Enhancement of CO_2/CH_4 Adsorption Selectivity on Low Pressure Cold Plasma-Modified Zeolite A-4 with Variation of Exposure Time.

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ABSTRACT

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Zeolite A-4 has potential as an adsorbent, but its selectivity toward CO_2 requires enhancement. This study aims to determine the effect of Low Pressure Cold Plasma (LPCP) exposure time variations of 10, 15, and 20 minutes on CO_2 adsorption capacity, CH_4 adsorption capacity, and CO_2/CH_4 selectivity of modified Zeolite A-4. This study employed an experimental laboratory method. CO_2 adsorption was measured using a LICOR 6262 CO_2/H_2O Analyzer, while CH_4 adsorption was analyzed using a Gas Chromatograph GC-2014 Shimadzu. Samples consisted of unmodified Zeolite A-4 (Z0) and three LPCP-modified samples with exposure times of 10 minutes (ZP10), 15 minutes (ZP15), and 20 minutes (ZP20). Results indicate that CO_2 adsorption capacity increased with longer LPCP exposure time. At a concentration of 1506 ppm, CO_2 adsorption increased from 2.01×10^{-6} mol/g (Z0) to 3.00×10^{-6} mol/g (ZP20). Conversely, CH_4 adsorption decreased from 3.0×10^{-8} mol/g (Z0) to 1.86×10^{-8} mol/g (ZP20) at the same concentration. The highest CO_2/CH_4 selectivity was achieved by ZP20 at 184.16 under a concentration of 8248 ppm, representing a substantial improvement over Z0, which reached only 113.05. LPCP modification with an exposure time of 20 minutes produced the highest CO_2/CH_4 adsorption selectivity in Zeolite A-4 compared to all other variations examined in this study.

Keywords: *Zeolite A-4, Low Pressure Cold Plasma, CO_2 Adsorption, CH_4 Adsorption, CO_2/CH_4 Selectivity*