8th CASEE Conference
Warsaw University of Life Sciences SGGW-WULS,
Warsaw, Poland
14th – 16th May, 2017

FROM WASTE TO FUNCTIONAL INGREDIENTS

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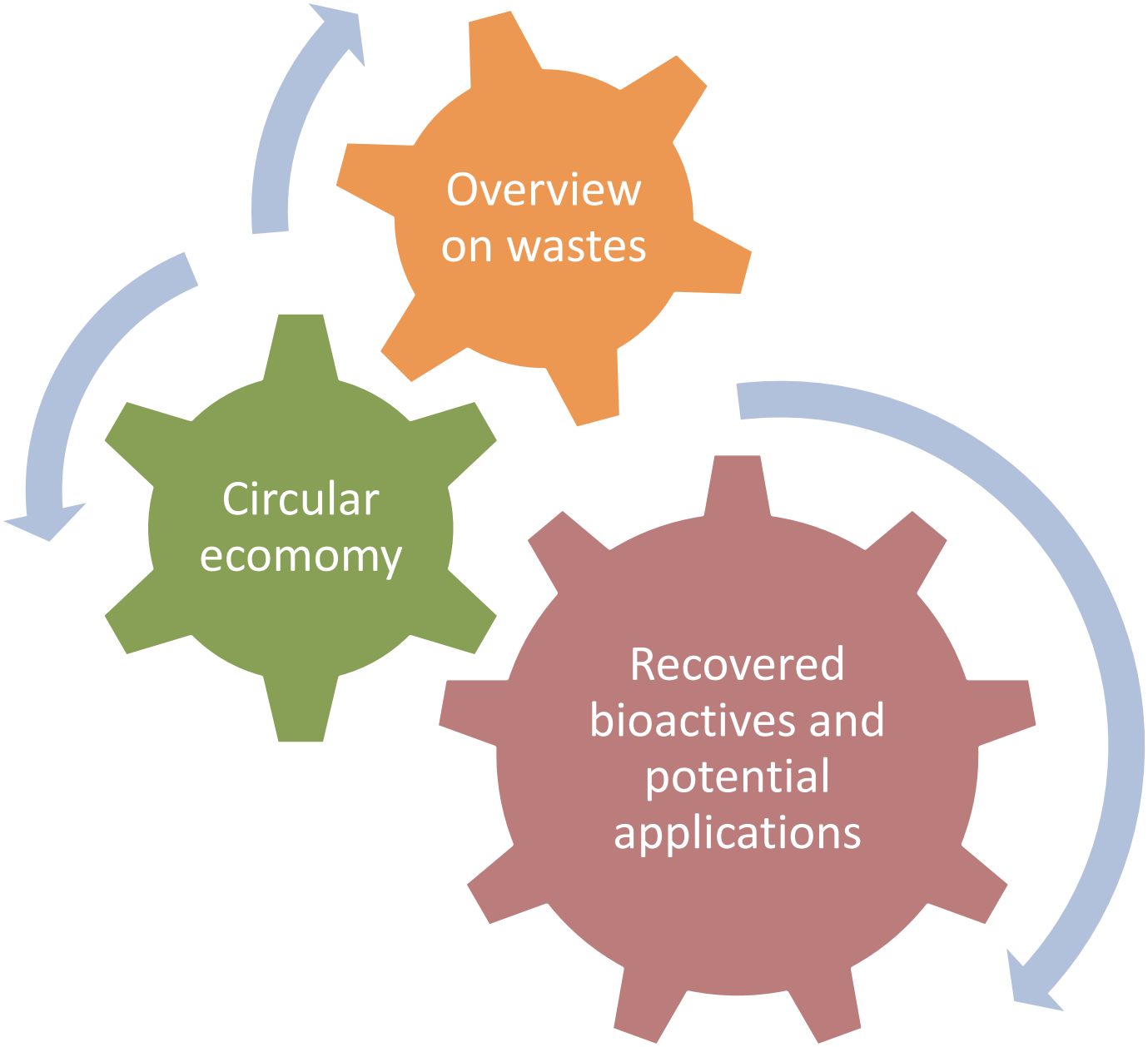
This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCSIS–UEFISCDI, project number PN-II-RU-TE-2014-4-0842.


