Oxyfuel Combustion of Waste Streams with Oxygen from Electrolysis and Analysis of Utilization Paths of Captured CO_2 with H_2 (WOxyfuel)

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Introduction

The utilisation of oxyfuel technology in waste incineration represents a potential path for enhanced CO_2 capture efficiency. The objective of "WOxyfuel" project is to evaluate possible routes to generate oxygen for the combustion process and supply experimental and theoretical data for a MSWI operating under oxyfuel conditions. Experiments are planned at batch and pilot scale. Initially, experiments are conducted at the laboratory fixed-bed reactor KLEAA at ITC. This is followed by experiments at the pilot plant with moving grate ROFEA at IFK. Based on the experimental data also from measurements at a MSWI and process simulations, different scenarios for a MSWI with oxyfuel combustion are calculated including an economic analysis. The study presented here shows preliminary experimental work in the fixed bed reactor.

Lab scale Fixed Bed Reactor

Experiments conducted at "Karlsruher Laboranlage zur Ermittlung des Abbrandverhaltens von Abfällen" (Karlsruhe laboratory facility for determining the combustion behaviour of waste, KLEAA) provide a straightforward method for evaluating the performance of diverse CO_2/O_2 mixtures in waste incineration. The scheme of the reactor is illustrated in Figure 1.

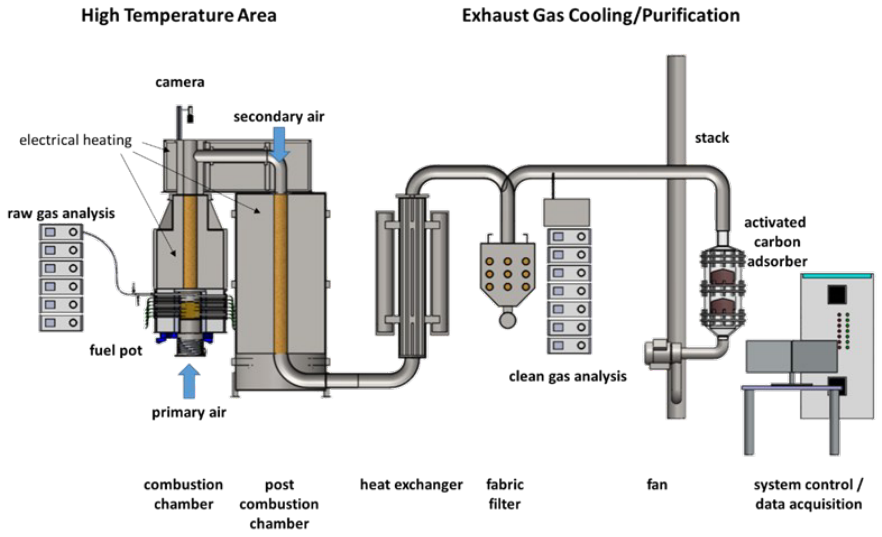

Figure 1. Scheme of the fixed bed reactor KLEAA

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KLEAA is an electrically heated fixed bed reactor with a post combustion chamber. The isothermal reactor has a thermal power of 40 kW. There is a fixed bed volume of 10 liters for the fuels. The reactor operates in a manner comparable to a waste incinerator, utilizing both primary and secondary air. Both pathways are capable of functioning as a mixture of CO_2 and O_2 instead of air. The post combustion chamber is followed by a dry flue gas treatment process with steam boiler, baghouse filter and activated coke filter. KLEAA offers a variety of measurement techniques that enable the analysis of gas in both the flue gas and the cleaned gas.

First results with the quality assured Solid Recovered Fuel SBS1® (RAL-GZ 724 and compliance with ISO 21640) produced from high calorific fractions of MSW and bulky waste by REMONDIS in Erftstadt show a significant influence of the oxygen in the mixture with carbon dioxide on the combustion behavior. The combustion behavior is evaluated by characteristic numbers like the ignition rate, the mass conversion rate and the reaction front velocity, among others. Together with the characteristic numbers the behavior of contaminants in the flue gas is investigated as a function of the oxygen content in the primary and secondary gas.