

Preparation and Gasification of Brewers' Spent Grains (BSG)

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- Introduction
- Objective
- Materials and Methods
- Results and Discussion
- Conclusions

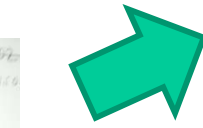


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Brewers' Spent Grains Production



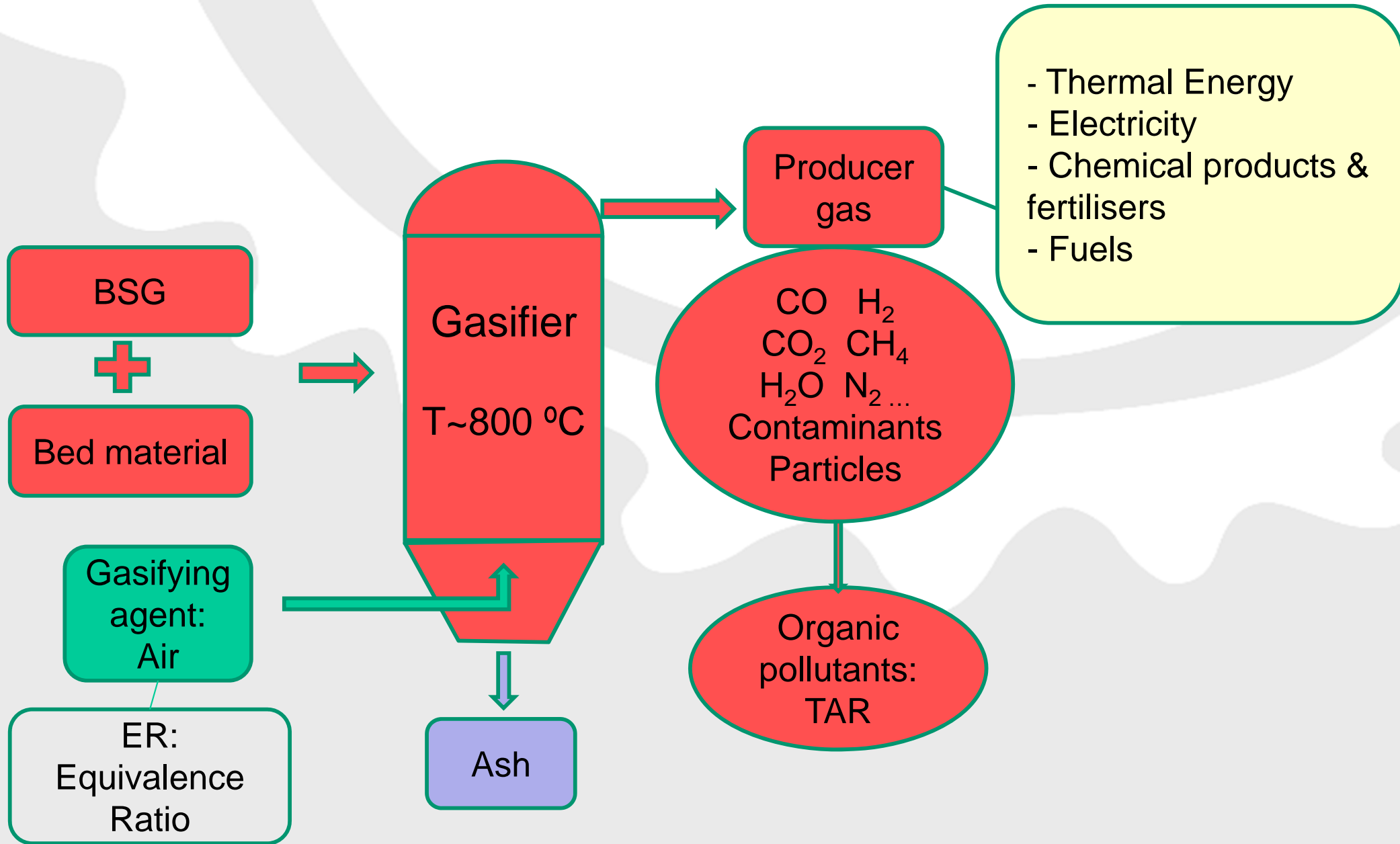
20 %



Beer world production
193 M Tonnes

BSG world production
38.6 M Tonnes

Bubbling Fluidised Bed (BFB) Gasification



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- Fuel preparation:
 - Decrease moisture contents
 - Increase density
- Gasification:
 - Study of the gas quality of the producer gas



