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AGRIMA

Production of biochars from agro-food wastes for environmental applications

Summer Camp | July 7 – 11, 2025 | Marseille, France

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Agri-food Waste Management for Sustainable bio-economy through Higher Education curricula and upskilling

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Goals

AGRIMA aims to foster universities' **capacity building** for the **green transition** through **innovative practices and higher education curricula updating in agri-food waste management** for the **circular bioeconomy**.

AGRIMA addresses:

1. **Advancing pedagogical methods** for industrial agri-food waste valorisation **based on business-academia synergies**.
2. **Integrating citizen science** in bio-economy-enhanced waste valorisation as a means of **civic engagement and environmental advocacy**.

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Partners

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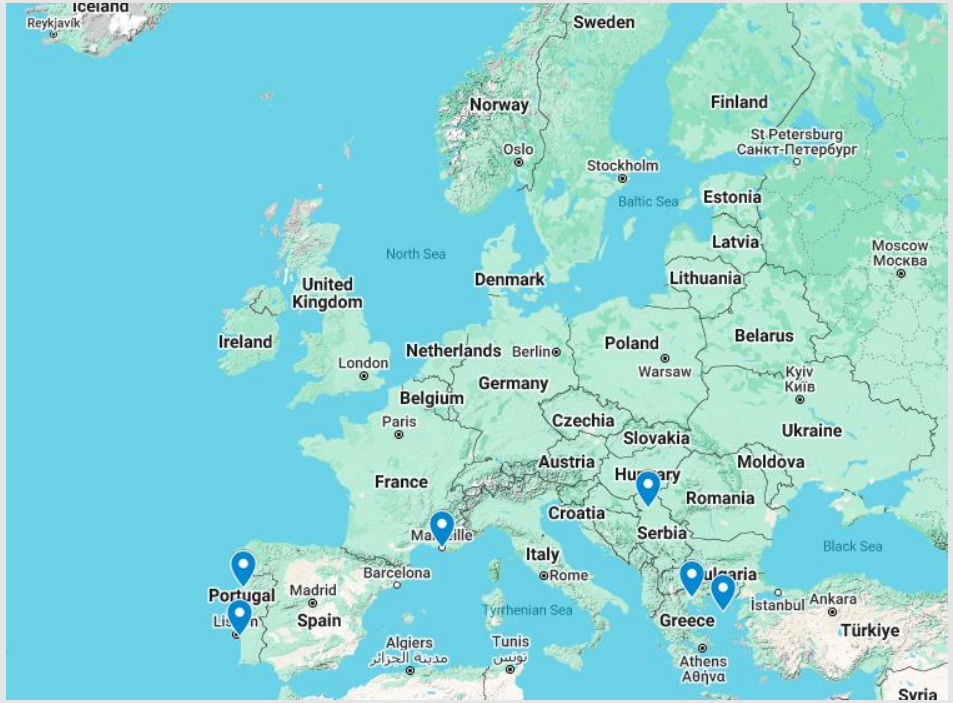

amU Aix Marseille Université

AVIPE Associação de Viticultores do Concelho de Palmela

P.PORTO

UNIVERSITAS STUDIORUM NEOPLANTENSIS

UNIVERSITY OF NOVI SAD

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Web2Learn Open, social learning

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Emerging Contaminants in Water: The Case of Pharmaceuticals

Water covers about 70% of the Earth's surface

The wastewater treatment plants are not designed to remove emerging micropollutants

Pharmaceuticals are detected in surface waters worldwide at **concentrations from ng/L to µg/L**

Directive (EU) 2024/3019 introduces stricter rules on micropollutant removal, requiring quaternary treatment to target pharmaceuticals, personal care products, and industrial chemicals.

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Biochar: A Sustainable Approach to Water Remediation

What's Biochar?

- Carbon-rich and porous material.
- Its characteristics depend on the thermochemical process conditions and the raw material.

Why Use Agroforestry Wastes?

- Unproperly management of agroforestry waste can cause odour, water pollution, and eutrophication.
- Traditional methods (open burning and poor composting) contribute to air, soil, and water contamination.
- As waste volumes and disposal costs rise, sustainable solutions are urgently needed.

