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BENCHMARKING OF THE PRE/POST COMBUSTION CHEMICAL ABSORPTION FOR THE CO_2 CAPTURE

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Highlights

- Integration of the chemical absorption process in pre- or post-combustion processes
- Increasing the syngas LHV from the coal gasification using the chemical absorption process for the CO_2 separation
- Parametrical study of the energy system with integrated chemical absorption

Abstract. The aim of the article was to compare the pre- and post-combustion CO_2 capture process employing the chemical absorption technology. The integration of the chemical absorption process before or after the coal combustion has an impact on the power plant efficiency because, in both cases, the thermal energy consumption for solvent regeneration is provided by the steam extracted from the low pressure steam turbine. The solvent used in this study for the CO_2 capture was monoethanolamine (MEA) with a weight concentration of 30%. In the case of the pre-combustion integration, the coal gasification was analysed for different ratios air/fuel (A/F) in order to determine its influences on the syngas composition and consequently on the low heating value (LHV). The LHV maximum value (28 MJ/kg) was obtained for an A/F ratio of 0.5 kg_{air}/kg_{fuel}, for which the carbon dioxide concentration in the syngas was the highest (17.26%). But, considering the carbon dioxide capture, the useful energy (the difference between the thermal energy available with the syngas fuel and the thermal energy required for solvent regeneration) was minimal. The maximum value (61.59 MJ) for the useful energy was obtained for an A/F ratio of 4 kg_{air}/kg_{fuel}. Also, in both cases, the chemical absorption pre- and post- combustion process, the power plant efficiency decreases with the growth of the L/G ratio. In the case of the pre-combustion process, considering the CO_2 capture efficiency of 90%, the L/G ratio obtained was of 2.55