Overview on wastes
Circular ecomomy
Recovered bioactives and potential applications

- European Commission provided the definition for the term “food waste” as “*food (including inedible parts) lost from the food supply chain, not including food diverted to material uses such as bio-based products, animal feed, or sent for re-distribution*”

- Among food wasted are included also the processing by-products, if these are not used for other high value functions (e.g. animal feed, industrial uses).

EUROPE'S BIGGEST FOOD WASTERS

ALL FIGURES IN MILLIONS OF TONNES – COURTESY OF EUROPEAN COMMISSION

GB

14.391

0.225 per head

1

DE

10.387

0.129 per head

2

NL

9.456

0.563 per head

3

FR

9.078

0.137 per head

4

FOODBEV.COM

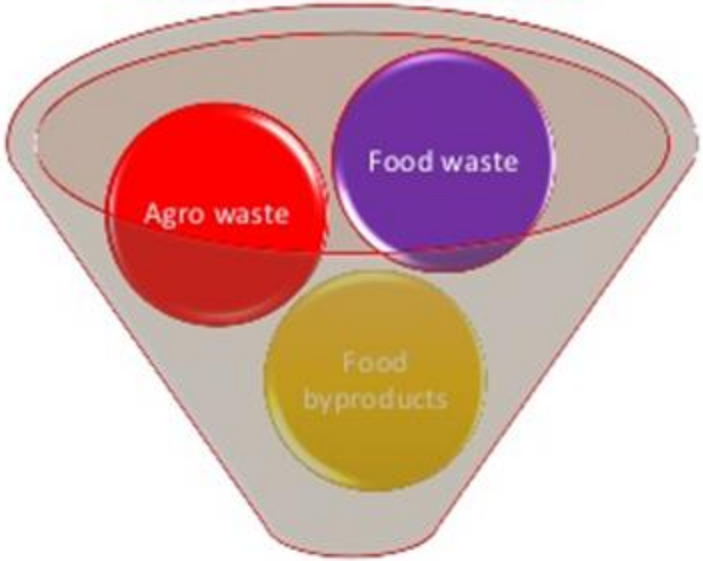
LINIAR ECONOMY CONCEPT

VS

CIRCULAR ECONOMY CONCEPT – “ZERO WASTE”

The problem:

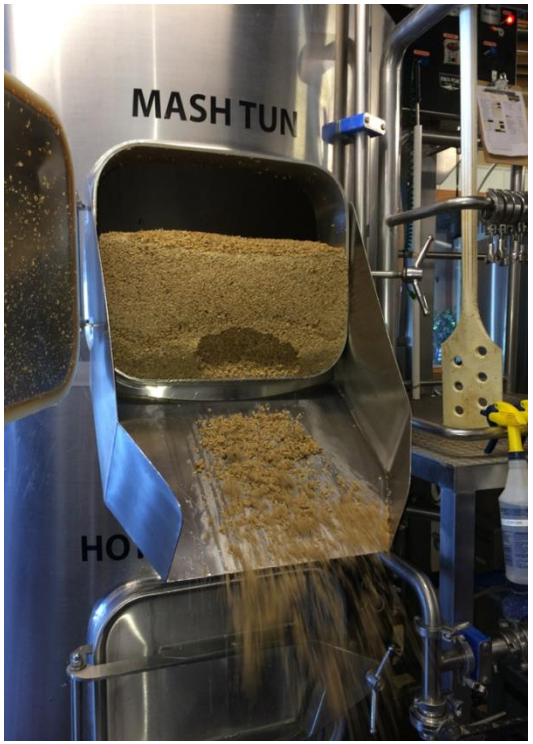
waste management



A possible solution:

high added-value compounds recovery

BREWERS' SPENT GRAIN (BSG)



