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PHOTOCATALYTIC MEMBRANE REACTOR FOR CO_2 CONVERSION

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Global warming is considered to be one of the principal environmental problems and CO_2, being a greenhouse gas, largely contributes to the global climate change. Owing to this problem, an increasing concern has brought the scientific community to devote huge efforts towards CO_2 reduction and/or valorization through a sustainable process. In this contest, photocatalytic membrane technologies can be a promising and innovative way to pursue CO_2 conversion into value-added products.[1] To this purpose, Carbon Nitride (C_3N_4) photocatalyst was prepared and characterized by FTIR and IR-ATR, DRS and XRD analyses. The preliminary reactivity experiments were carried out in a batch reactor (V = 120 mL) filled with humid CO_2 and irradiated in a solar box (65°C). CH_4 and CO were the main reduction products detected. This catalyst was then dispersed to obtain catalytic mixed matrix Nafion membranes. Comprehensive structural and morphological analyses by DRS, FT-IR, ATR-IR, SEM and N_2 and CO_2 permeability measurements were performed. The photocatalytic membranes were then used for the same reaction under UV-Vis irradiation in a membrane reactor operating in continuous mode, as already done with TiO_2-Nafion catalytic membranes[2]. Different H_2O/CO_2 molar ratios and residence times were used. MeOH, EtOH and HCHO were the main products detected. Under the best experimental conditions, methanol and ethanol were identified as the main products with a productivity of 23 and 25 □mol g^{-1} h^{-1}, respectively.

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