Conversion of CO_2 e H_2O into methanol using MCM-41 as support to Cu_2O/ CuO nanoparticles

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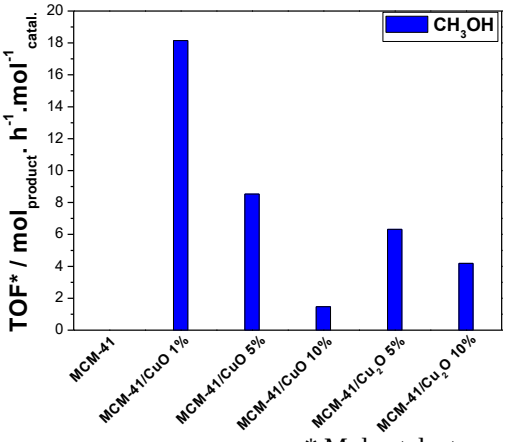
Many environmental problems are caused by the increase of CO_2 levels in the atmosphere. One useful way to tackle this problem is the photoconversion of CO_2 into solar fuels. This work describes the synthesis of hexagonal molecular sieve MCM-41 which was impregnated with Cu_2O and CuO nanoparticles previously prepared. The materials were characterized by: XRD, Uv-Vis, SEM, HRTEM and BET. The photocatalytic tests were carried out in a reactor using a solar simulator (AM 1.5). The results of the photocatalytic tests were monitored by gas chromatography (GC). We observed the formation of CH_3OH.

Molecular sieve MCM-41 was synthesized following the reference [1] and the copper oxide nanoparticles (Cu_2O and CuO) were prepared according to the literature. [2,3] The molecular sieves and the copper oxide nanoparticles were mixed in isopropyl alcohol 99%, using sonication the different ratios (1, 5 and 10 wt.%). The materials were dried in oven at 150 °C for 24 h under inert atmosphere. The photocatalytic process occurs in a reactor containg 50 mg of catalysts, 300 μL of water and 2 bar of CO_2. The system was irradiated for 20 h. Next, the liquid phase was collected and analyzed by GC. The photocatalytic results were compared those pure MCM-41 collected in the same conditions. In **Figure 1** are shown the photoconversion results of CO_2 and H_2O to CH_3OH using solar simulation.



* Mol catalyst= overall concentration of Cu_2O or CuO.

Figure 1- Photoconversion of CO_2 and H_2O into CH_3OH.

The results demonstrate the influence of surface area and nature of nanoparticles. The material MCM-41/CuO exhibit the highest photoconversion to CH_3OH using a smaller concentration of CuO. The same phenomena were observed for MCM-41/Cu_2O with 5 and 10%. The good photoconversion of CO_2 into CH_3OH using CuO/Cu_2O nanoparticles is attributed to the adequate energy levels and smaller value of band gap (CuO =1.7 eV and Cu_2O= 2.2 eV), which promotes an efficient electrons transfer for CO_2 photoreduction into methanol while the better dispersion on the molecular sieve facilitates the interaction between the CO_2, H_2O and photocatalysts. [4]

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The authors would like to thank the financial support from FAPESP (2012/08904-3).