





Abstract:

Biomass presents an extremely high share of renewable sources in the EU, but up to now it is underexploited, in particular for the value-added products. Our research focus on applicability of widely available wheat and barley stalks to produce both final products: biofibers and pellets. Cereal residues were used for the fibers production with the aim of reduction of fossil fuels dependence. Reaction conditions and energy efficiency of biomass pretreatment were improved in a way that instead of high consumption of electric energy, microwave energy was applied in the pretreatment stage of the textile fibers extraction.

RESEARCH FOCUS:

Major green initiatives of bio-based industries include usage of underexploited feedstocks from crop plants, fungi and algae, trees, agricultural and forestry residues. Our research focuses on residues derived from cereal-based agriculture waste.

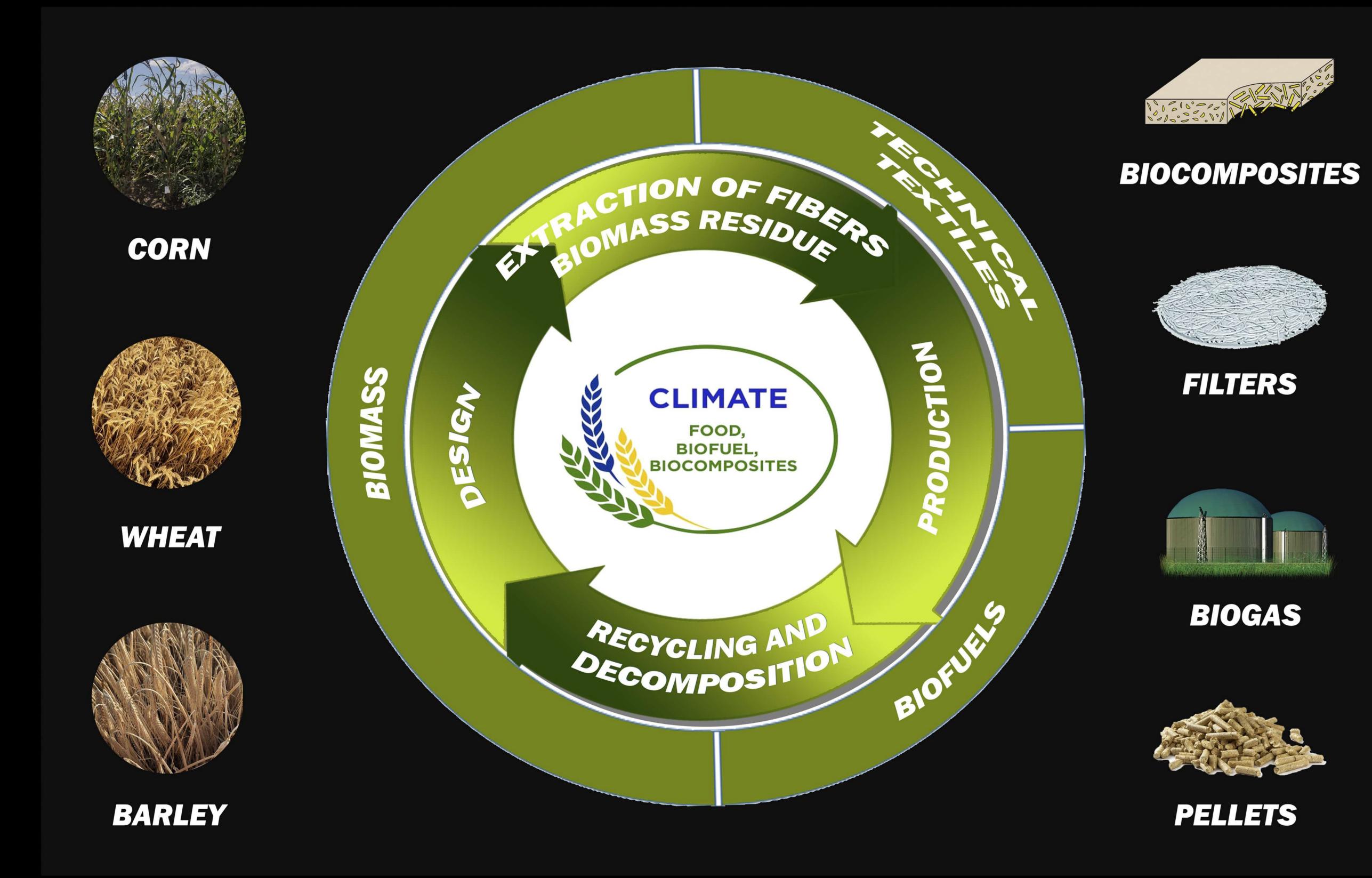


Fig. 1. Project scheme



DUAL UTILIZATION OF CEREAL RESIDUES FOR BIOFIBERS AND PELLETS

REPUBLIC OF CROATIA Ministry of Regional Development and EU Funds

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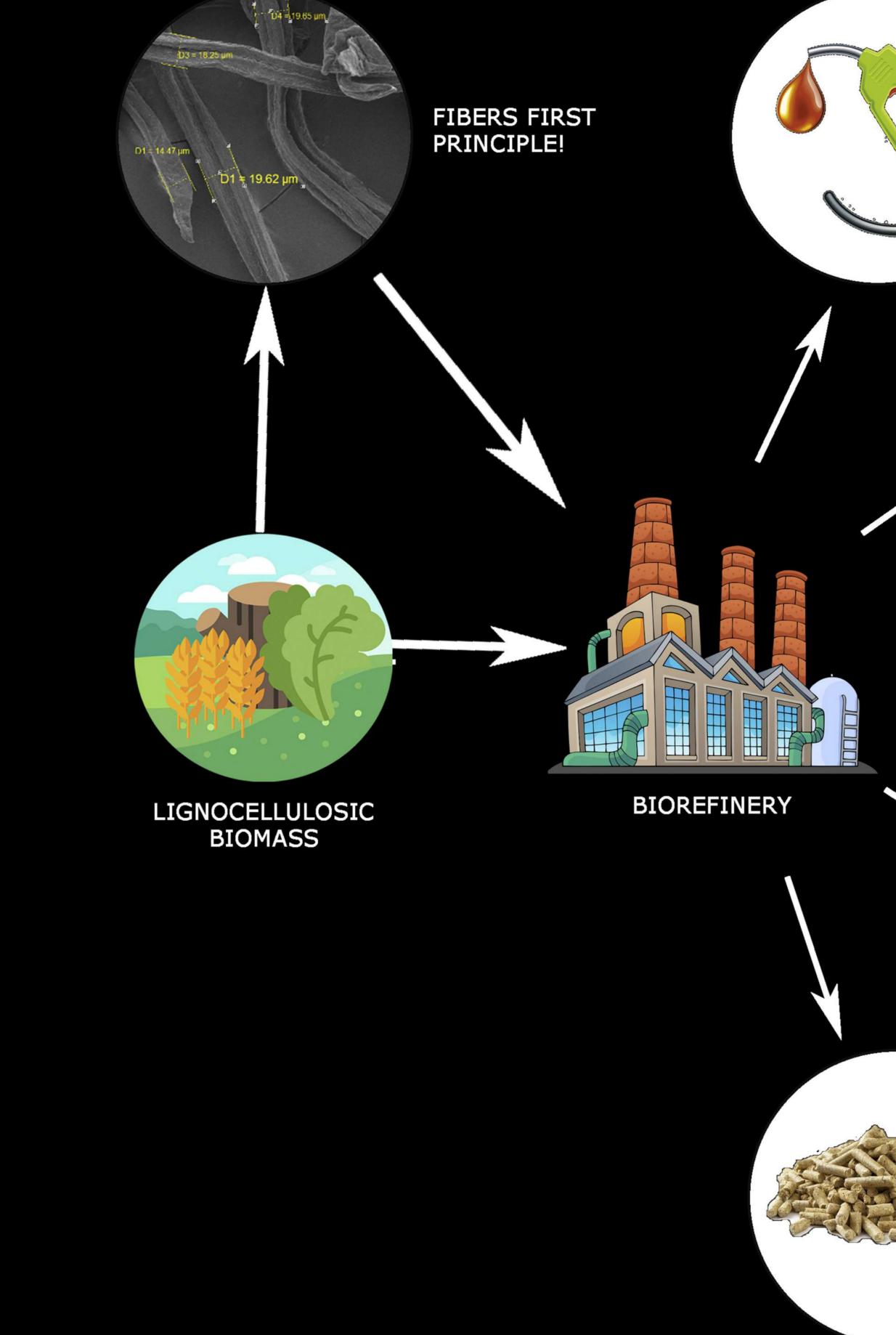


Fig. 2. Textile technologist approach fo

RESULTS:

Quality of extracted biofibers proved to be in line with convenient cellulose-based products.

