

Politechnika
Wroclawska

Torrefaction of Agro-Biomass

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Wydział
Mechaniczno-Energetyczny

Agro Biomass

The principles of qualifying biomass for energy purposes in the domestic legislation have been laid down, first of all, in the Regulation of the Minister of Economy of 14 August 2008 on the detailed scope of the obligation to acquire and present certificates of origin for cancellation, pay the substitution fee, purchase electricity and heat produced from renewable energy sources and the obligation to confirm the data concerning the amount of electricity produced from in a renewable energy source (Journal of Laws of 2008 no. 156 item 969 as amended). Pursuant to the definition included in § 2 item 1 of this regulation, biomass is fixed or liquid substances of plant or animal origin that undergo biodegradation, originating from products, waste and residues from agricultural and forest production as well as the industry processing their products and parts of remaining waste which undergo biodegradation and cereal grains that do not fulfill the quality requirements for grains in intervention buying-in, as specified in Article 4 of Commission Regulation (EC) no. 687/2008 of 18 July 2008 establishing procedures for the taking-over of cereals by intervention agencies or paying agencies and laying down methods of analysis for determining the quality of cereals (Official Journal of the EU L 192 of 19.07.2008, p. 20, it applies to four kinds of cereals, i.e. wheat, corn, sorghum and barley) and cereal grains that are not subject to intervention buying-in.

Source: biomasapartner.pl

Agro Biomass

In accordance with the present regulations, agro biomass includes biomass:

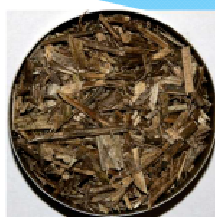
- originating from energy cultivations;
- being waste or residue of agricultural production and industry processing its products (thus no product of agricultural production can be qualified and no product from industry processing agricultural products, which is to prevent competition between the food market and biomass for energy purposes);
- in the form of cereal grains that do not fulfill the quality requirements for grains in intervention buying-in and cereal grains that are not subject to intervention buying-in;
- from waste from industry processing forest products, combusted at the place of their generation – e.g. mixture of coniferous and deciduous wood and bark burnt directly in the unit functioning within the sawmill ;
- biomass being a different type of waste undergoing biodegradation, excluding waste and residues from forest production as well as the industry processing its products.

Source: biomasapartner.pl

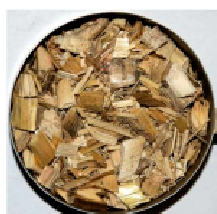
Agro Biomass in Poland



Wheat straw



Rape straw



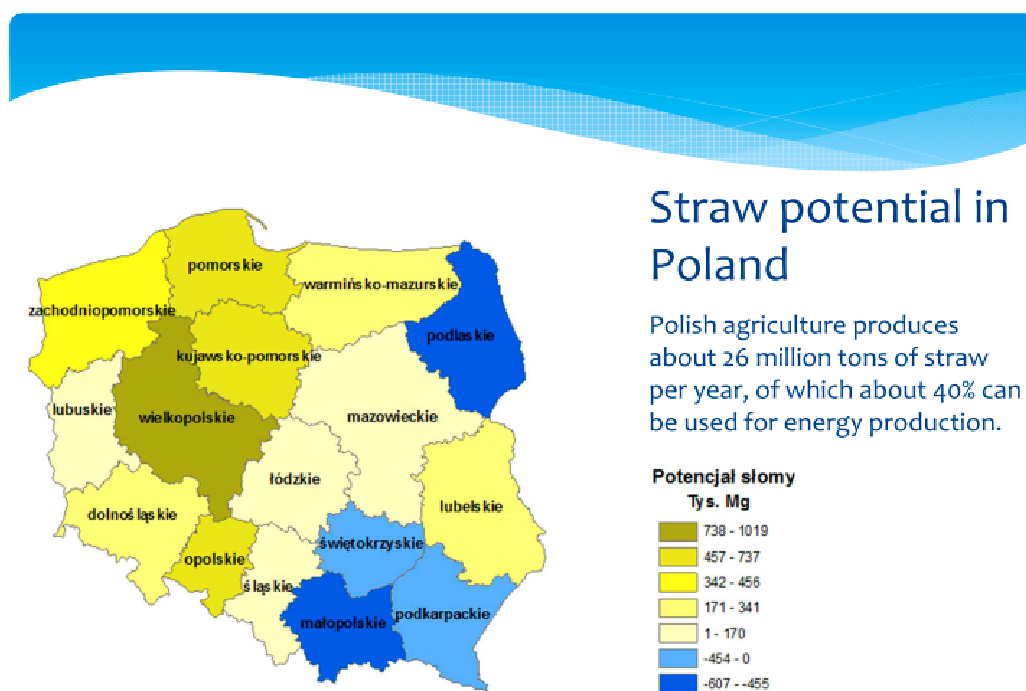
Corn stover



Corn cob



Palm Kern Shell
(imported biomass)



