 catalyst

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Abstract

In recent years, CO_2 utilisation has been a focus of many chemical industries as an innovative way to reduce the accumulation of anthropogenic CO_2. Recent publications show that significant progress has been made in the effective utilisation of CO_2 as a value-added products e.g. organic carbonates. Organic carbonates such as propylene carbonate (PC), styrene carbonate (SC) and chloromethyl ethylene carbonate (CMEC) are widely used as polar aprotic solvents, fuel additive and electrolytes for lithium-ion batteries.

The development of an efficient and a stable Zr/ZIF-8 catalyst for the synthesis of chloromethyl ethylene carbonate (CMEC) from epichlorohydrin (ECH) and CO_2 is a promising greener technology for CO_2 utilisation. Incorporating zirconium into ZIF-8 has significantly increased ZIF-8 stability as well as the catalytic performance of Zr/ZIF-8 with the conversion of ECH, selectivity and yield of CMEC being 93%, 91% and 71%, respectively. The catalyst displayed high ECH conversion and high selectivity to CMEC at 80^{o}C. The optimum reaction condition was found at 80^{o}C, 8 bar CO_2 pressure and 8 h using fresh 10% (w/w) Zr/ZIF-8 catalyst loading for this reactive system. The activity of reused catalyst showed consistent stability over seven subsequent runs as shown in Figure 1.

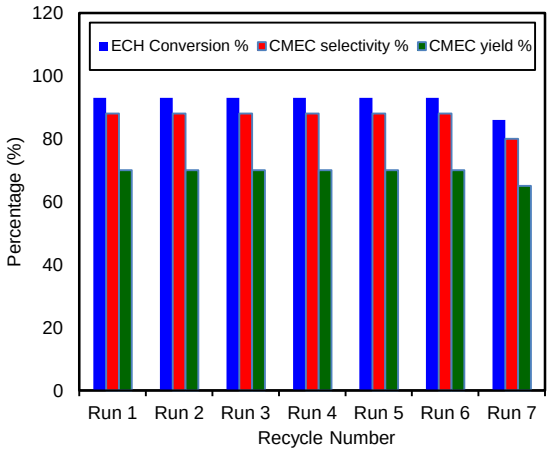

Figure 1. Catalyst reusability studies on conversion of epichlorohydrin (ECH), selectivity and yield of chloromethyl ethylene carbonate (CMEC).