Table 1: Comparison of cereal-based lignocellulosic crops properties

Crop	Chemical agent	Time (min)	Fiber yield (%)	Moisture content (%)	Density (g/cm³)			
Barley straw	3% <u>NaOH</u>	60	8.9	/	/			
		90	10.6	10.52 (0.08)*	1.48 (0.00)*			
	5% NaOH	60	6.9	/	/			
		90	8.2	/	/			
Wheat straw	3% NaOH	60	9.5	/	/			
		90	10.2	10.63 (0.03)*	1.42 (0.08)*			
	5% NaOH	60	7.2	/	/			
		90	8.9	/	/			
*Standard deviation								

Additionally favorable is the fact that solid waste from the production of cellulosic fibers which amounts up to 35.0% (wheat) and 27.5% (barley) can be further applied as resource to produce biofules (both solid fuel – pellets and bioethanol).



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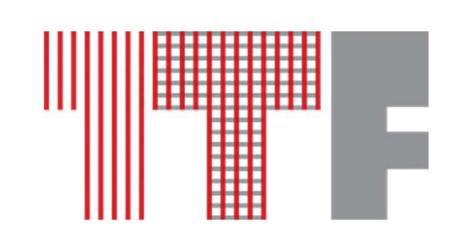
	Table 2. Proximate analysis of wheat and barley biomass					
II. GENERATION BIOETHANOL	Culture	Moisture (%)	Ash (%)	Cfix (%)	Volatile substances (%)	
CO, FOR BIO-CCUS	Wheat	10.97±0.23b	7.68±0.25b	8.35±0.37b	74,75±0.82a	
(Carbon Capture Usage and Storage)	Wheat after extraction	7.93±0.71a	1.76±0.18a	6.74±0.17a	84.25±1.55b	
	Barley	9.01±0.46b	10.08±0.31b	6.98±0.81a	75.46±0.66a	
	Barley after extraction	7.07±0.16a	2.07±0.06a	5.05±0.18a	84.55±1.45b	
	stalks (10.08%) and the traction of wheat and back Table 3. Calo	arley (e.g. 1	1.76% and	2.07%).		
BIOGAS PRODUCTION	Culture	HHV (MJ/k	g) LHV	(MJ/kg)	Pellet:oil ratio (for LHV)	
	Wheat	18.07±0.21	b 16.6	69±0.06b	2.46:1	
PELLETS AND BRIQUETS	Wheat after extraction	16.35±0.12	a 14.5	56±0.09a		
for lignocellulosic biomass usage			h 1C 1		2.81:1	
	Barley	17.44±0.16	D 16.1	.8±0.21b	2.81:1 2.53:1	
to be in line with convenient cellulose-based	Barley Barley after extraction	17.44±0.16 16.96±0.09		.8±0.21b 74±0.12a		

Ultimate analysis (N, C, S, H, %) displays lower values of Sulphur, measured on solid waste after extraction (0.02% both for wheat and barley). Lower calorific values (LHV, MJ/kg) confirmed high quality of proposed raw material – wheat and barley residues. The energy value of the pellets generated from fiber production waste was 14.56 MJ/kg for wheat (lower that value of wheat stalks e.g. 16.69) and 15.74 MJ/kg for barley (compared to barley stalks e.g. 16.18). Our research revealed pellet: oil ratio values in the range 2.46-2.81:1, meaning that only 2.81kg of wheat stalks is requested for the production of 1 kg of pellets.

CONCLUSIONS:

By exploiting the residues, potential waste will become a raw material and the process of circular bioeconomy will be a closed loop. The inclusion of waste/renewable bioresources in composite/structural/construction materials (while overcoming current limitations in their performance and high price) represents one of the guidelines for researchers, designers and businessmen for sustainable development and environmental preservation in the light of global climate change.

Research is funded by project KK.05.1.1.02.0016: Production of food, biocomposites and biofuels from cereals in circular economy (CLIMATE), under ESIF, Operational programme Competitiveness and Cohesion







ances, %) to barley after ex-