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Monomers & Materials from Coffee by-products

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Global Coffee Forum



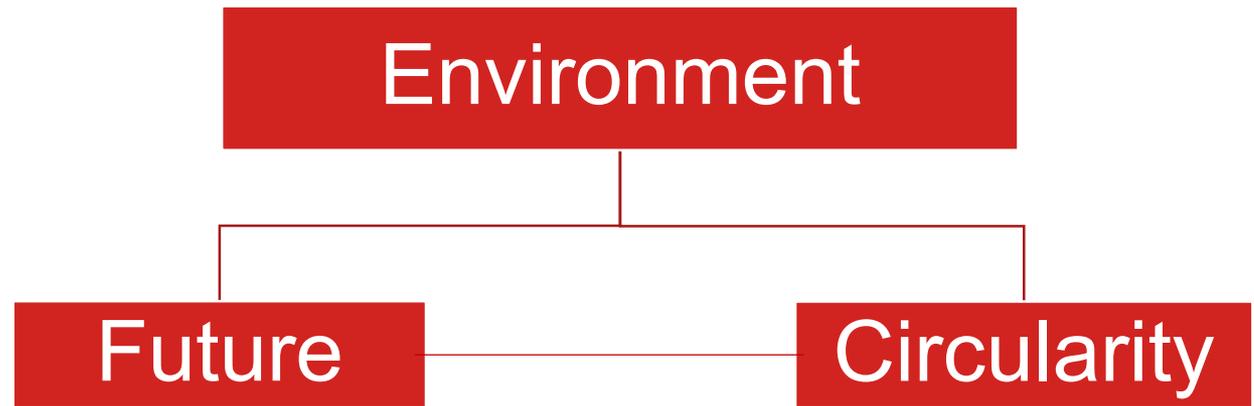
Future Coffee Research Focus

	THREATS	OPPORTUNITIES
AGRONOMY	<u>Climate change</u> <ul style="list-style-type: none"> • agronomical practices • new varietals • new ecosystems • predictive modeling <u>Sustainability</u> <ul style="list-style-type: none"> • chemical residues • productivity 	<u>Differentiation</u> <ul style="list-style-type: none"> • new varietals • ecosystem optimization • agronomical practices <u>Sustainability</u> <ul style="list-style-type: none"> • regenerative agriculture
PROCESSING		<u>Differentiation</u> <ul style="list-style-type: none"> • roasting • grinding
TECHNOLOGY	<u>Environmental impact</u> <ul style="list-style-type: none"> • packaging • coffee machines 	<u>Performance</u> <ul style="list-style-type: none"> • artificial intelligence • active packaging
PHYSIOLOGY	<u>Toxicology</u> <ul style="list-style-type: none"> • new contaminants • 'holistic' approach • metabolomic 	<u>Longevity</u> <ul style="list-style-type: none"> • bioactive compounds • synergies

