Economic Torrefied Pellets from Herbaceus Biomass

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Herbaceous biomass has a huge potential worldwide similar to woody biomass and even higher in some areas of the world. In addition herbaceous agricultural residues and energy crops could have a lower sourcing cost than woody biomass and better developed logistics. On the other hand herbaceous biomass has some technical drawbacks regarding handling and logistics (low bulk density and poor flowability), contaminant contents (Cl, N, S) and ash melting behavior.

Torrefaction treatment radically changes herbaceous biomass properties. Torrefied pellets have a much higher bulk density and calorific value. Handling behavior improves, fuel properties are much homogenous transforming a biomass residue in a biomass commodity. Torrefaction process also reduces contaminant content and combustion emissions therefore.

Herbaceous biomass is a challenging fuel for torrefaction process due to low density and handling behavior. On the other hand raw material reactivity is usually higher than woody feedstocks. CENER has overcome raw material drawbacks and developed optimized herbaceous biomass torrefaction process at demo scale (350 kg/h production rate). Regarding solid flow behavior, CENER has optimized the process increasing the reactor and pellet mill capacities, by means of feedstock pretreatment, reducing the CAPEX in this way with similar OPEX. Production cost is reduced by 20%.

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Torrefied straw pellet characterization

Analysis Description	Min	Max	Standard Method
Proximate Analysis			
Total moisture (% a.r.)	7.1	8.5	UNE-EN ISO 18134-2:2015
Ash (% d.b.) (1)	4.4	8.2	UNE-EN ISO 18122:2016. Alwayscal 550°C.
Volatile matter (% d.b.)	66.5	74.8	UNE-EN ISO 18123:2016
CV Net MJ/kg db	19.5	20.4	UNE-EN 14918:2011
Ultimate Analysis (1)			
Chlorine (% d.b.)	0.057	0.20	UNE-EN-ISO 15984:2016
Sulphur (% d.b.)	0.099	0.050	UNE-EN-ISO 15984:2016
Nitrogen (% d.a.f.)	0.22	0.80	UNE-EN-ISO 15945:2016
Physical Properties			
Tamped Bulk Density (kg/m³)	700	730	UNE-EN ISO 17828:2016 To be reported to nearest 10 kg/m3
Fines (Content through 3.15mm round hole sieve (%)	0.07	0.16	UNE-EN ISO 17827-2:2016
Mechanical Durability	96.2	98.2	UNE-EN ISO 17831-1:2016

n.d. determined
(1) Dependent on raw material composition