Up to 85% of the brewing by-products

European Union
3.4×10^6 t / year

Globally
38.6×10^6 t/year

200 tons BSG / 10.000 hl beer

Compound class	Waste origin	By-product source	Extraction techniques
Proteins	Cereals	Brewers' spent grain	Ultrasonic-assisted extraction
			Sequential extraction of proteins and arabinoxylans
			Enzymatic assited extraction
	Oil crops	Rapeseed meal	Ultrasound assited aqueous extraction
		Sunflower meals	Alkaline solubilization and acid precipitation
		Hazelnuts meal	Solvent extraction (water, acetone)
		Canola meals	Alkaline solubilisation and acid precipitation (Isoelectric precipitation)
			Electro-activated solutions (non-invasive extraction method)
			Salt precipitation
		Palm kernel cake	Enzymatic hydrolysis
	Fruits and vegetable	Apricot kernel cake	Alkaline solubilisation and acid precipitation
Polysaccharides (pectin, cellulose, hemicellulose)	Cereals	Brewers' spent grain	Enzymatic hydrolysis
			Sequential extraction of proteins and arabinoxylans
			Acid hydrolysis
	Oil crops	Olive pomace	Sequential extraction
	Fruits and vegetables	26 different wastes (e.g. orange peel, grape pomace, tomato skin, berries, apple pomace, seabuckthorn pulp and seeds, parsely, hop, etc.)	Sequential extraction
Lipids	Cereals	Brewers' spent grain	Soxhlet extraction
Polyphenols	Cereals	Brewers' spent grain	Alkaline hydrolysis
	Oil crops	Rapeseed	Ultrasound assisted aqueous extraction
	Fruits and vegetables	Tomato pomace and skin	Enzymatic assisted extraction
			Solvent extraction
		Potato peels and tubers	Pressurized liquid extractor
			Solvent extraction (stirring)
			Ultrasound extraction