Source: www.bioenergjadlaregionu.eu

Biomass for research



Triticale straw

Oat straw

Rye straw

Barley straw

Wheat straw

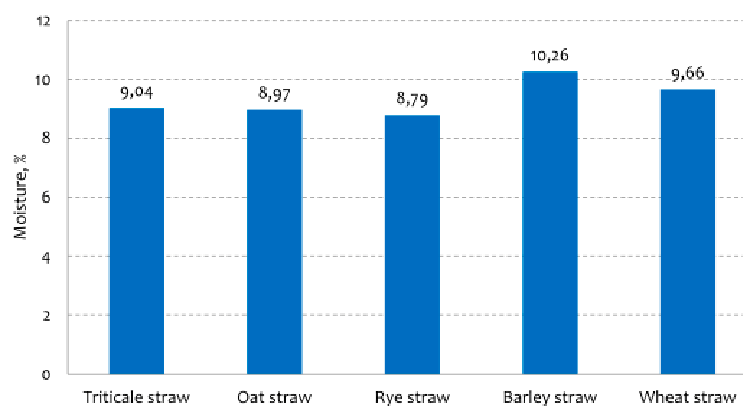
Measuring of moisture content



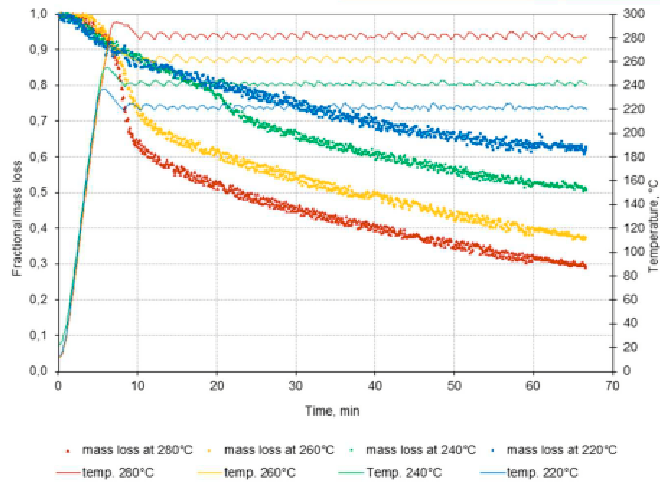
Polish Norm PN-80/G-04511
Solid fuels – moisture content
determination

