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Techno-economic Assessment of CDW-derived Filter Media

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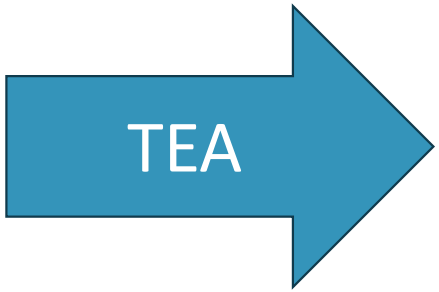
TEA



- Research objective
- Functional unit and System boundary
- CDW and commercial media
- Cost comparison
- Performance
- Key Result
- Economic insight and circular economy advantage

Research Objective

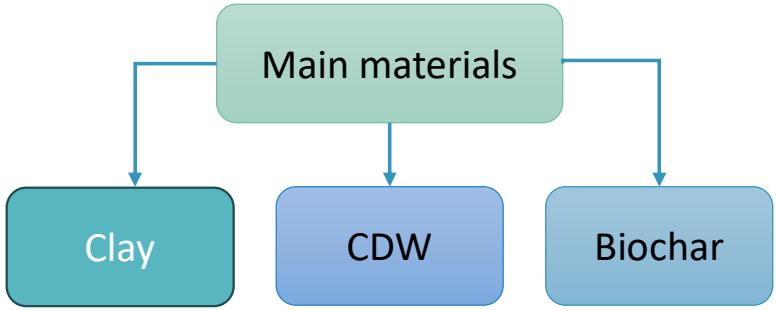
Develop TEA framework

Compare CDW with:

- Lightweight Expanded Clay Aggregate
- Expanded Clay Filtration Media
- Carbon-rich, porous material (biochar)

Evaluate:

- Cost
- Performance
- Sustainability



Functional unit and System Boundary

Functional unit:

1 filtration unit (50 years)

Metrics:

Net present cost (NPC)

Levelized cost of treatment (LCOT) (€/m^3)

€/kg pollutant removed

System Boundary

👉 Cradle-to-grave approach

Material production

Transport

Installation

Operation (50 years)

Maintenance

End-of-life

CDW vs Commercial Media

CDW System
Waste → Processing → Agglomeration
Low energy (180–200°C)
No replacement
Reuse / recycle

Commercial System
Raw materials → Industrial production
High energy (~1200°C)
Replacement needed
Mostly disposal

Material	Temp
CDW	180–200°C
Clay	~1200°C
Biochar	350–700°C

CDW = **5–6× lower energy**
✓ Lower embodied energy
✓ Lower cost

Cost comparison

Why CDW is cheaper

- Waste-based material
- No extraction cost
- Low processing temperature
- Simple process (crushing + agglomeration)
- Local availability

Performance

- Expanded clay → Balanced and widely used performance
- Processed clay media → Consistent and well-documented performance
- Biochar (biomass-derived carbon) → Variable performance depending on feedstock and conditions
- CDW-based media
- Preliminary results indicate promising potential
- Performance depends on material composition and design

- Cost and performance do not always correlate directly
- Material selection should consider cost, performance, and sustainability together

Key Results

Key Insight: Cost–Performance–Circularity Trade-off

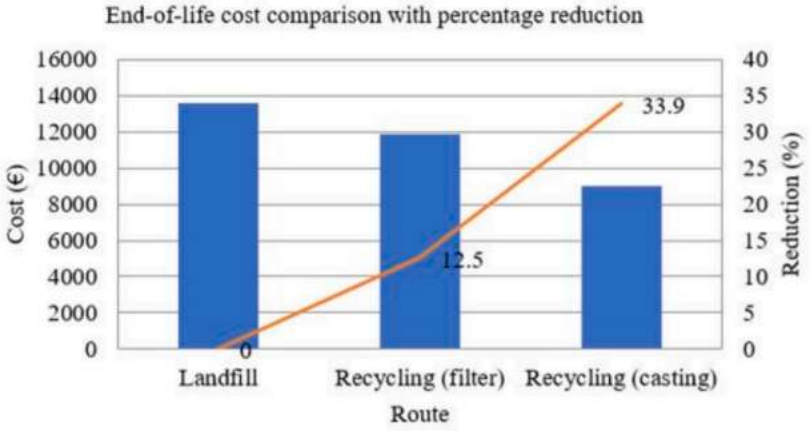
- CDW-based media → Low cost, high circularity, performance under evaluation
- Expanded clay → Balanced cost and performance
- Processed clay media → Well-established and consistent performance
- Biochar → Variable performance with relatively higher cost

Economic Insight and Circular Economy Advantage

O&M = biggest cost driver
Removal efficiency = critical
CDW can compete even with:
Moderate efficiency

Circular Economy Advantage
CDW:
- recyclable
- reusable
- reduces landfill

End-of-life benefits:
Recycling ↓ cost ~34%



CDW is not a replacement for high-performance media, but a strong alternative for cost-effective and sustainable stormwater systems

Thank you!

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