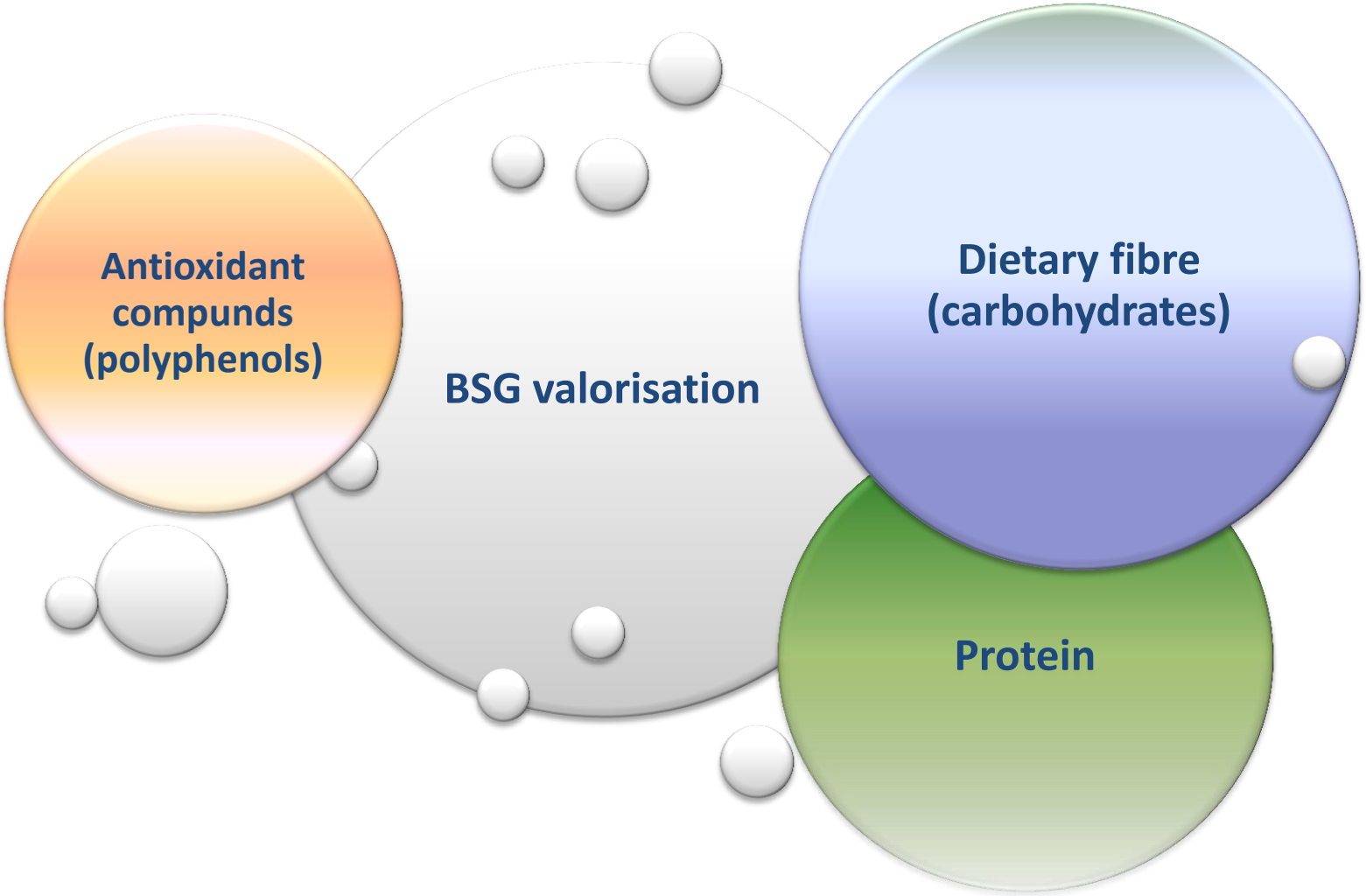
BSG VALORISATION

- **Protein – Fiber - Minerals**

	Wheat flour	Brewers' spent grain
Moisture, %	12.1	5.7
Protein, %	13.3	18
Fiber, %	0.6	41.28
Starch, %	81.06	10.1
Sugars, %	0.22	16.11
Fat, %	0.59	6,61
Minerals, %	1.7	3.82
Energy, cal/100g	335.43	228.6