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Brewers' Spent Grains (BSG)

Parameter	Unit	Value
Moisture	% w.b.	81.3
Proximate analysis		
Ash	% d.b.	4.0
Volatile	% d.b.	77.1
Fixed carbon	% d.b.	18.9
Ultimate analysis		
C	% d.b.	50.4
H	% d.b.	6.5
N	% d.b.	4.44
S	% d.b.	0.32
Cl	% d.b.	0.01
O	% d.b.	34.33
Heating value		
HHV	MJ/kg d.b.	21.35
LHV	MJ/kg d.b.	19.94



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Fuel preparation

DRYING

Hybrid solar biomass dryer



DENSIFICATION

Pelletizing plant





Gasification





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Fuel preparation

217 h
 9448 kWh
 93.9 % renewable

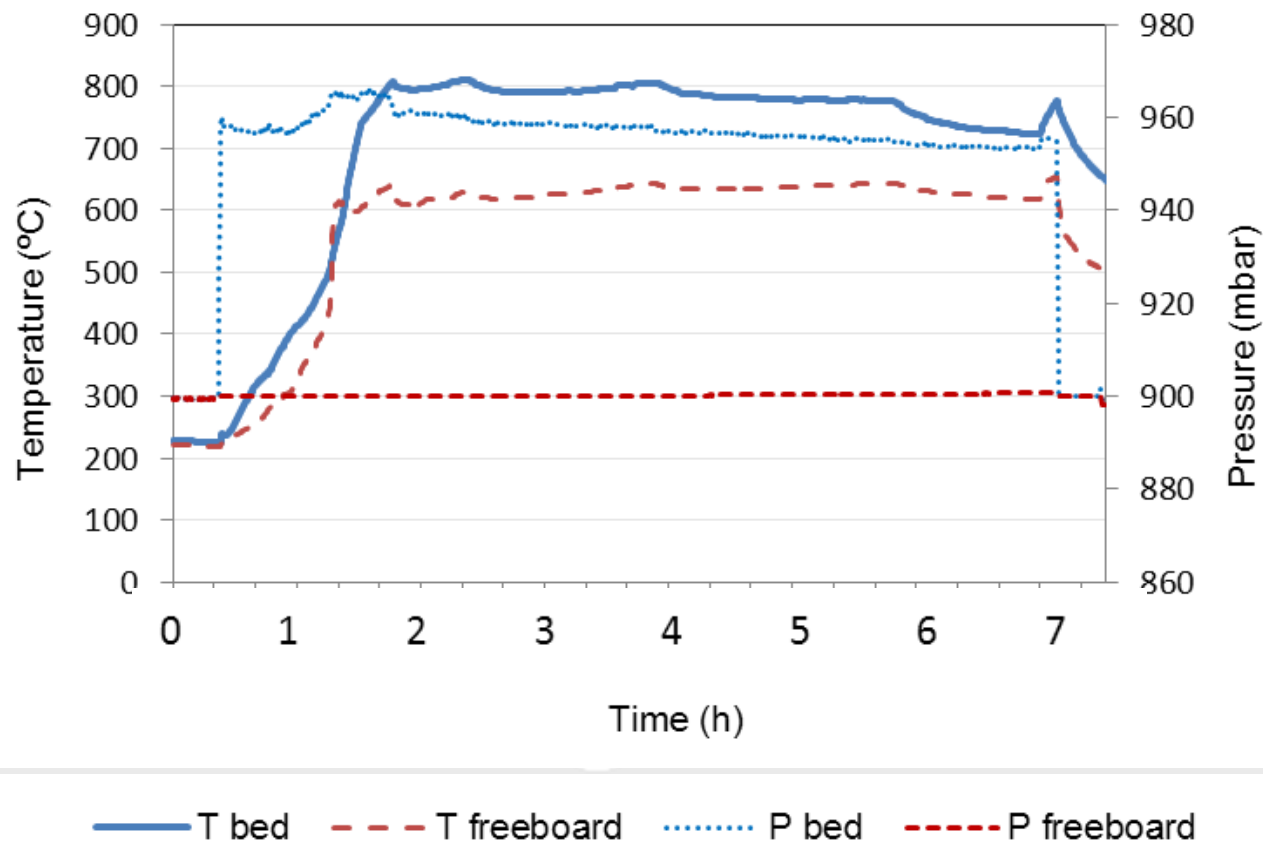


Parameter	BSG as received	BSG dry	BSG pellets
Moisture	81.3	19.5	11.5
Bulk density	-	148	517