Sustainability

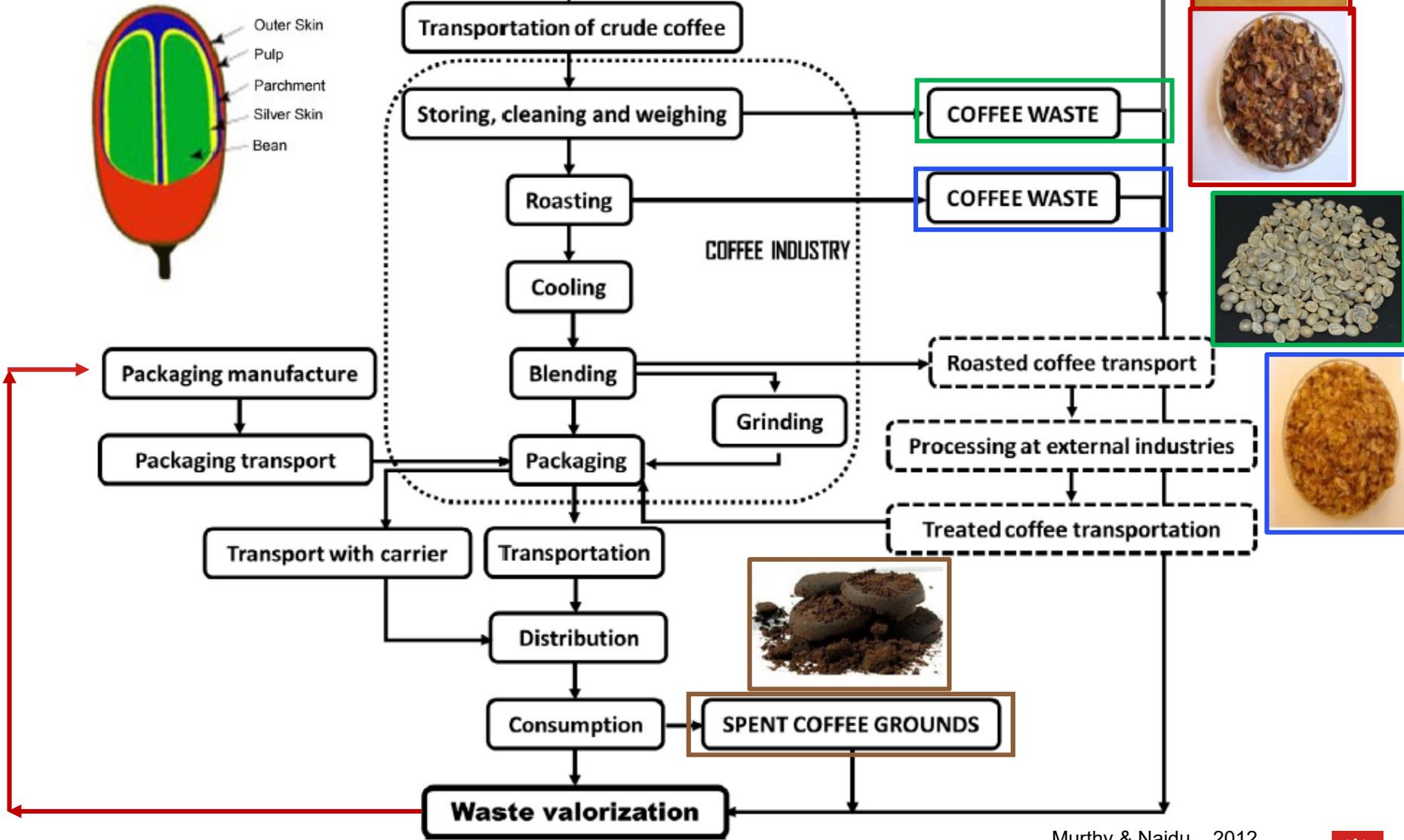


circularity development **economy** education
environment **ethics**
future recovery recycling
responsibility reuse **society**



Economic system that replaces the ‘end-of-life’ concept with **reducing**, alternatively **reusing**, **recycling** and **recovering** materials in production/distribution and consumption processes with the aim to accomplish **sustainable development**, thus simultaneously creating **environmental quality**, **economic prosperity** and **social equity**, to the benefit of current and **future generations**.

