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Modeling and optimization of carbon dioxide methanation *via in situ* hydrogen generated from aluminum foil and alkaline water by Box–Behnken design

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ABSTRACT

The catalytic activity of carbon dioxide (CO_2) methanation by *in situ* hydrogen generated from aluminum foil (Al) and alkaline water over a novel catalyst (AHZ–CM) was investigated. Response surface methodology involving Box–Behnken design (RSM-BBD) was implemented for optimization where the reaction temperature was found to be the utmost significant effective factor, followed by H_2/CO_2 ratio and weight catalyst loading. The optimum condition for CO_2 conversion was at 3.29 g of weight catalyst loading, H_2/CO_2 ratio of 4.08 and reaction temperature of 276.7 °C which resulted in 97.5% of CO_2 conversion. The result was approximately in agreement with the predicted result found by RSM which achieved 99.9% CO_2 conversion. Interestingly, this study proved that the hydrogen gas production from Al and alkaline water can be used *in situ* reaction and the novel catalyst (AHZ–CM) would be an excellent candidate to be used for CO_2 methanation reaction.