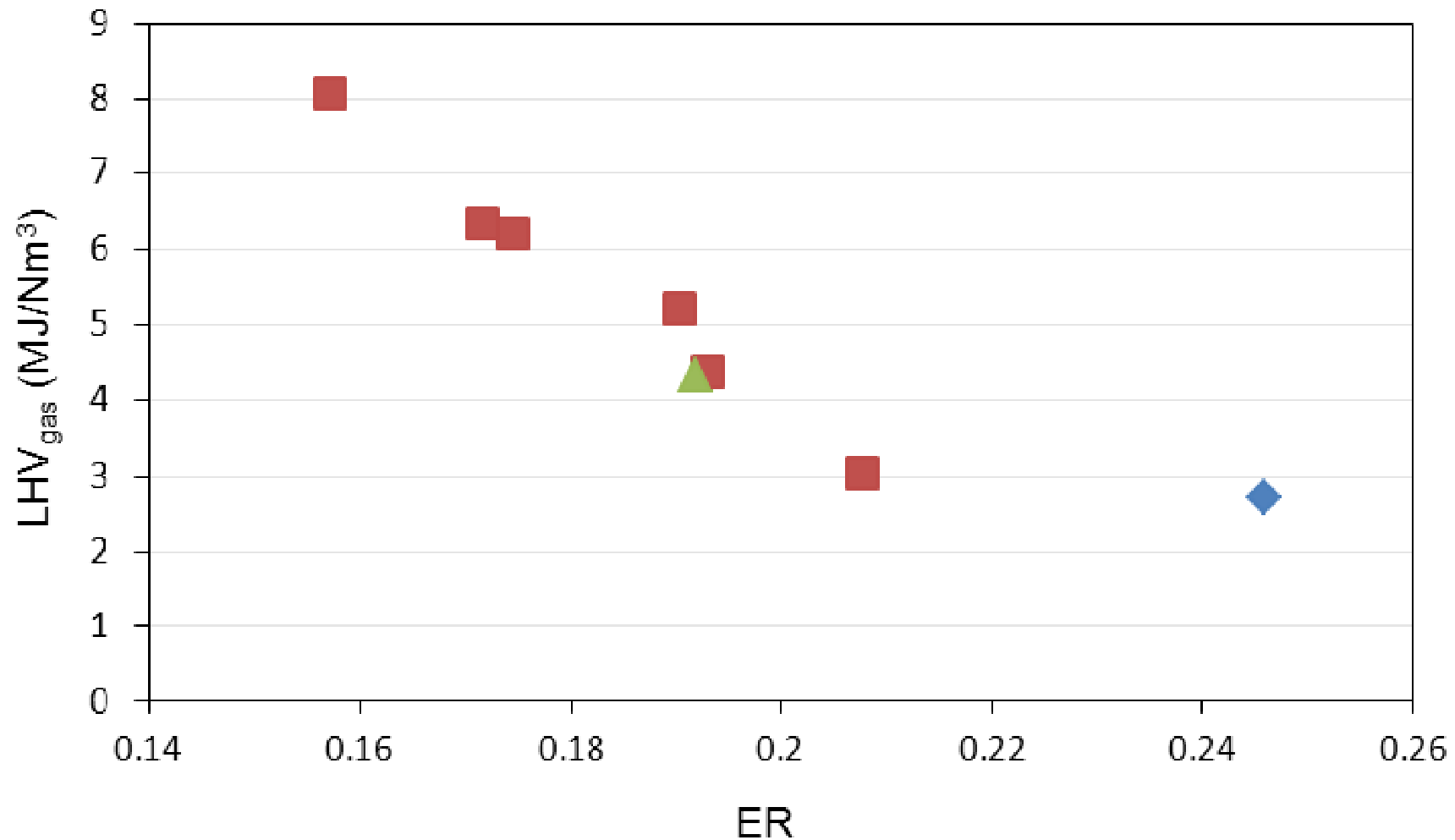


Gasification

Operating conditions	
THR (Throughput)	424, 567, 706 kg/(h·m ²)
ER	0.15-0.25
Bed Temperature	725-860 °C
Bed material	Silica