Laboratory dryer

Comparison of moisture content

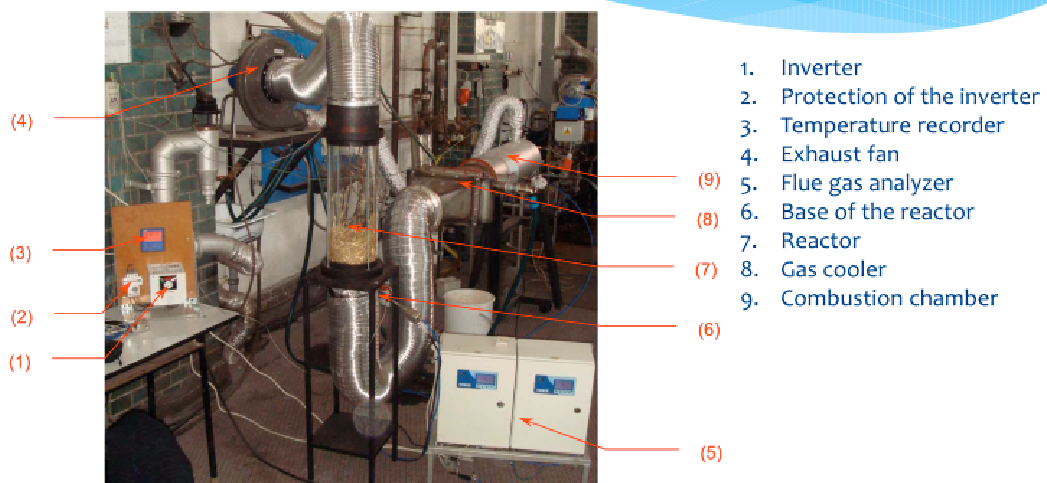


TGA analysis



Mass loss of wheat straw depending on temperature and time

Test stand for torrefaction

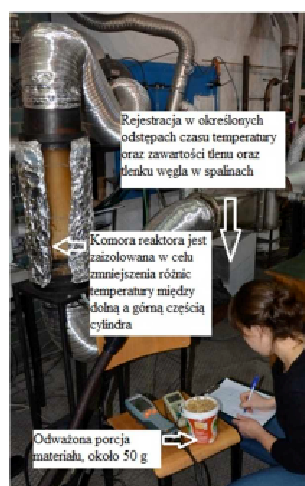


Rotating bed



Wideo





Wideo



Wheat straw



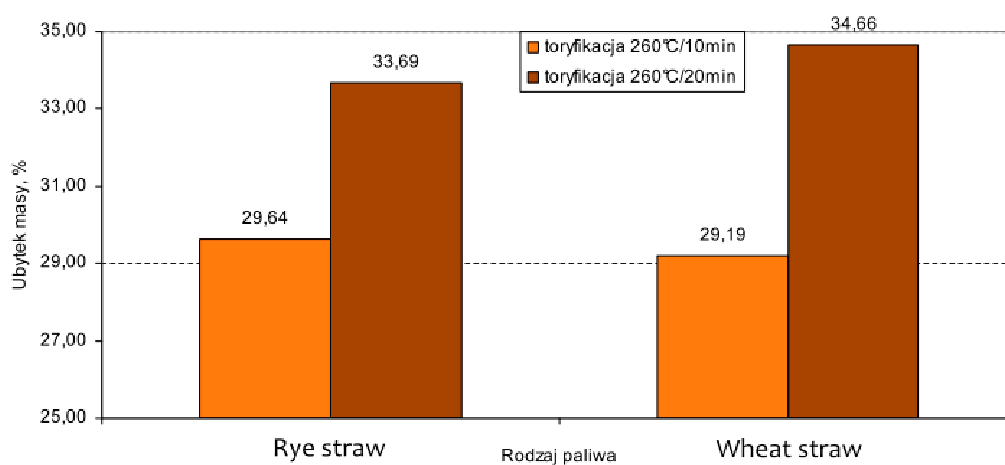
- 0 – Fresh,
- 1 – Torrefied at 10 minutes,
- 2 – Torrefied at 20 minutes,
- 3 – Torrefied at 40 minutes,