Fărcas et. al. / Journal of Agroalimentary Processes and Technologies 2014

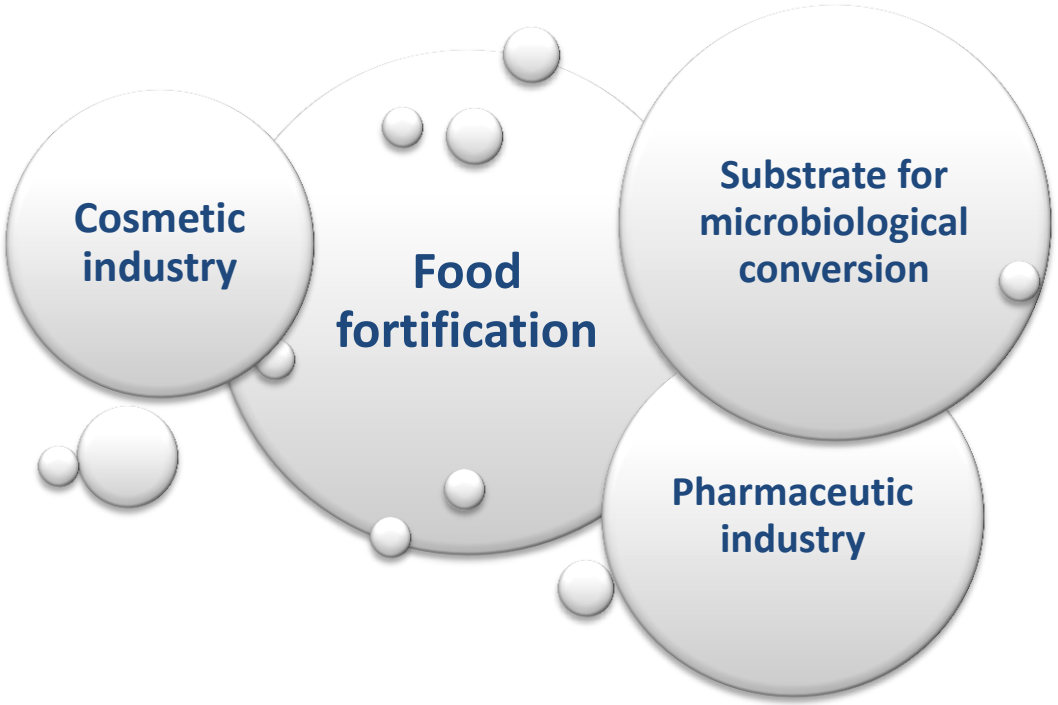
BSG VALORISATION



BSG VALORISATION

- **Polyphenols extraction**

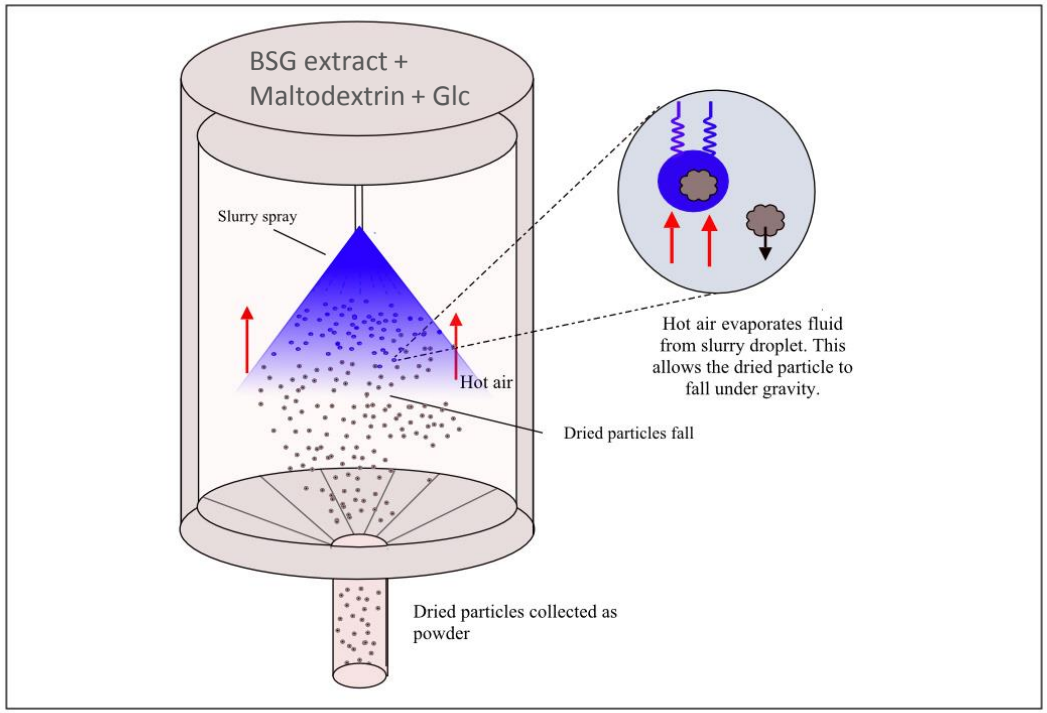
Sample	Total phenols (mg GAE/100 g)	Flavonoids (mg QE/ 100 g)	DPPH inhibition (%)
Dried BSG	284.20±3.07	13.16±0.27	52.87±0.28
Wheat flour	21.12±1.42	2.85±0.10	32.59±0.24
Wholemeal wheat flour	64.68±3.48	3.18±0.15	37.94±0.36

