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Conversion of greenhouse gases (CO2 and CH4) from biowastes to energy and chemical using innovative calcium phosphates catalysts

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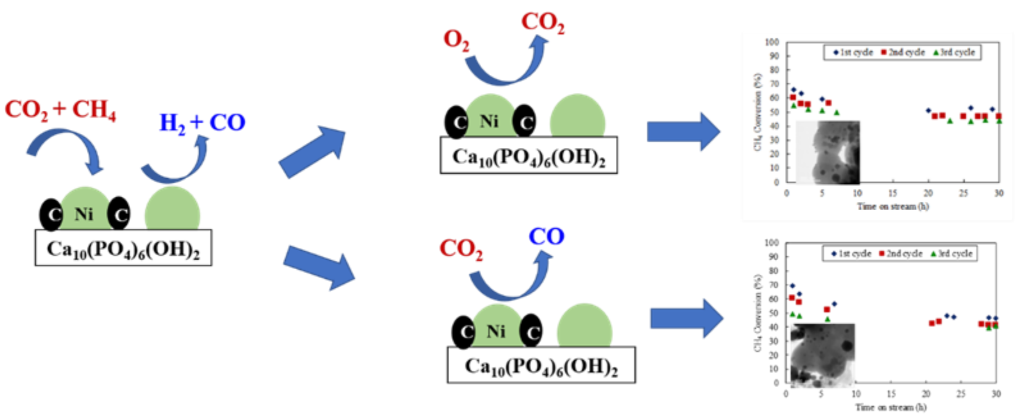
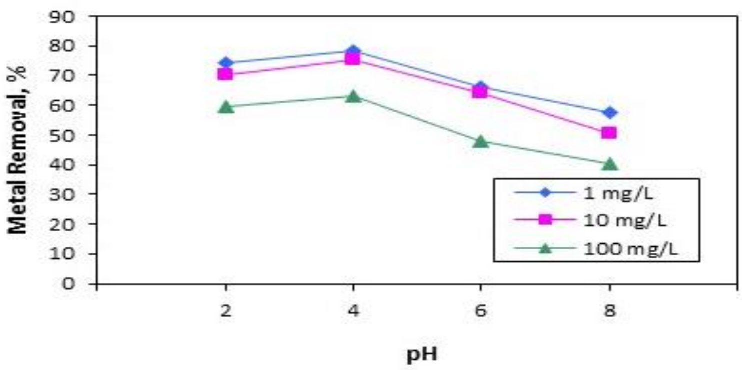
Abstract The increasing levels of CO2 and CH4 concentration in the atmosphere, especially due to fossil fuels combustion for energy production, agricultural activities and other industrial processes have led to severe climate changes. CO2 reforming of methane ($CH_4+CO_2 \leftrightarrow 2H_2+2CO$) has gained increasing attention due to the conversion of these greenhouse gases into synthetic gas (syngas) [Kathiraser, Moradi, Farniaei, Liu, Usman, Lavoie], which can be used for energy production or synthesis of high-value chemicals. Also, this reaction could be used for the valorization of biogas, natural gas and CO2 waste streams. However, rapid catalyst deactivation is commonly observed in this reaction, mostly due to coke deposit on the catalyst active sites and to catalyst sintering [Lin, Aw]. In the present work, the hydroxyapatite-supported nickel catalysts were synthesized and evaluated in this reaction. The catalysts presented high greenhouse gases conversion and high syngas selectivity during long periods of time (>300 h). Moreover, the comparison between these catalysts with the conventional ones highlighted the competitiveness of hydroxyapatite-supported nickel catalyst [Rêgo de Vasconcelos (2015, 2016, 2016)]. The good performance of these catalysts was linked to their physico-chemical properties, such as nickel particle size, metal-support interaction and supports basicity. In addition, the occurrence of carbon gasification reaction (C(s))+H2 O↔H2+CO) was crucial not only for lowering coke selectivity but also for increasing syngas production. Characterization of spent catalysts revealed that besides the amount of coke, the type of carbon had an influence on the catalysts deactivation. In-situ regeneration under air flow was also performed in order to evaluate the reuse of the catalysts.

Keywords: syngas, phosphate, CO2,

Graphical





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