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## **Comparison of a pilot scale gasification installation performance when air or oxygen is used as gasification medium**

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### **ABSTRACT**

Oxy-gasification may play an important role in controlling and decreasing CO<sub>2</sub> emissions. Gasification is a possible option to achieve carbon capture from the fuel before combustion and to produce a hydrogen rich fuel and a CO<sub>2</sub> stream for storage. To achieve these goals it is fundamental to use oxygen instead of air during gasification to avoid the dilution effect of nitrogen and to simplify the separation process of a CO<sub>2</sub> stream. Oxy-gasification leads to the production of a syngas, whose main components are: CO, CO<sub>2</sub>, H<sub>2</sub> and CH<sub>4</sub>. After syngas cleaning processes to remove particulates, tar, NH<sub>3</sub>, H<sub>2</sub>S and HCl, the water gas-shift reaction converts CO into CO<sub>2</sub>, thus the final syngas main components are only H<sub>2</sub> and CO<sub>2</sub>, which simplifies CO<sub>2</sub> capture. However, the production of oxygen increases the overall cost of gasification process and may be a drawback of the process. This paper compares the performance of a pilot scale gasification installation when air or oxygen is used as gasification medium.

Co-gasification studies were undertaken on a pilot-scale fluidised bed installation. The gasifier height was 3.7 m and it had a square section with 0.2 m. Different types of wastes: pine, olive oil bagasse, and polyethylene (PE) were mixed with coal, keeping coal amount always higher than that of waste. The use of wastes did not give rise to any feeding system operational problems. The gasification medium was a mixture of steam and air, or oxygen. Syngas went through a cyclone to retain particulates and then through a fixed bed reactor with calcined dolomite. This reactor retained sulphur and halogens and also destroyed some tar. Afterwards, syngas went through another fixed bed reactor with a nickel based catalyst, whose main function was to promote further tar and heavier gaseous hydrocarbons reduction. Syngas was sampled and analysed in three sample points, after the cyclone (sample point 1), after the dolomite fixed bed reactor (sample point 2) and after the second fixed bed reactor with the Ni-based catalyst (sample point 3). This syngas cleaning configuration proved to be suitable to destroy completely tar and heavier gaseous hydrocarbons and also to ensure very low contents of H<sub>2</sub>S and NH<sub>3</sub> that allowed syngas to be used in boilers and gas engines for most coal and waste blends.

This paper analysis and discusses the full results obtained when either air or oxygen was used as gasification medium considering gasification performance, syngas composition and cleaning process.