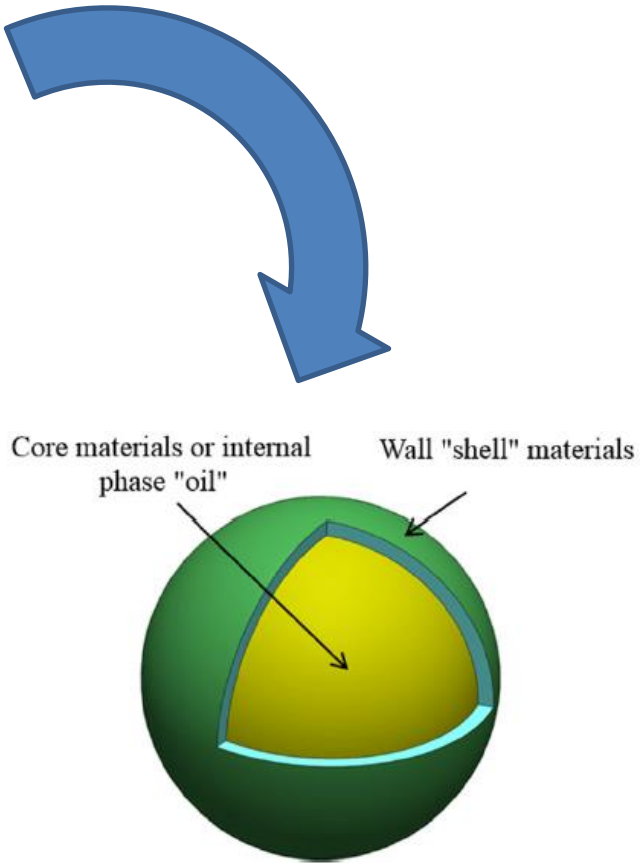


Farcaş, et al. / Journal of Cereal Science 64 (2015) 34-42

BSG VALORISATION

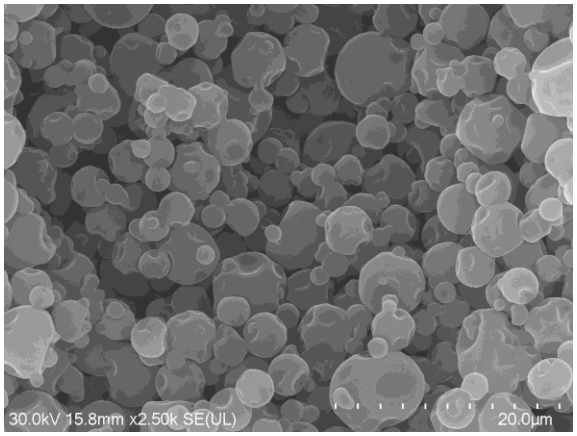
- **Polyphenols microencapsulation**

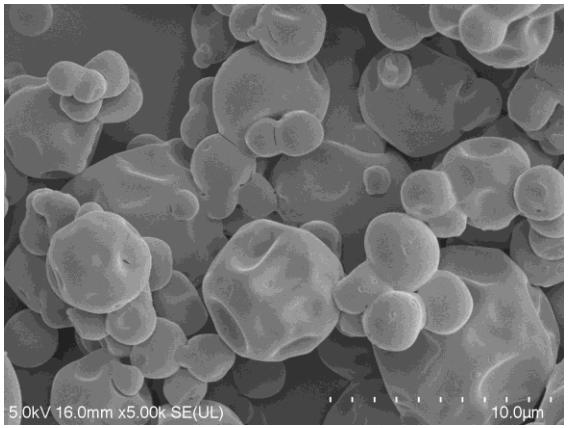


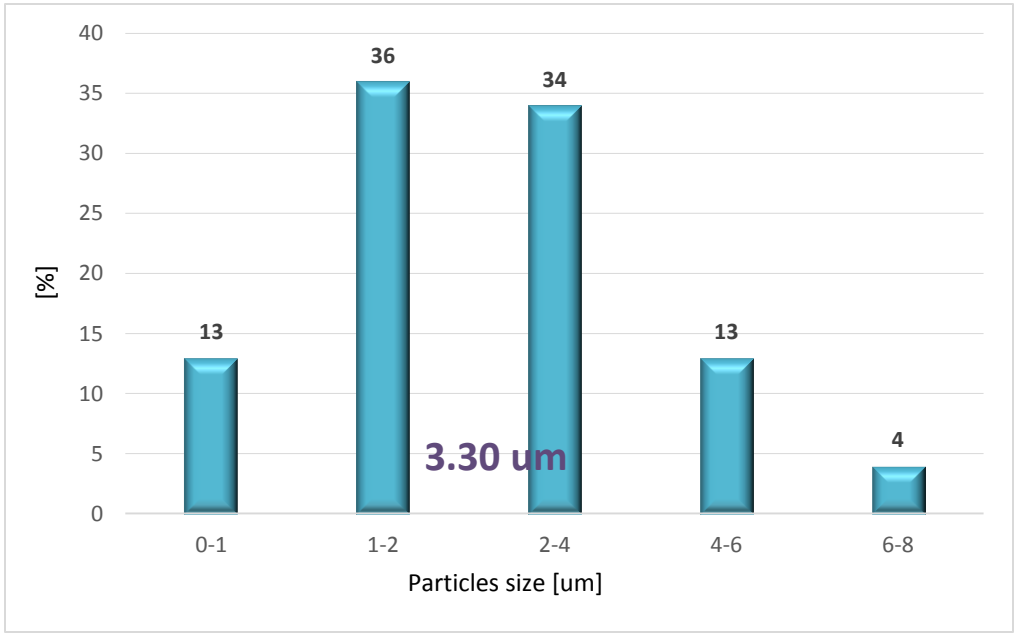


BSG VALORISATION

- **Polyphenols microencapsulation**

