Sommersymposium 2018
am 28. Juni 2018

» Biokohle für nachhaltige und ökologische Kreisläufe in der Europäischen Landwirtschaft«

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TECHNIK im ZELT

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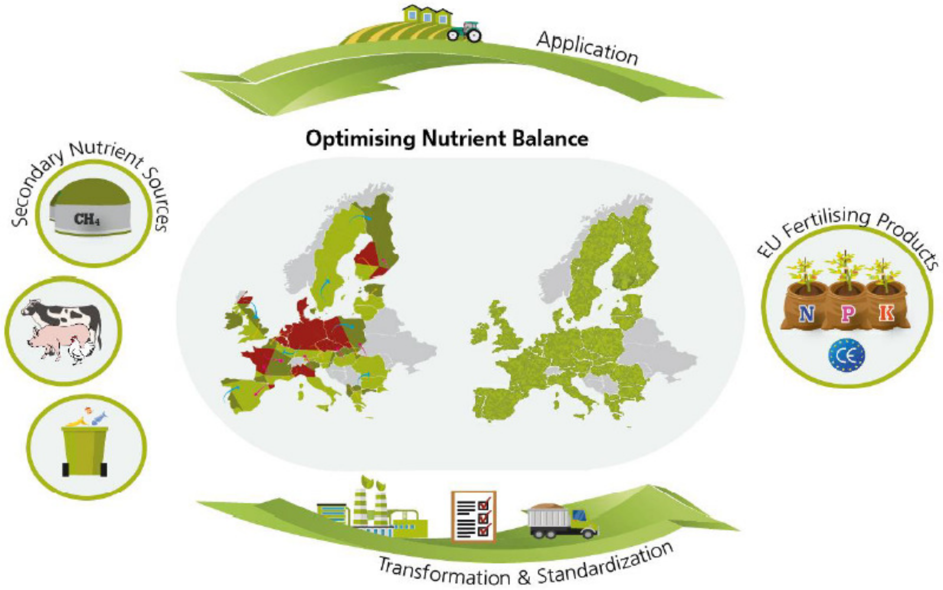
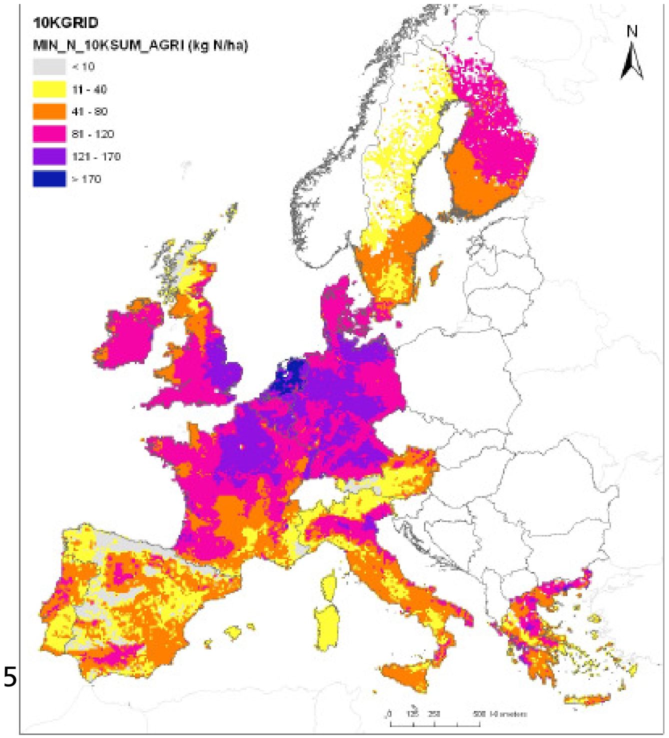
Agenda

- Fertilisers from secondary raw materials in the EU
- TCR process and Biochar
- Biochar modification for nutrient adsorption
- Agronomic performance of Biochar



