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Bio-char production and usage for iron ore pelletization

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In the race towards Net Zero, ArcelorMittal is committed to reduce their CO2e emissions by 30% in Europe and 25% worldwide by 2030. To achieve these ambitious goals, the group is looking at using (and potentially self-producing) bio-chars to substitute fossil fuels (coal and coke) in the different iron and steel-making processes. Here, the production of bio-chars for the substitution of coke breeze in iron ore pelletizing is explored. In order to be applicable in the existing plants and maintain iron ore quality, bio-chars need to meet several Key Process Indicators (KPIs). These include prescriptions on minimum calorific value, maximum ash content and oxides in the ash. In this work, slow pyrolysis of forestry residues was carried out at different temperatures, and mass and energy balance were performed to allow for a techno-economic assessment of bio-char production. The different bio-chars were characterized and compared with the KPIs to determine the technical feasibility of coke breeze replacement with bio-char. An economic assessment of the biochar utilization in iron ore pelletizing was drafted.
Results show that bio-chars can be used in replacement of fossil fuel in iron ore pellets. Nevertheless, careful selection of raw biomass is mandatory to meet the process KPIs. Bio-char usage may represent an economically viable solution, provided environmental policies and raw materials market are favourable. Slow pyrolysis trials indicate that bio-char mass yield varies between 20-40% (in dry basis), depending on process temperature and feedstock. The energy balance carried out on the feedstock (input) and pyrolysis products (output) reveals that bio-char represents the main energetic resource. Self-production of bio-chars from secondary raw materials (like forestry residues) may represent a sustainable solution to reduce ArcelorMittal's CO2 emissions in steel industry, provided all pyrolysis products are fully exploited.

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