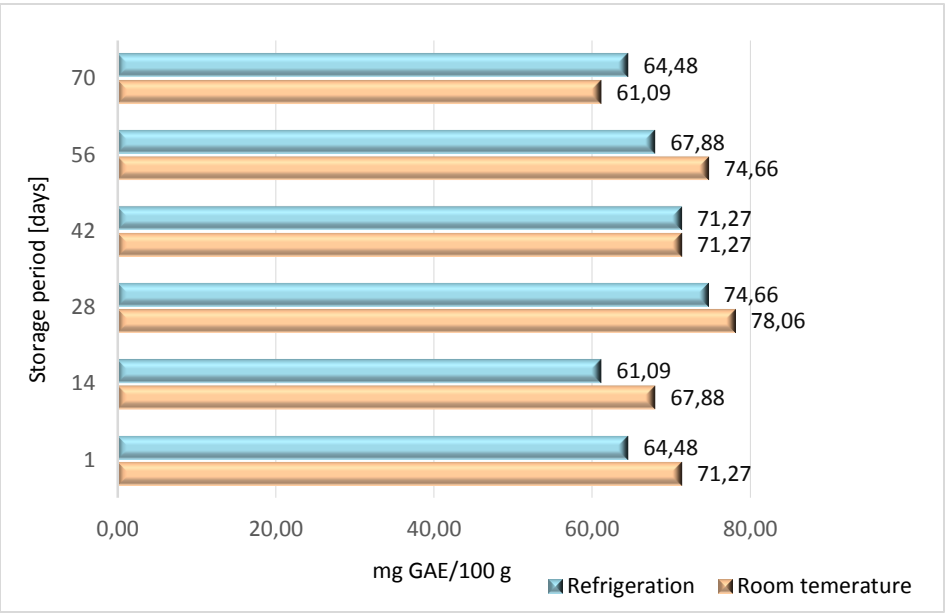


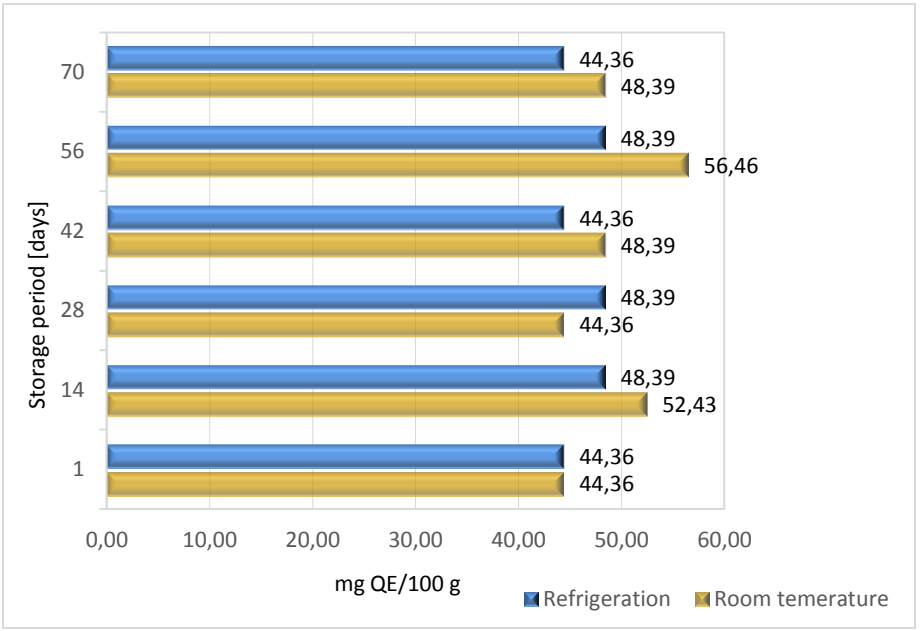


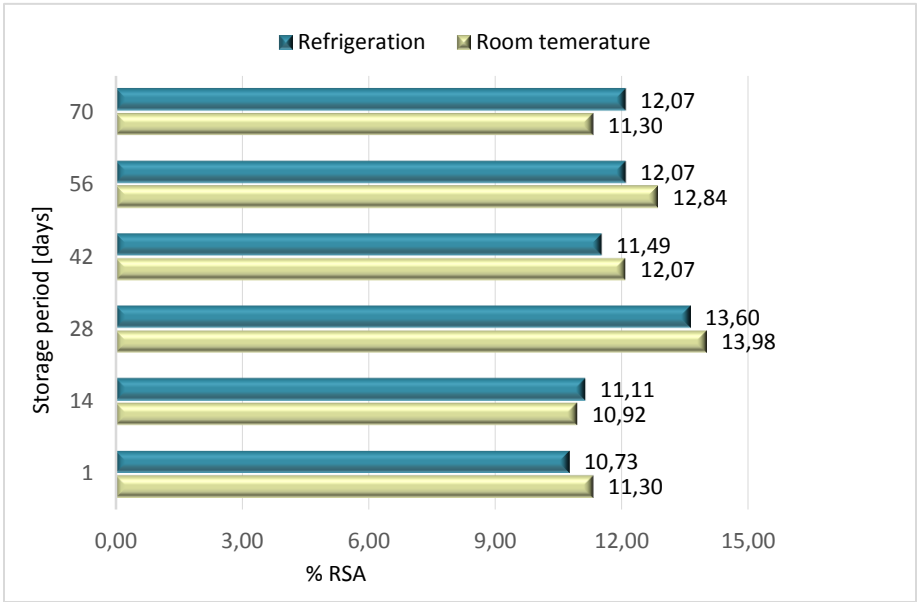


BSG VALORISATION

- **Microencapsulated polyphenols stability**







BSG VALORISATION

FUTURE TRENDS

Renewable resources

Innovation

Sustainable development

Food industry

Chemicals

Science

Waste valorisation

High value compounds

"ZERO WASTE"

Results

Competitiveness

Research

Functional ingredient

By-products

Success

Health

Biomolecules recovery

New generation

Circular economy

Unconventional ways

Food production system

***Acknowledgements**: This work was supported by CNCSIS–UEFISCDI national project, number PN-II- RU-TE- 2014-4- 0842, 52/01.10.2015*