Sustainable fertilisers in Europe: Actual Situation

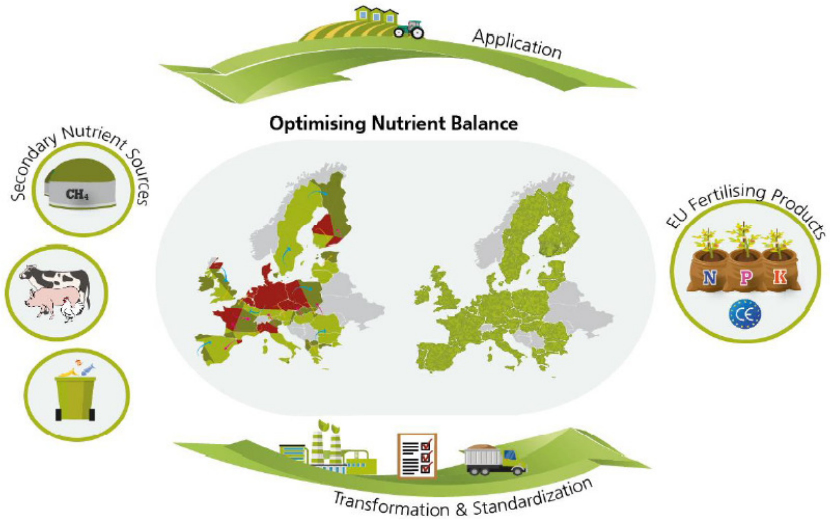
- Fertiliser demand will grow as global food production is expected to increase by 70% in 2050
- Mineral-based fertilisers (NPK) are mainly produced from fossil resources with serious drawbacks:
  - losses from 70-80% from farm to fork
  - high energy input for production
  - reliance on imports
  - eutrophication of water bodies
- Unexploited recovery potential of 9.6 Mt of N and 2.3 Mt of P



Nitrogen mineral input in EU15
Grizzeti et al 2007

Sustainable fertilisers in Europe: Our Vision

- Nutrient loop closed by 2050
- Acceleration of market introduction of fertilisers from secondary sources (sewage, manure, food waste) → common European regulation, certification pathways, technological mature
- Optimised nutrient distribution between EU regions → new value chains
- Worldwide use of Biochar as soil amendment, nutrient carrier and stable carbon storage



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Sustainable fertilisers: EU Regulation and Certification

- New European Fertiliser Regulation (under revision)
  - 7 Product Function Categories (PFC) including organic fertilisers, inorganic fertilisers, soil improvers and bio-stimulants
  - Shortcomings: exclusion of bio-waste materials as well as garden and park waste; contradictions on definition of waste; limit of 20 mgPb/kg excludes bio-waste and compost

- Certification for new fertilising products
  - Standardisation of European fertilisers through CENs (*Comité Européen de Normalisation*)
  - Joint Research Centres (JRC) working groups on Struvite, Biochar and Ashes (STRUBIAS)
  - International initiative 4 per 1000 for carbon storage in the soil

