Valorisation of snail processing waste for sustainable agriculture within a circular economy framework

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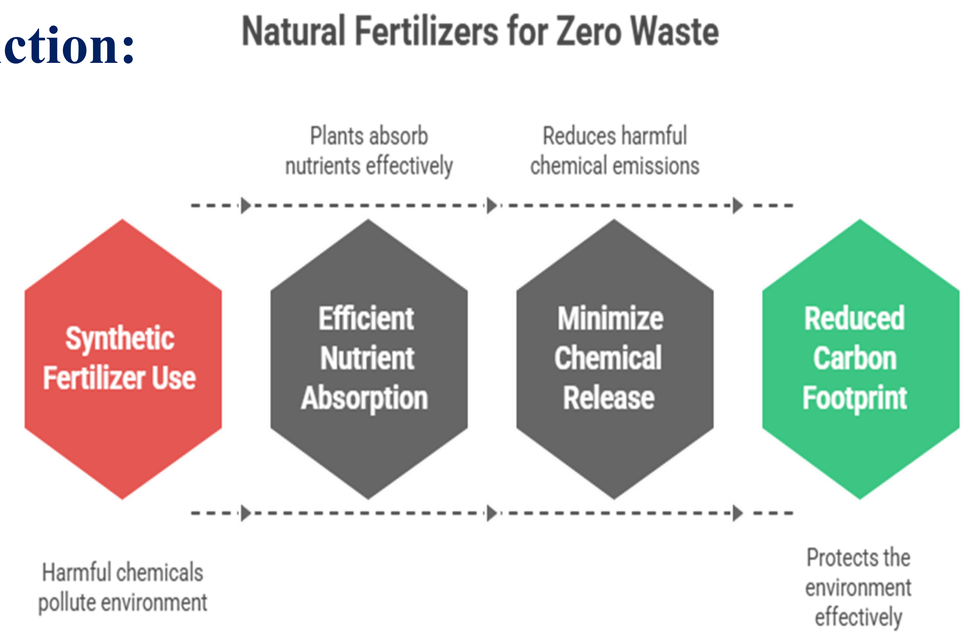
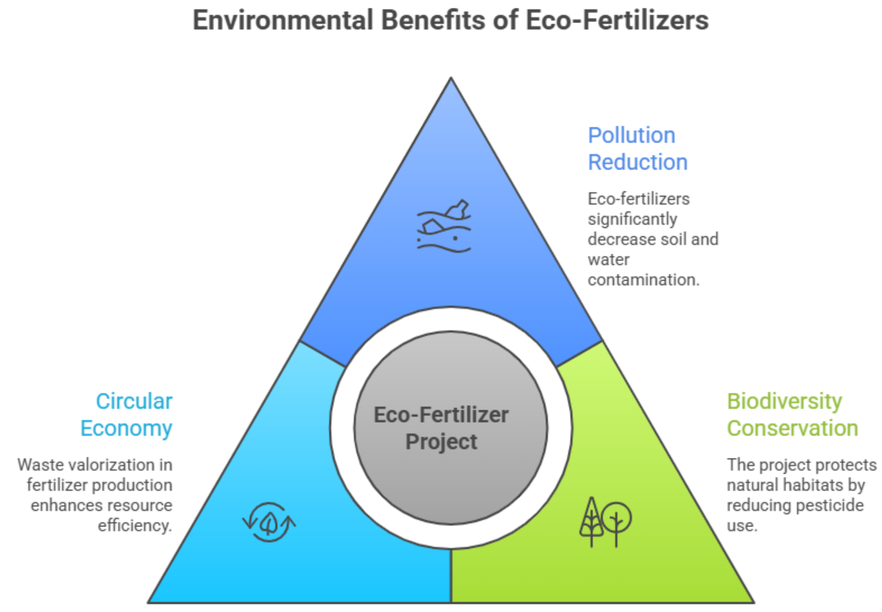
Introduction:



