MINICOR - MILD COMBUSTION WITH NITROGEN AND CARBON DIOXIDE REFORMING

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Abstract

Reduced net emissions of carbon dioxide (CO_2) are necessary to achieve the goals of limited global warming and ensure a sustainable future for our society. This project presents a versatile and scalable process for management and valorization of CO_2 and nitrogen. Starting from biomass residues, a first step in the proposed scheme involves a pyrolysis process that results in the release of pyrolysis oil and gas of rather low heating value. However, combustion under very diluted conditions using a Moderate or Intense Low-oxygen Dilution (MILD) concept allows for efficient and low-pollutant energy conversion. The MILD combustion process is utilized for a CO_2 reforming step resulting in generation of syngas. The pyrolysis and the reforming are supplied by heat from the MILD combustion that can be further supplemented by intermittent energy sources such as solar and wind power. The residual biochar from the pyrolysis step can be upgraded by activation with CO_2 and utilized for adsorption of nitrogen. The nitrogen-enriched biochar can then be used for soil carbonization and nitrification. The concept thus addresses the objective of CO_2 and nitrogen management with efficient renewable resource deployment. It also adopts a circular approach as it can employ biomass residues as raw material and combines the production of heat and syngas with that of porous biochar materials for several possible utilizations. The process can be adapted by multiple parameters and optimized for different conditions and purposes, and rather than optimizing on a single product or aspect, the concept brings a holistic view. Life-cycle analysis will be made during the project to guide process development and assess its impact.

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