Source: www.thepairlamentmagazine.eu

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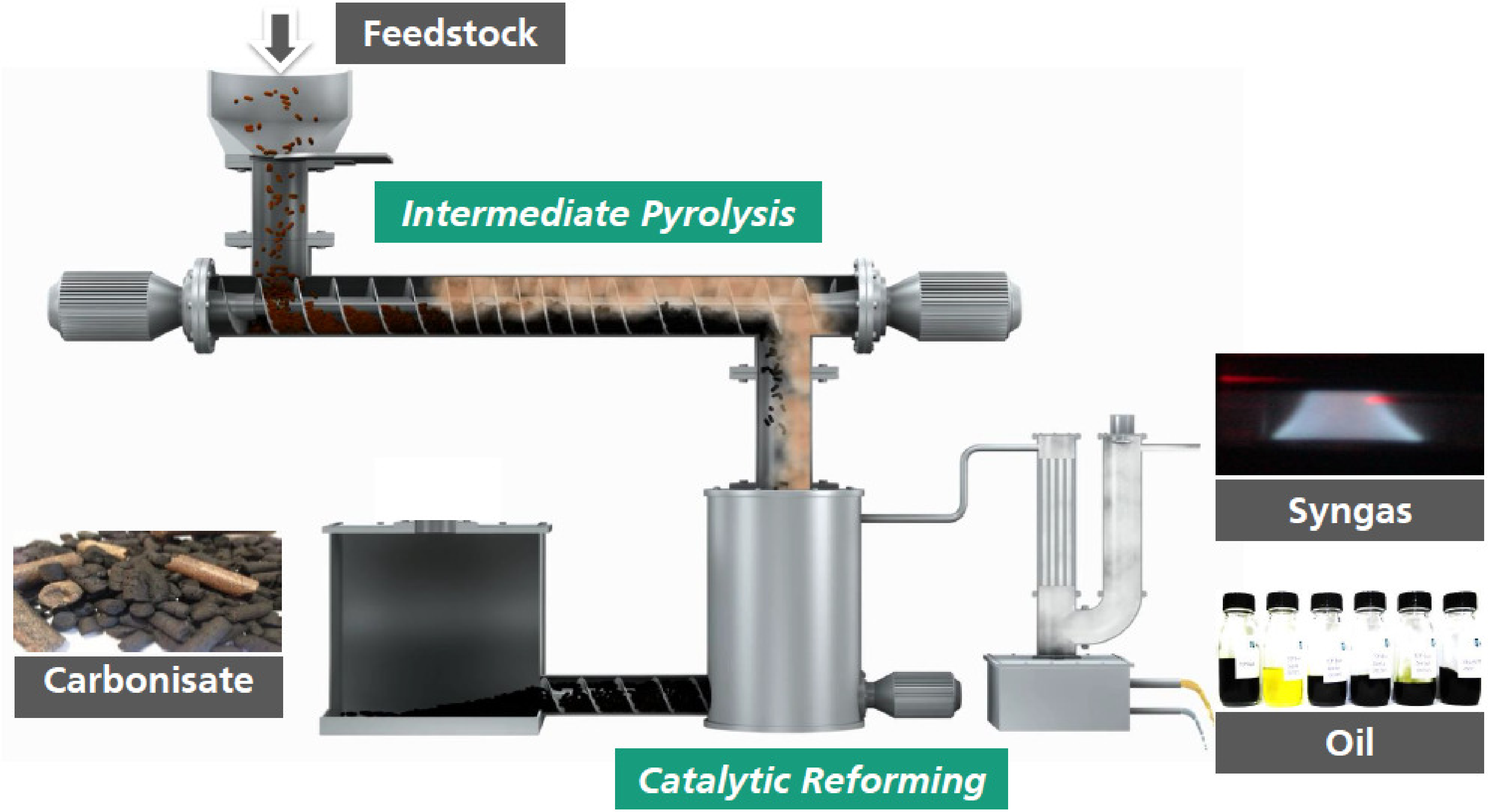
TCR Process


Feedstock
Intermediate Pyrolysis
Syngas
Carbonisate
Oil
Catalytic Reforming

TCR Process: Input materials

TCR-Biochar properties

	Sewage sludge	Digestate	Brewer's spent grain	Wood
C	**25.0 wt.-%**	**41.6 wt.-%**	**48.6 wt.-%**	**45.0 wt.-%**
H	4.3 wt.-%	5.1 wt.-%	6.9 wt.-%	6.4 wt.-%
N	3.6 wt.-%	1.6 wt.-%	4.3 wt.-%	0.1 wt.-%
S	0.9 wt.-%	0.3 wt.-%	0.5 wt.-%	0.1 wt.-%
O*	19.7 wt.-%	31.6 wt.-%	36.2 wt.-%	47.8 wt.-%
Ash	**46.5 wt.-%**	**8.7 wt.-%**	**3.5 wt.-%**	**0.6 wt.-%**
	LHV 8.1 MJ/kg	LHV 15.8 MJ/kg	LHV 20.5 MJ/kg	LHV 17.8 MJ/kg

	Sewage sludge	Digestate	Brewer's spent grain	Wood
C	**22.1 wt.-%**	**64.0 wt.-%**	**72.6 wt.-%**	**89.8 wt.-%**
H	0.9 wt.-%	1.0 wt.-%	0.1 wt.-%	2.2 wt.-%
N	2.0 wt.-%	1.4 wt.-%	4.6 wt.-%	0.3 wt.-%
S	1.0 wt.-%	0.5 wt.-%	0.4 wt.-%	0.1 wt.-%
O*	0.0 wt.-%	1.1 wt.-%	4.8 wt.-%	4.5 wt.-%
Ash	**74.0 wt.-%**	**32.0 wt.-%**	**17.5 wt.-%**	**3.1 wt.-%**
	LHV 8.2 MJ/kg	LHV 23 MJ/kg	LHV 26 MJ/kg	LHV 34.4 MJ/kg