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Biochar Production from Basil Residues

Basil residues

Pyrolysis conditions

- 8 hours of heating time
- 14 hours of holding at 500°C
- Cooling for 18 hours until ambient temperature
- Biochar was ground and separated into different particle sizes: <0.5 mm; 0.5-1 mm; 1-2 mm; >2 mm.

Basil-derived biochar

Specific Surface Area = 9.5 m^2/g
Point of zero charge = 6.91

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Purpose of the Study

Pharmaceutical abatement — Antidepressants — Trazodone (TRZ), Fluoxetine (FLX)

Objective

- Evaluate the adsorption performance of basil-derived biochar.
- Investigate the degradation of these pharmaceutical compounds.
- Contribute to the development of sustainable water treatment strategies targeting pharmaceutical contaminants.

1 — Adsorption Assays
Evaluating biochar's ability to capture pollutants.

2 — Degradation Assays
Testing the effectiveness of the Electron-Fenton process in degration of pollutants.

3 — Biochar Regeneration
Restoring biochar's properties for reuse.

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Experimental Parameters

Adsorption Assays

Target Contaminants
TRZ & FLX, 5 mg/L each
Volume & Agitation
200 mL, 200 rpm
pH 7-9
Biochar Granulometry
0,5 mm – 2 mm

Degradation Assays

Electro-Fenton Process
Target Contaminants
TRZ & FLX, 5 mg/L each
Volume & Agitation
200 mL, 150 rpm
pH 7-9
Biochar Granulometry
< 0.5 mm
Electrolyte
$[Na_2O_4S]$ = 0.1M

Biochar Regeneration

Solvent
Methanol, 50 mL
Agitation
100 rpm

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Performance Results: Adsorption Assays

