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Pyrolysis yields from refinery residue using a batch process

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ABSTRACT

Batch pyrolysis has proved to be a valuable process of assessing the potential of recovering and characterizing valuable products from various materials. Furthermore, the off-gases produced are easily handled by conventional gas clean-up processes in order to achieve environmental emission compliance. This research explores the pyrolysis of hydrocarbon rich refinery residues, left over from crude oil and other crude fraction conversion processes, in a 1200 liter electrically-heated batch retort. It also provides the novel offering of a cost effective and environmentally compliant method of assessing the recovery potential of valuable products. The process design has been formulated by careful consideration of key aspects of previous work cited in literature. The pyrolysis of the residue has shown significant oil *(70%)*, char *(14%)* and non-condensable gas *(6% by difference)* yields. The oil yield obtained shows a remarkably high calorific value *(~40MJ/kg)*, comparable to that of standard liquid fuels. The char obtained, with high carbon content *(~80%)*, could be a candidate for a solid fuel source. The non-condensable gas stream possesses significant calorific value *(240KJ/mol, estimated)* implying the potential generation of an additional heating source. The non-condensable gas stream was subjected to an oxidative process prior to gas clean-up, and continuous on-line monitoring of the vented gas demonstrated compliance with South African emission guidelines. The gas treatment is economically optimal as only a smaller portion of the original residue is subjected to emission-controlling steps. The current work is aimed at a semi-commercial batch pyrolysis plant which generates substantial quantities of material for the purposes of proving compliance with emission standard regulations.