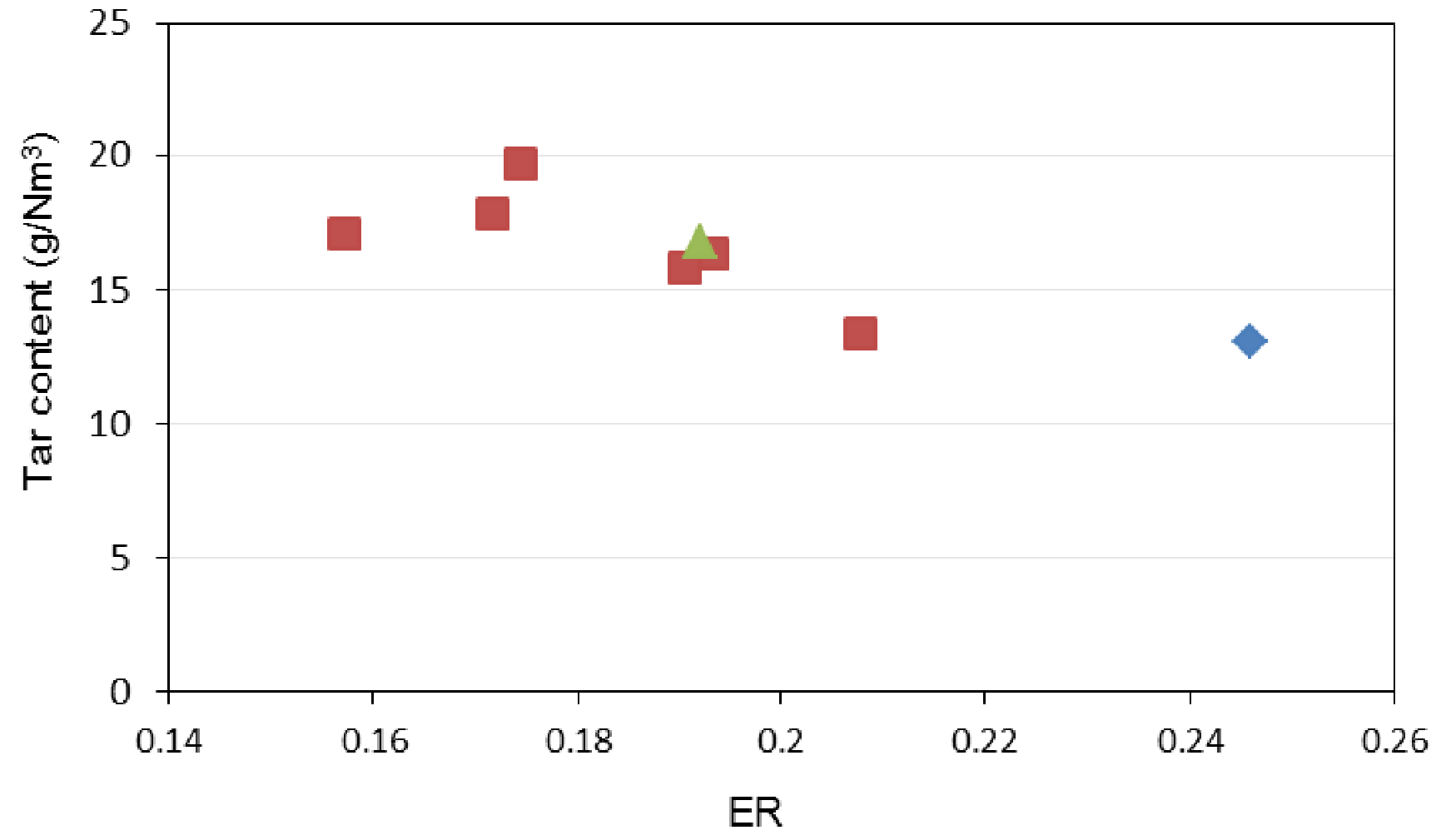


Low Heating Value (LHV)



◆ THR = 424 kg/(h·m²) ■ THR = 567 kg/(h·m²) ▲ THR = 706 kg/(h·m²)

Tar content



◆ THR = 424 kg/(h·m²) ■ THR = 567 kg/(h·m²) ▲ THR = 706 kg/(h·m²)

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- **BSG preparation:**
 - Drying: Reduction of moisture content from 81.3 % to 19.5 %, using 93.9 % of renewable energy.
 - Densification: Pelletizing increases BSG density from 148 kg/m³ to 517 kg/m³.
- **Gasification:**
 - The produced gas has a LHV between 2.7-8.1 MJ/Nm³ and between 13-17 g/Nm³ of tar contents.
 - The LHV decreases with ER. Moreover, total tar decreases with ER
 - The LHV increases with THR. Tar content increase with THR.

THANK YOU!

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