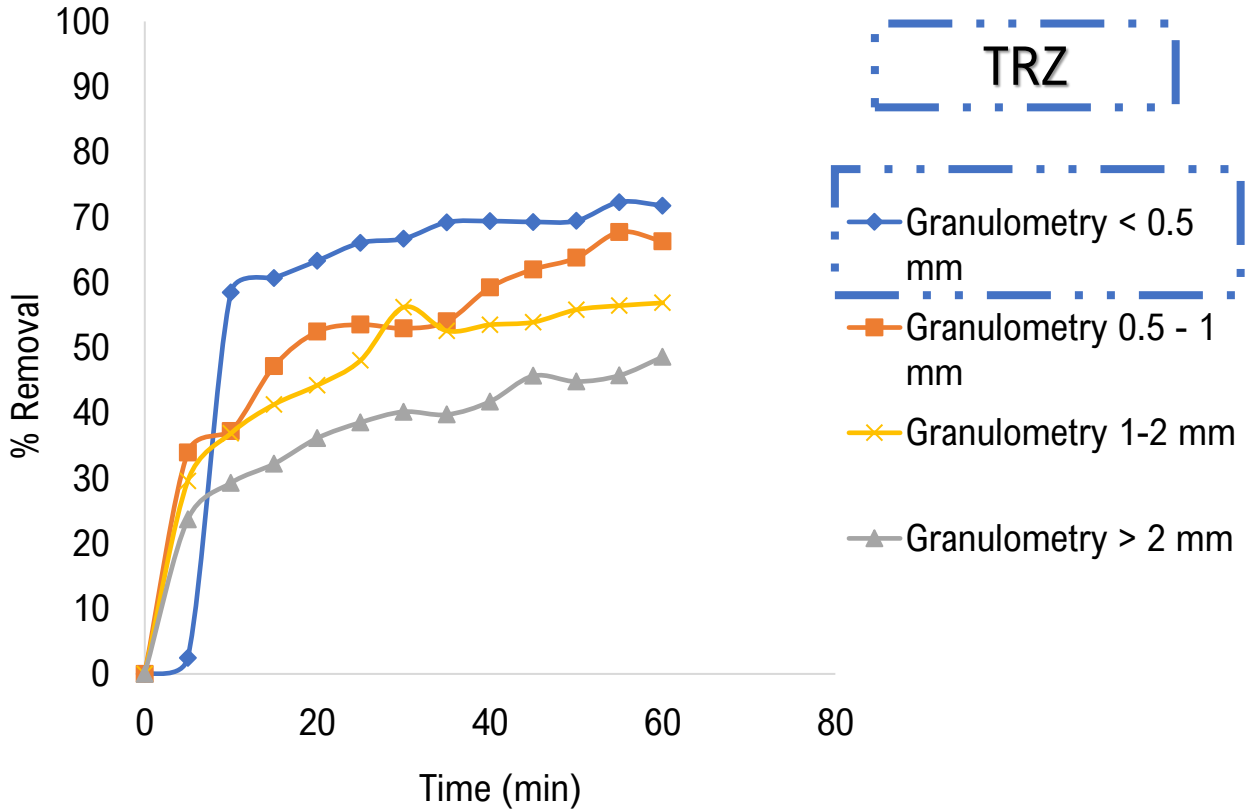

Figure 1 - Adsorption of TRZ using different biochar particle sizes.

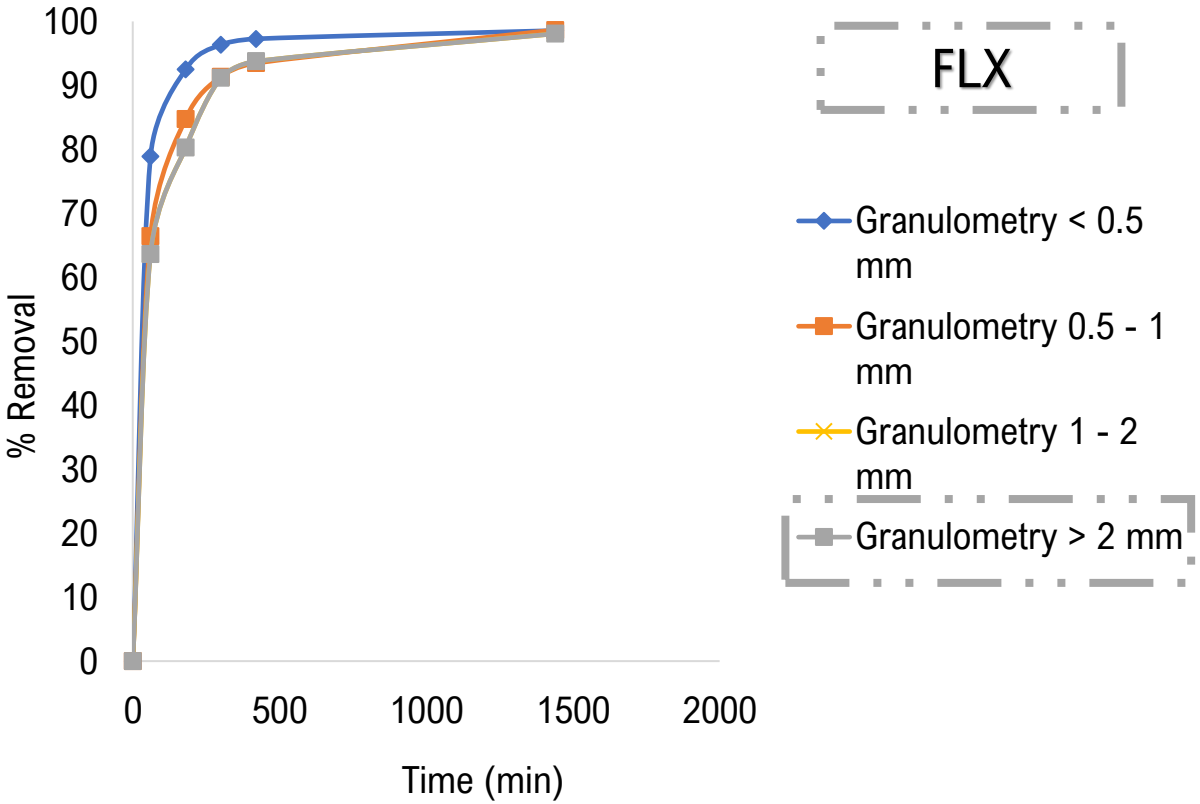

Figure 2 - Adsorption of FLX using different biochar particle sizes.