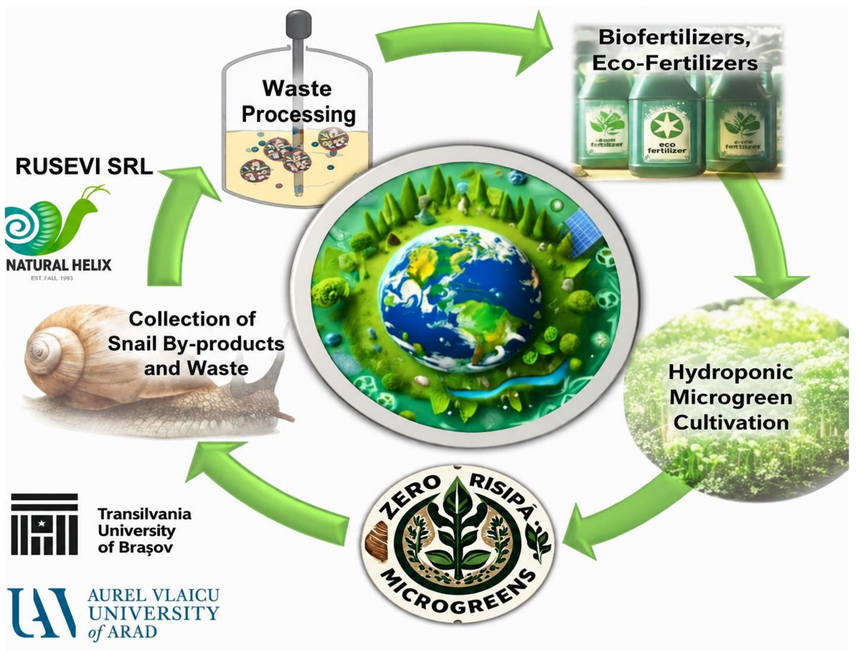


Context:

Anually în Romania are produced 480 tons of snail wastes.

❖ Types of wastes:
- hepatopancreas
- broken shells
- mucus
- process wastewater

Proposal: obtaining eco-fertilizers for use in hydroponic agriculture



Materials and obtaining methods

Step	Material / Fraction	Processing/Test	Key Parameters	Purpose
1	Snail processing waste (*Helix pomatia*)	Collection and homogenisation	Mass balance	Recovery of secondary resources
2	Organic fraction	Slow maceration (≈3 months)	DOC/TOC release	Nutrient solubilisation
3	Liquid macerate	Vacuum filtration	TOC, TN, COD	Nutrient-rich extract
4	Liquid macerate (diluted)	Algal growth inhibition test	72 h exposure, μ, μ_{max}, EC_{50}	Ecotoxicity screening (*Chlorella vulgaris*, OECD 201 / ISO 8692)
5	Solid residue	Drying and milling	Particle size	Solid amendment precursor
6	Hepatopancreas powder (HPF)	Drying + grinding	SEM, granulometry	Organic fertiliser fraction
7	Shell powder (HPO)	Milling + calcination	FTIR, XRF, BET	Mineral nutrient carrier
8	Organo-mineral system	Fraction integration	Functional assessment	Closed-loop fertiliser concept

