Biocoal as an alternative to biomass

Jose Pablo Paredes Sánchez
University of Oviedo, EIMEM,
Department of Energy, 13 Independencia Street, 2nd floor, 33004 Oviedo (Spain)
E-mail: paredespablo@uniovi.es.

Abstract

The future use of coal is strategic as it has applications in the energy or steel industries and in the modern economic development, but conditioned on corrective action resulting from the allocation of allowances of Greenhouse Gases (GHG). Biofuels are one of the energy resources of interest in the transition to a sustainable energy model for being a renewable resource reducer of CO_2 emissions. Given this energy scene, the renewable fuels development for both thermal and electric applications and the analysis of the manufacturing process with the technology currently available is of industrial interest before a future of strong demand in view of the energy policies in the Northern Europe under the EU or in countries like the US and Canada. Biocoal is a type of fuel obtained by a thermochemical process which combines drying, thermal decomposition and pyrolysis of organic matter stages, better known in the food industry as roasting. Such biofuel can overcome barriers such as heterogeneity, handling difficulty and low energetic density of the raw material favoring the use of biomass, even the residual one, as fuel and, therefore, reducing storing, management and transport costs. It also helps to expand the biomass feedstock to be used with the inclusion of both agricultural and forest biomass. The purpose of this work is to present biocoal as an energy self-sufficiency improvement since it can be used as a substitute for fossil fuel resources which would reduce the amount of CO_2 emitted in the world.

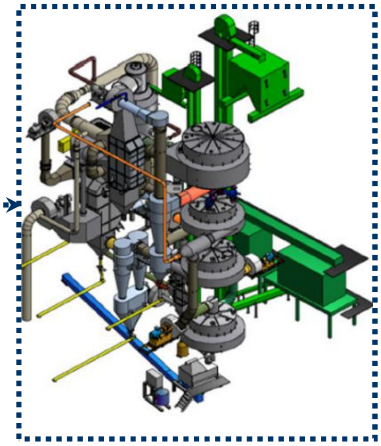
Introduction

Biomass is an important energy source worldwide. The privileged position of biomass as sustainable carbon carrier and renewable energy makes it particularly attractive for corrective action resulting from the allocation of allowances of Greenhouse Gases (GHG). Biomass potential can be generated by different sources. Three types of biomass energy sources are included: dedicated bioenergy crops, agricultural and forestry residues and waste. Several technologies are moving towards a commercial market introduction. Biomass properties can be modified closer to the properties of coal by torrefaction. The final product of the torrefaction is known as “biocoal”. Biocoal is a replacement for coal in power plants and energy applications.

Materials and Methods

Torrefaction is a pyrolysis process that subjects the biomass feedstock(1) to thermal treatment at a relatively low temperature of 200 to 300 °C in the absence of oxygen over a time span of 10-30 minutes in which hemicellulose(2), the most reactive fraction of wood, is decomposed to obtain biocoal(3). It has been studied at laboratory and pilot scale with respect to different biomass and process parameters. Biocoal use can overcome biomass barriers such as heterogeneity, handling difficulty and low energy density and, therefore, reducing storing, managing and transport costs.

Torrefaction Reactor



Source: Topell Energy - ECN.

$$\text{Energy densification} = 1\,\frac{0.9}{0.8} = 1.1^{(*)}$$

Conclusions

Biocoal has the potential to become an important biomass technology. It improves biomass as solid fuel with good characteristics in homogeneity, energy density, grindability and hydrophobic behaviour. Torrefaction reduces the oxygen/carbon ratio and forms porous structures. The process could be self-sufficient because the output gas is combustible. Commercial development is currently in progress in the bioenergy industry.

References

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(*) *Note: It depends on the biomass composition.*

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