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Performance Results: Degradation Assays

Using biochar as a catalyst in an electro-Fenton system

Figure 3 - Experimental setup for degradation assays

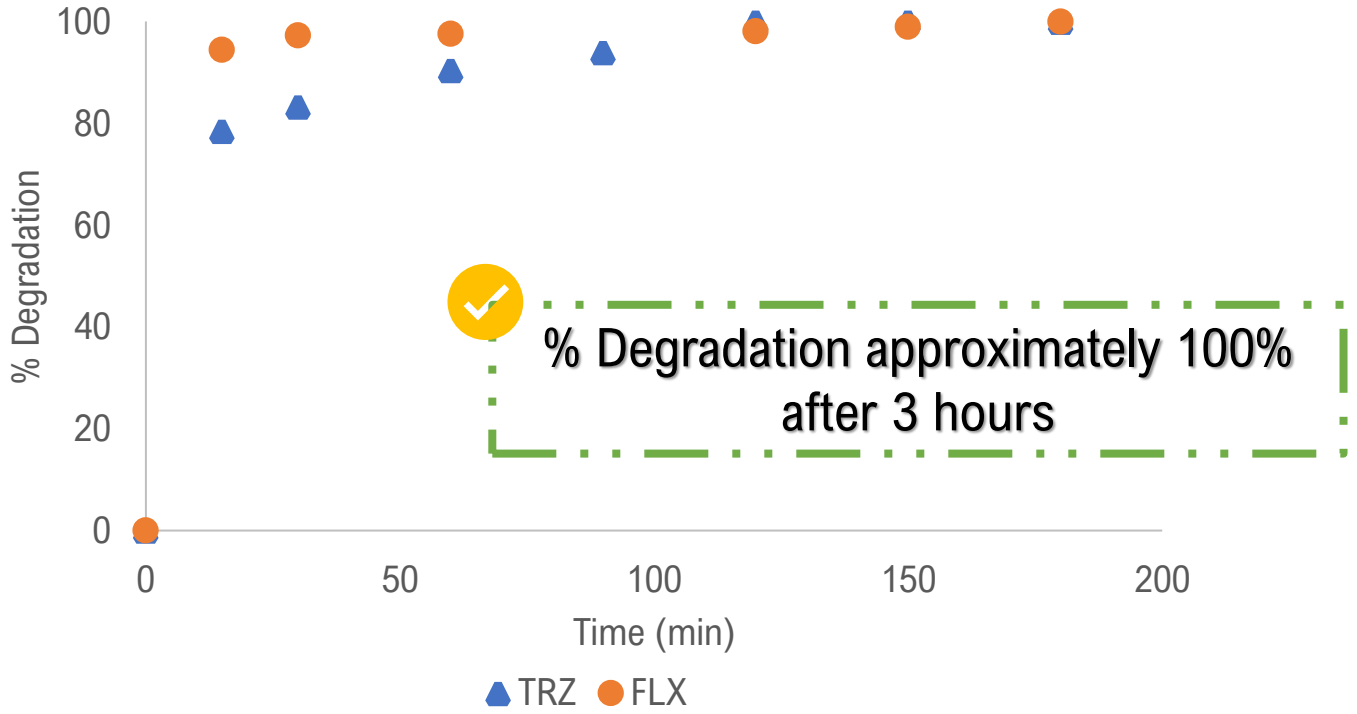

Figure 4 - Catalytic removal of TRZ and FLX using biochar in Electro-Fenton treatment.