Shells milling

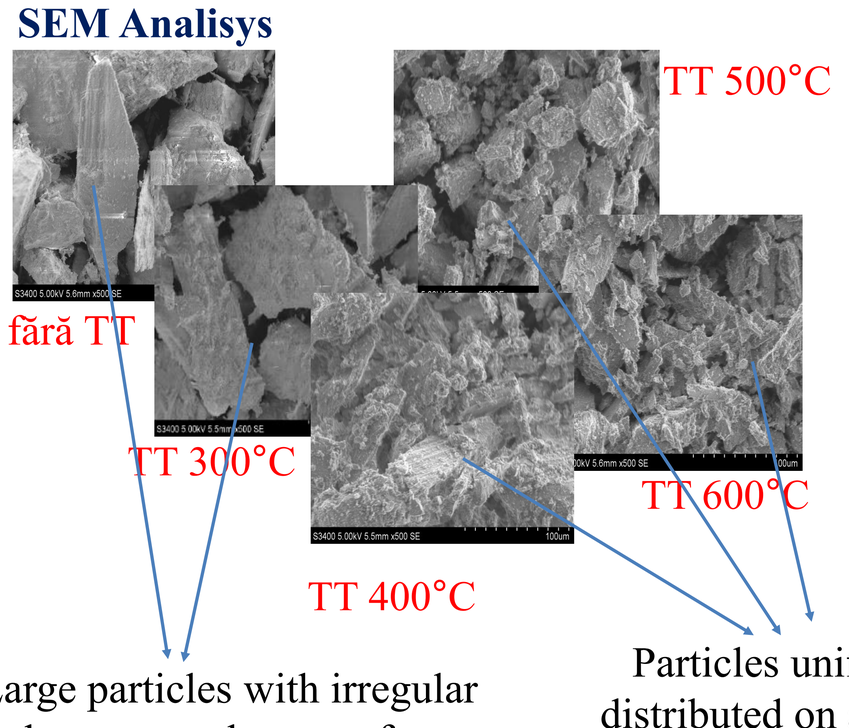
Shells powder (HPO) dimension 40μm

Heat treatment (HT) at 300°C, 400°C, 500°C, 600°C

Active materials for nutrients adsorbtion

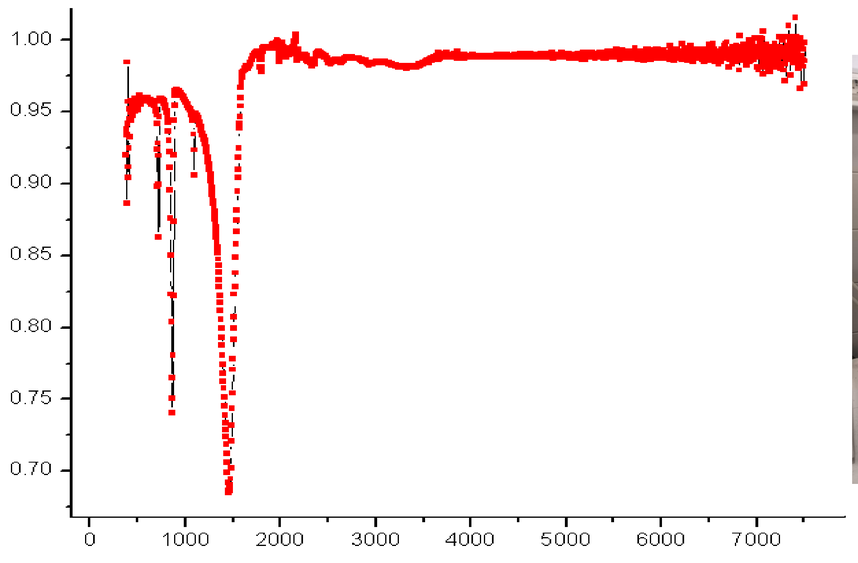
Results

SEM Analisys



Large particles with irregular shapes on a dense surface

Particles uniformly distributed on a porous surface



FTIR for shell powderHT at 600°C:
Chemical bonds:
–C=C–, C–N, C–H, C–C, C–O, N–H, Si–H, P–H

Biofermentation

Fertilizer obtained by biofermenting of hepatopancreas having controlled nutrient concentration (NH_4^+-N, NO_3^--N, P, K, Ca, Mg, Na, Fe, B, Mn, Zn)

Conclusions:

✓European directives require the efficient recovery of waste and reducing environmental impact, in the context of the circular economy.
✓Waste from the agri-food industry can be recovered in fields such as environmental engineering and agriculture industries, enhancing the concept of sustainable agriculture.
✓A new way to recover waste from the snail meat processing industry is to obtain biofertilizers used in hydroponic cultures.
✓In this context, the paper proposes the biofermentation of hepatopancreas and Helix snail shell to obtain fertilizers with an optimal nutrient content.

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