Rye straw

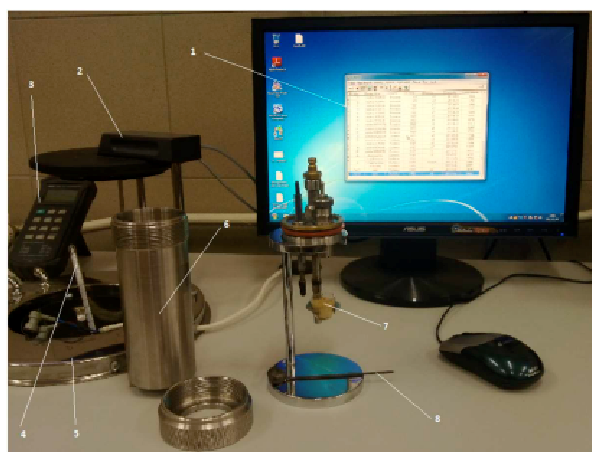


- 0 – Fresh,
- 1 – Torrefied at 10 minutes,
- 2 – Torrefied at 20 minutes,

Comparison of mass loss



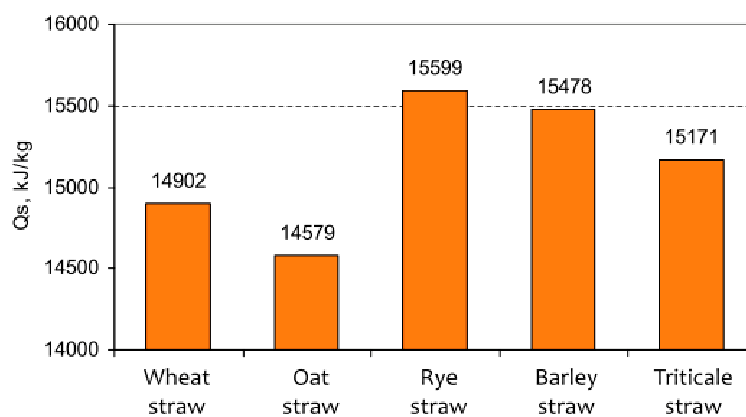
Measuring heating values



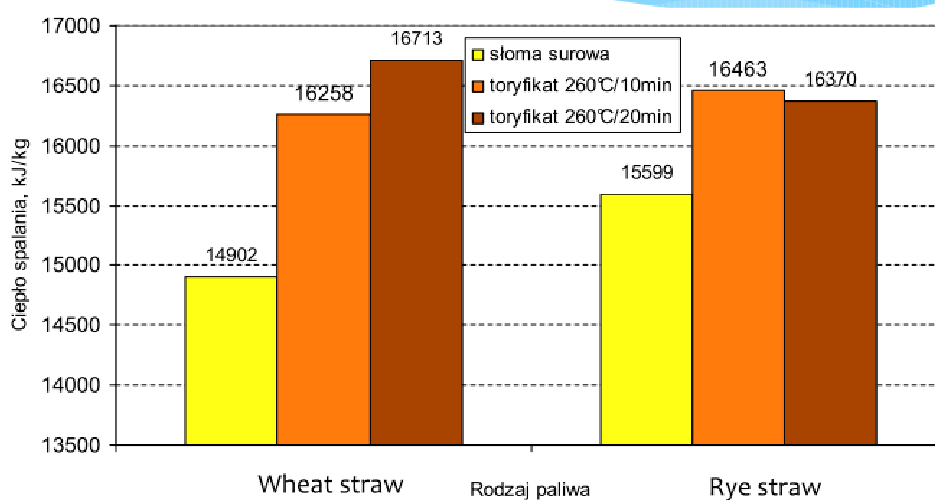
Polish Norm PN-81/G-04513
Solid fuels – determination of heat of combustion and calculation of calorific value.

KL-12M bomb calorimeter

Higher heating value of biomass



Comparison of HHV



Measuring of volatile content

Polish Norm PN-81/G-04516
Solid fuels – determination of volatile matter
content by gravimetric method.



