Evaluation of catalysts derived from palm kernel shell carbon in a passive NOx removal from a diesel engine exhaust

ABSTRACT

Carbon-supported de-NOx catalysts have attracted much attention lately due to their reactivity at low temperature, where it is usually challenging to remove NOx from mobile emission sources such as light-duty diesel-powered vehicles. In addition, passive mode of NOx removal system is preferable due to the absence of a reductant injection requirement, which could add an extra cost to the system. Palm kernel shell activated carbon (PKS) was used to synthesize SCR catalysts by precipitating manganese (Mn) and/or cerium (Ce) oxides. The catalysts were characterized using nitrogen adsorption-desorption experiment, X-ray fluorescence analysis (XRF), hydrogen temperature-programmed reduction (H2-TPR) and Fourier-Transform infrared spectroscopy (FTIR). The experiment of NOx removal from a real diesel engine exhaust system revealed that Mn/PKS exhibited the highest NOx removal at 74% and at the lowest temperature of 140 °C. This was attributed to the high surface area and micropore volume, high metal loading, enhanced hydroxyl and carbonyl functional groups and the presence of reducible MnO2 species. Therefore, it is expected that this type of catalyst may serve as a cost-effective material for a sustainable alternative to the current practice in removing NOx from diesel engine vehicles.

Keyword: NOx removal; Passive mode; Carbon catalyst; Real diesel engine exhaust