Investigation of the Impact of Different Fuel Types on Oxy-Fuel Combustion CO_2 Capture Efficiency

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Abstract

To substitute fossil-based fuels, electrified fuel production offers a promising solution. E-methanol, one of the various types of e-fuels, has recently garnered significant attention. The synthesis process of e-methanol requires CO_2 and H_2 as primary inputs. Oxy-fuel combustion, one of the most promising carbon capture technologies, is considered a technology to cover the demand for CO_2. The cost of purification and compression of CO_2 depends on the composition of CO_2 streams, which is influenced by the type of fuel used in oxy-fuel combustion. The impact of different fuels on CO_2 stream composition is explored, and an economic comparison of the fuel types: coal, lignite, and sawdust is presented. The study found that the combustion of coal in fluidized bed furnaces results in flue gases with higher CO_2 concentrations compared to the combustion of biomass-based fuels and pulverized coal. Black liquor as a fuel type for oxy-fuel combustion, CO_2 captured from cement kilns, and direct air capture are identified CO_2 sources that have great potential for the future. Moreover, two case studies of oxy-fuel combustion facilities are presented.

Keywords: CO_2 supply, Oxy-fuel, CCUS, E-fuels, CO_2 impurities