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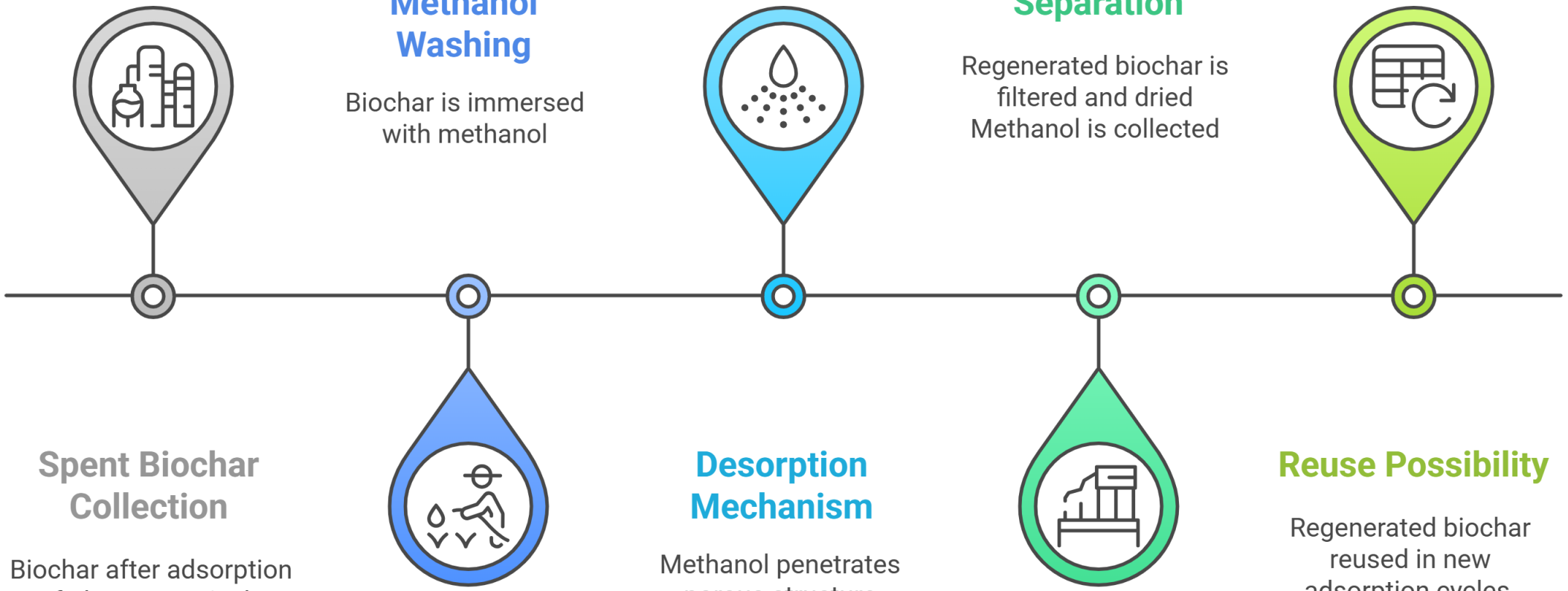
Biochar Regeneration



Spent Biochar Collection

Biochar after adsorption of pharmaceuticals compounds

Methanol Washing

Biochar is immersed with methanol

Desorption Mechanism

Methanol penetrates porous structure

Separation

Regenerated biochar is filtered and dried
Methanol is collected

Reuse Possibility

Regenerated biochar reused in new adsorption cycles

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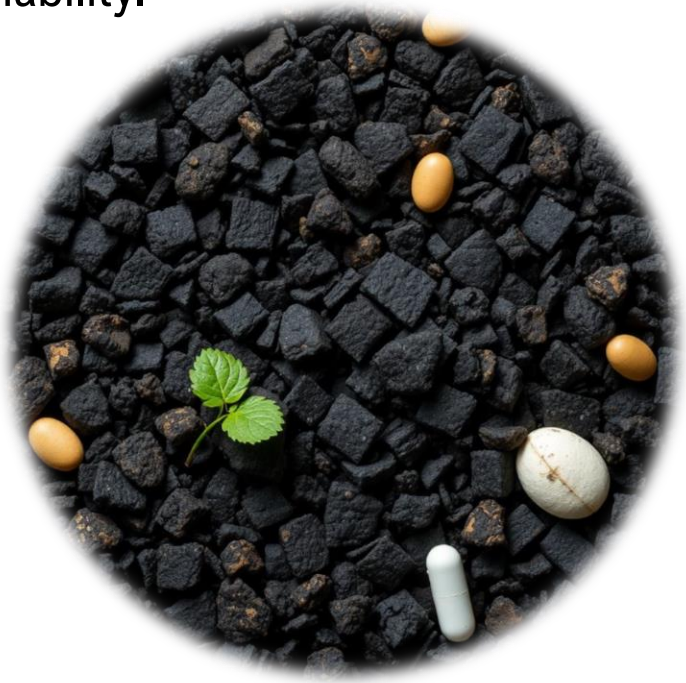
Conclusions and Future Perspectives

Conclusions

Biochar from basil residues showed good adsorption performance for TRZ and FLX.
The electro-Fenton process using biochar as a catalyst achieved high degradation efficiency (>99% in 3 hours).
Biochar regeneration with methanol proved effective, supporting process sustainability.



Future Perspectives

Test effectiveness in wastewater samples.
Explore pilot-scale integration for potential industrial applications.
Explore solutions to use the regenerated biochar.

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Thank you for your attention!

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