Laboratory furnace

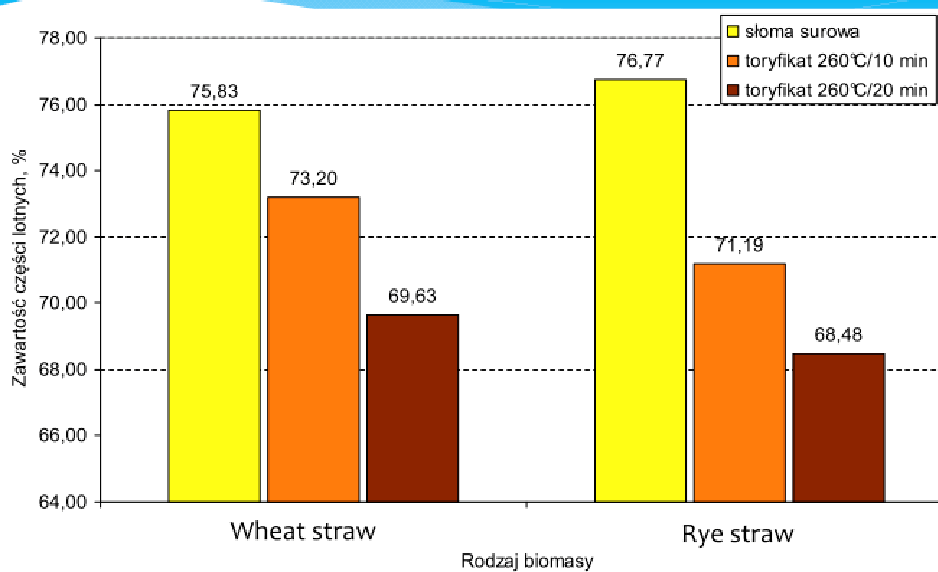


Digital laboratory scales



Biomass sample before (left) and after (right) test

Comparison of volatile content



Measuring of ash content

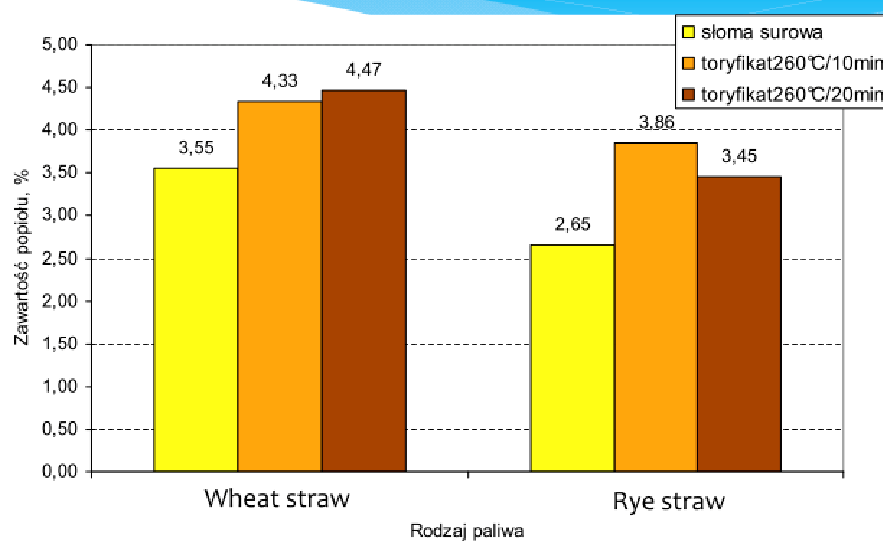
Polish Norm PN-80/G-04512

Solid fuels – determination of ash content by gravimetric method.



Biomass sample before (left) and after (right) test

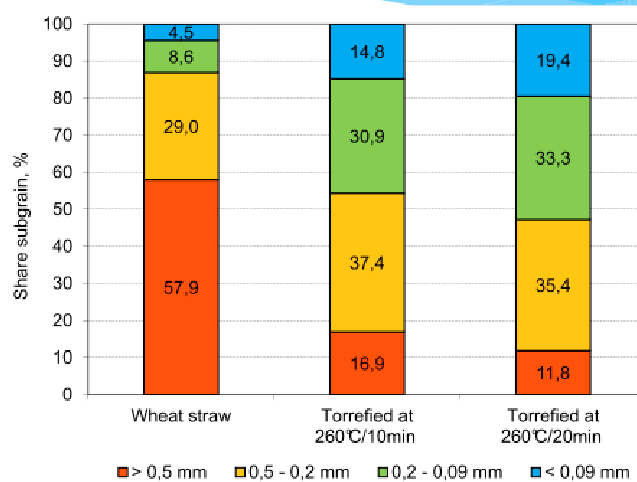
Comparison of ash content



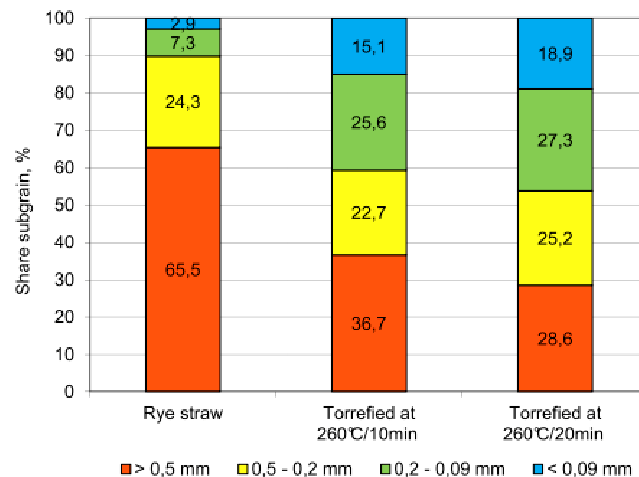
Analysis of milling process



Influence of torrefaction on the grindability



Influence of torrefaction on the grindability



Conclusion

Torrefaction belongs to the processes of thermal valorisation of lignocellulose biomass.

The process makes possible to produce torrefied biomass (called BioCoal) being a solid fuel of improved properties in comparison to raw biomass.

The most important advantages of BioCoal include higher degree of fuel coalification, increase in calorific value, better grindability and hydrophobic nature of torrefied material.