

# Response Surface Methodology Approach for Optimizing the Gasification of Spent Pot Lining (SPL) Waste Materials

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## Abstract

This paper presents new results on the gasification of spent pot lining (SPL) waste material generated in the primary aluminium smelting industry. The main objective is to test the performance of the gasification process of treated SPL materials and to develop an optimization method to maximize the quality of syngas fuel. Modelling and simulation analysis were performed to convert the SPL solid materials to syngas fuel. The percentage of hydrogen (H<sub>2</sub>) and carbon monoxide (CO) in the syngas fuel, the cold gasification efficiency (CGE), and the carbon conversion (CC) were determined. The response surface methodology (RSM) is used for the optimization of the performance of the gasification process. The effects of the input factors such as the temperature, the equivalence ratio, the steam to fuel ratio on the output variables (H<sub>2</sub> and CO in the syngas, the CGE and the CC) are determined. The optimization results show that the optimized operating parameters to maximize the H<sub>2</sub>, CO, CGE and CC were T=1200 °C, ER=0.1 and SFR=1.29. The optimum values for the H<sub>2</sub>, CO, CGE, and CC were 37.2%, 22.2%, 79.75%, and 97.7%, respectively. New correlations for the variation of the output variables versus the input factors are also presented.

**Key Words:** *Gasification, Syngas, Alternative Fuel, SPL, Optimization, Response Surface Methodology*