Synthesis of propylene carbonate from propylene oxide and CO_2 by natural amino acids/H_2O as metal- and halide-free catalyst system

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An environmentally clean, binary catalytic system of naturally occurring α-amino acids (AAs)/H_2O has been found to deliver promising yields of propylene carbonate (PC) from propylene oxide (PO) and CO_2 under moderate reaction conditions. Among the various AA systems tested, the highest yield of PC from PO-CO_2 coupling was achieved with the L-His/H_2O system, associated with the basic nature of L-histidine. The effect of various reaction parameters such as the catalyst loading, temperature, CO_2 pressure, and time were evaluated. A plausible reaction mechanism involving synergistic interplay between the −OH groups of H_2O and the COO^- end of the zwitterionic L-His and the amine moiety of the imidazole ring of L-His was proposed. The process presented herein represents a low cost, ecologically safe, and efficient route with simple work-up employing readily available materials for chemical fixation of CO_2 into high-value chemicals.