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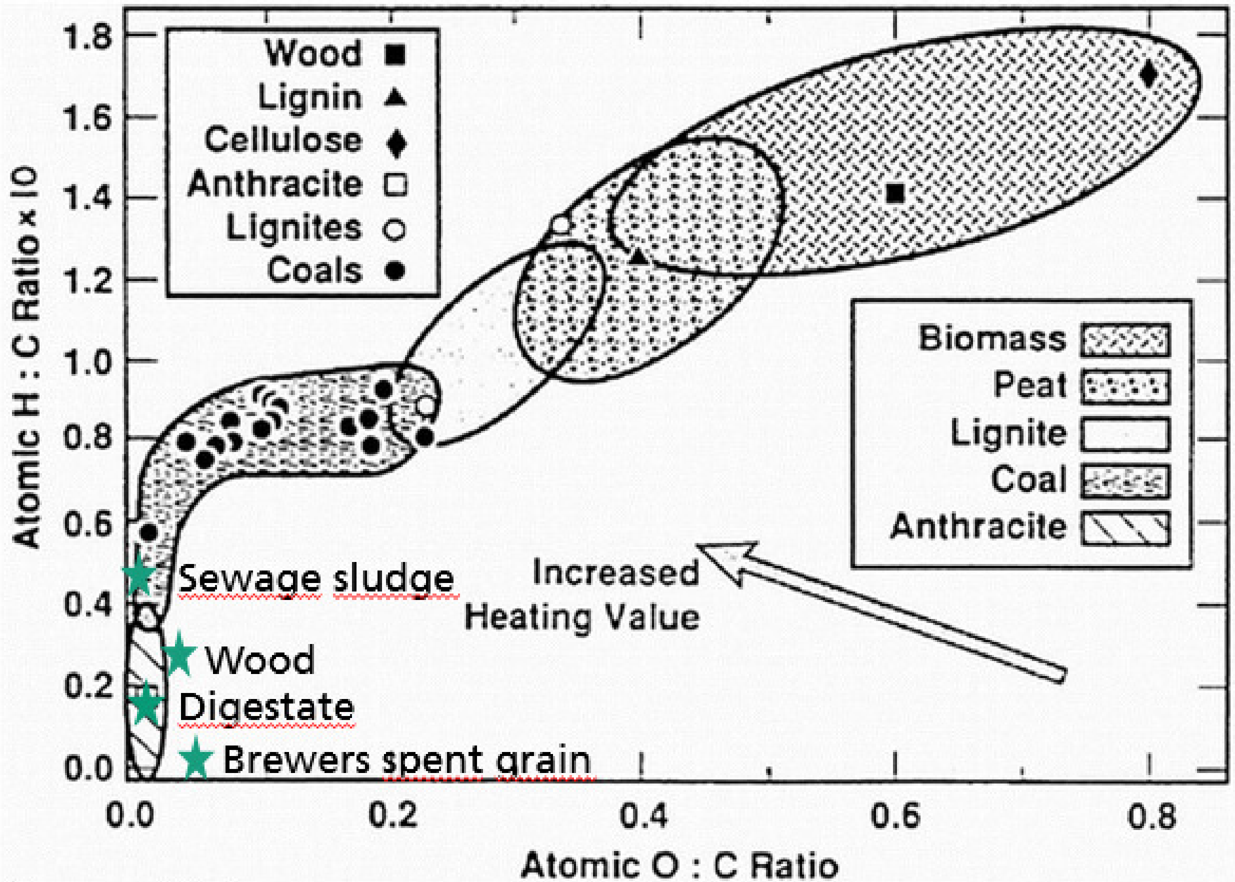
TCR-Biochar properties