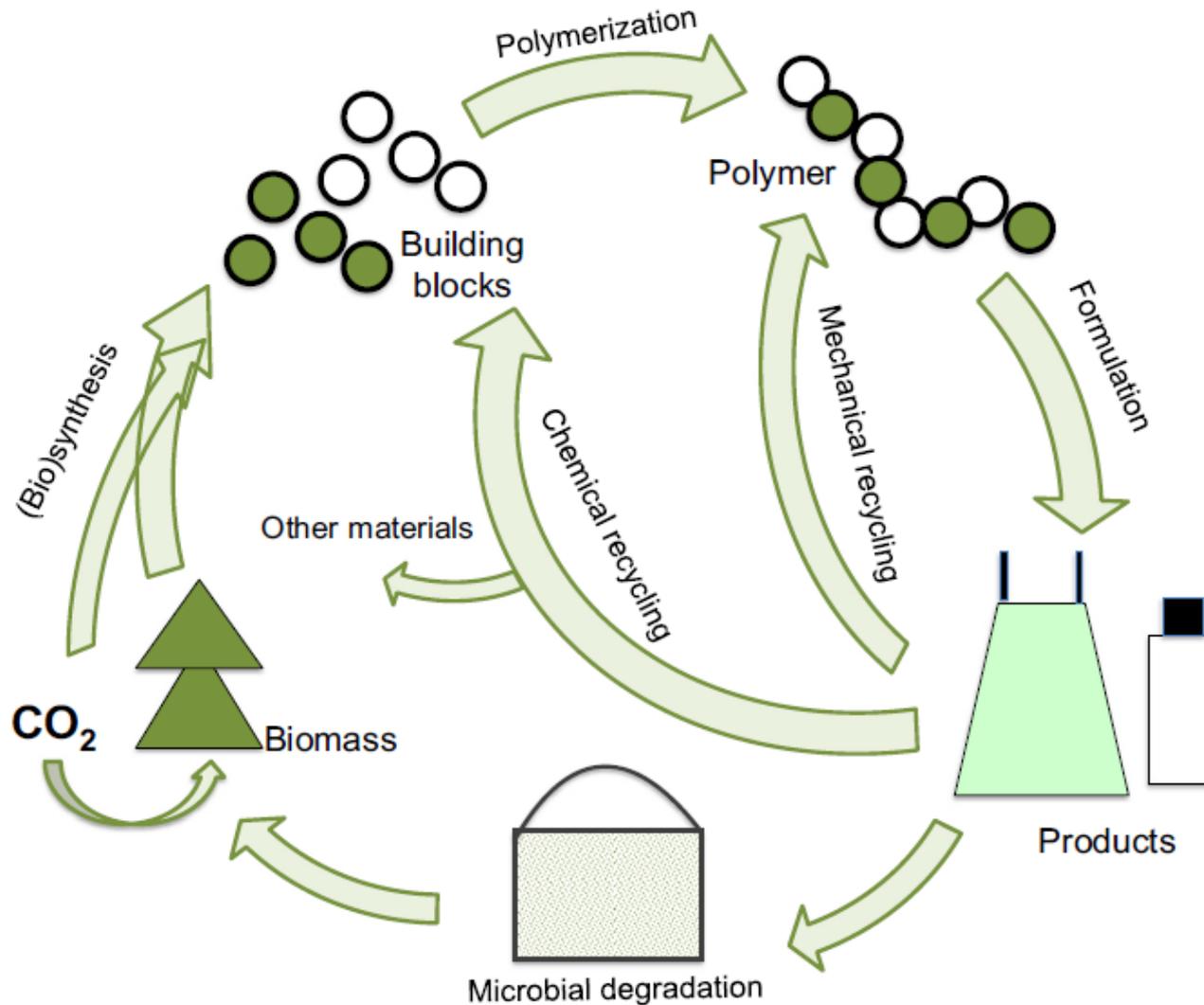
Circularity



Murthy & Naidu, , 2012

Fig. 3. Coffee life cycle shows formation of coffee waste and spent coffee grounds. (adapted from Karmee, 2019).

Sustainable Packaging from Coffee Waste?



Plant-based polymeric materials

Table 1

Common plant-based and petroleum-based materials and their approximate prices.

Material	Source	Price (\$/lb.)
Lignocellulose fiber	Plant	0.2–0.6
Cellulose esters/ethers	Plant/petrochemical	2–10
Starch	Plant	0.10–1.0
Starch/polymer blends	Plant, petrochemical	1–2?
● Polylactic acid (PLA)	Plant	~1.0
● Polyhydroxyalkanoates (PHA)	Plant	2–6?
● Polybutylene succinate (PBS), polybutylene adipate phthalate (PBAT)	Plant, petrochemical	2–3
Polyamides (Nylon 10, 11)	Castor oil	
Zein	Corn	
Biopolyurethanes	Plant, petrochemical	
Bioepoxies	Plant, petrochemical	
● Bio-polyethylene (bio-PE)	Ethanol from corn, sugarcane,etc.	
● Bio-polypropylene (bio-PP)		
Bio-polyethylene terephthalate (bio-PET)	Plant sugars	
Polytrimethylene terephthalate (PTT)	Corn glucose, petrochemicals	
Polyethylene furanoate (PEF)	Corn sugars	
PE	Petrochemicals	0.65–0.80
PP	"	0.85–0.95
PET	"	0.85–0.90
PS	"	1.0–1.2
PVC	"	0.85–0.90

R. Shogren, D. Wood, W. Orts et al. / Sustainable Production and Consumption 19 (2019) 194–215

Conclusion

- Valued added products such as monomers, biopolymers and biocomposites can be obtained from coffee by-products
- A biorefinery based on selected coffee by-products is possible by using a combination of compatible chemical, biotechnological, and thermochemical methods
- Coffee by-products valorisation methods report preliminary experimental results
- Future research needs to focus on techno-economic analysis and feasibility of industrial scale production

Sustainable Packaging from Coffee Waste ?



Thank you for your attention!

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