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Simulation analysis and ternary diagram of municipal solid waste pyrolysis and gasification based on the equilibrium model

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Abstract: A self-sustained municipal solid waste (MSW) pyrolysis-gasification process with self-produced syngas as heat source was proposed and an equilibrium model was established to predict the syngas reuse rate considering variable MSW components. Simulation results indicated that for constant moisture (ash) content, with the increase of ash (moisture) content, syngas reuse rate gradually increased, and reached the maximum 100% when ash (moisture) content was 73.9% (60.4%). Novel ternary diagrams with moisture, ash and combustible as axes were proposed to predict the adaptability of the self-sustained process and syngas reuse rate for waste. For wastes of given components, its position in the ternary diagram can be determined and the syngas reuse rate can be obtained, which will provide guidance for system design. Assuming that the MSW was composed of 100% combustible content, ternary diagram shows that there was a minimum limiting value of 43.8% for the syngas reuse rate in the process.

Keywords: MSW; pyrolysis-gasification process; equilibrium model; ternary diagram

1. Introduction

With economic growth in the past two decades, the amount of municipal solid waste (MSW) was continuously rising while the world's fossil fuel resources were

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