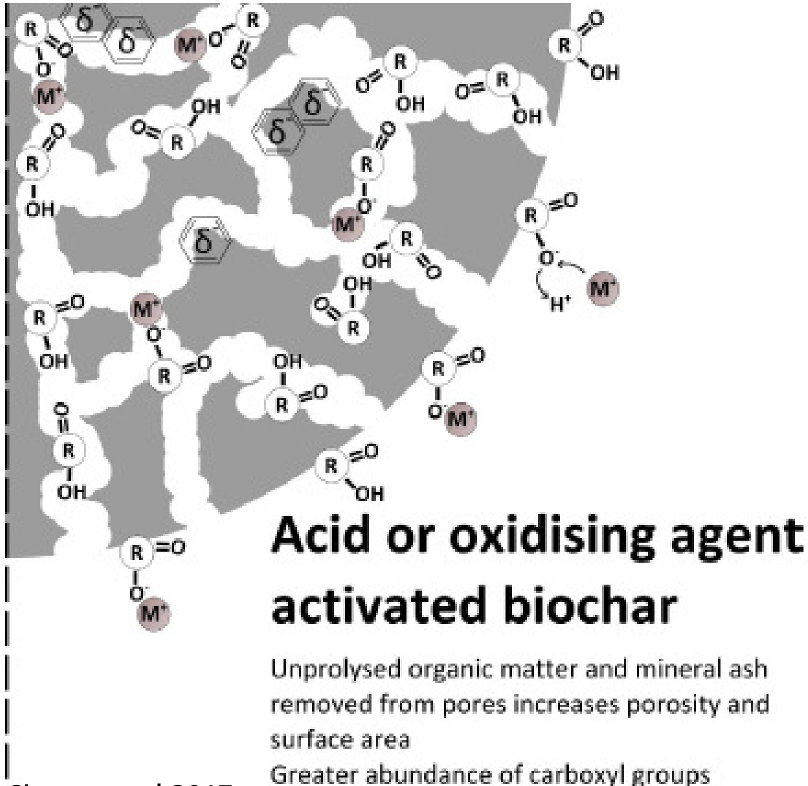
Van Krevelen Diagram



Source: www.intechopen.com

TCR-Biochar modification for N adsorption

- Goal: adsorption of N-Ions (NO_3^-, NH_4^+) from the aqueous phase
  - Modifications for NH_4^+ adsorption:
    - Acid activation HNO_3
    - Alkaline activation
    - Steam activation
  - Modifications for NO_3^- adsorption:
    - Thermal activation
    - Impregnation with transition metals (i.e. Zn, La)
  - Achieved adsorption performance
    - 1-2 mg/g for both ions NH_4^+ and NO_3^-



Sizmur et al 2017

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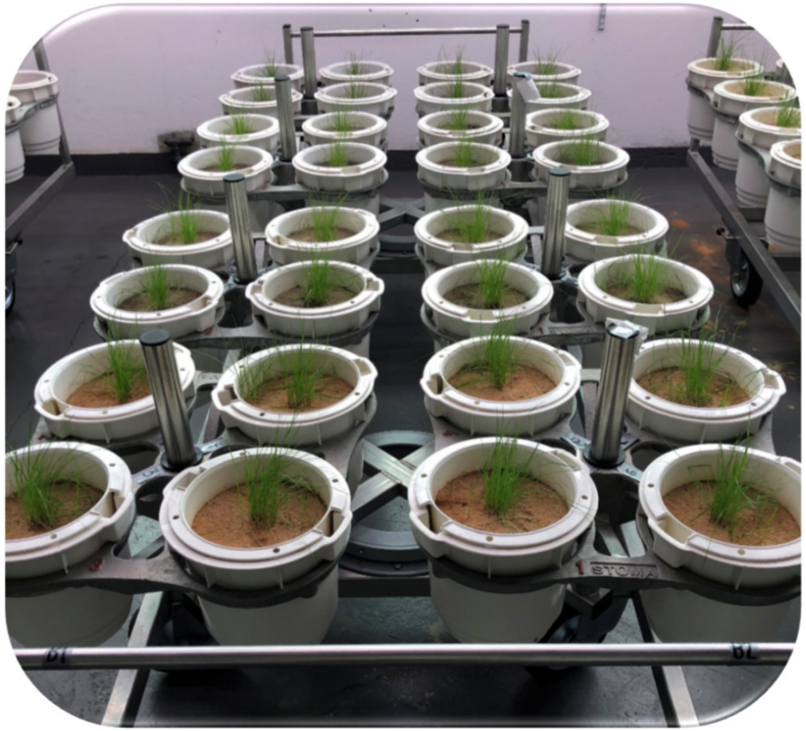
Agronomic performance of Biochar

- Pot trial equipment with capacity of 96 pots, light system, scaling system, collection of drain/leakage flows. Additional grinders and mixer unit for substrate preparation.



Thank you for your attention!

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