THE PYROLYSIS-FLOX TECHNOLOGY

Clean heat and biochar from agricultural waste

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HIGH VOLUME OF BIOWASTE

Millions of tons of harvest residues are waiting to be treated !

But also:

Sawdust, wood chips, coconut shells etc.

PRODUCTION COSTS FOR FARMERS

the main production costs that farmers is paying

Expensive amounts of fertilizer

High costs for irrigation

Huge demand for “continous“ thermal energy

THE TROUBLES OF CURRENT DRYING METHODS

Current burners …

→ cause heavy **smoke** emissions with negative effects both on the health of the local population and the quality of the product that is dryed.

→ Leaves only **ash** as by-product, which is not easy to valorize

THE PYROLYSIS AND THE FLOX TECHNOLOGIES

PYROLYSIS

Traditional combustion without O_2, producing Biochar and generating smoke, with no easy collection of heat

FLOX

Combustion at very high temperature, without flamme nor smoke, generating gaz with an easy collection of heat

PYROLYSIS-FLOX

Under a research from Ökozentrum (Switzerland), merging both processes creates a continuous generation of collectable heat, with biochar production and no smoke

DIFFEERNCE BETWEEN NORMAL COMBUSTION AND FLOX

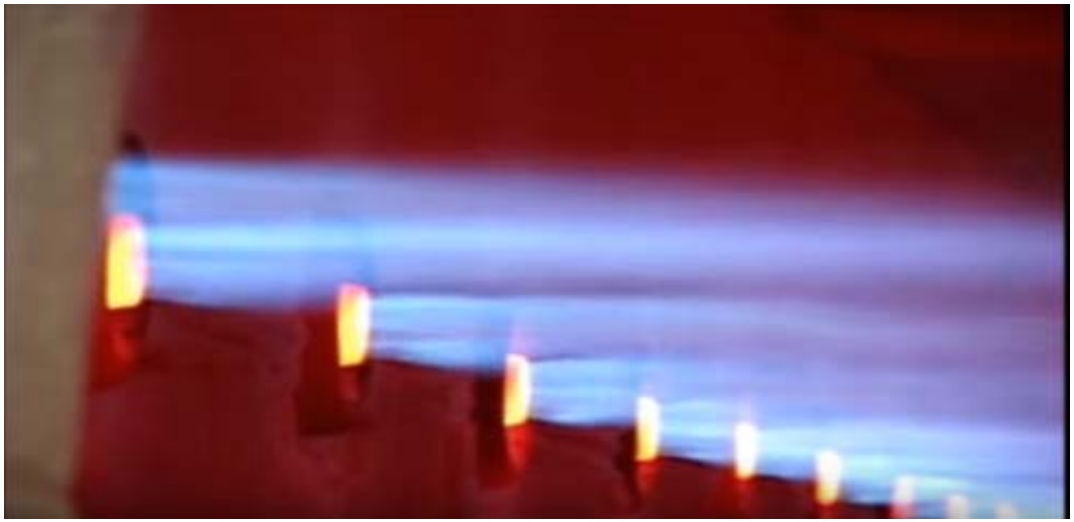
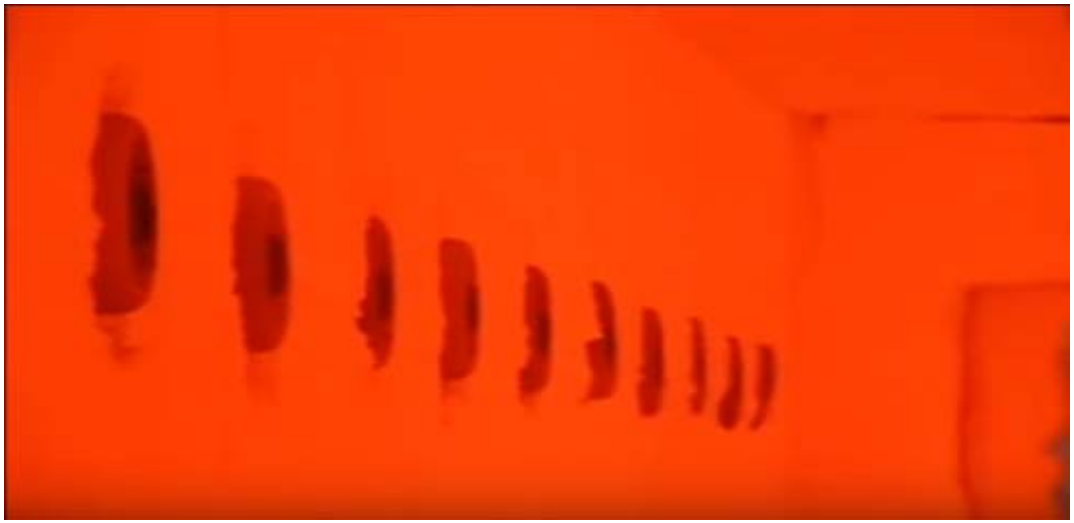


Image of the normal combustion of gas in the combustion chamber with flame.
In this situation, we use a lot of gas, resulting in poor performance and not the highest temperature especially for gas produced from agricultural waste or biomass.



Flox technology was an invention in the 1990s discovered by Dr. Joachim G. Wünning (Germany).
It creates high temperature combustion at 1200°C and WITHOUT A FLAME
Image of the unusual combustion with Flox principle.
At very high temperature, which can burn anything, including smoke.

A NEW DESIGN FOR THE PYROLYSIS-FLOX TECHNOLOGY

- is designed to fit local context
- is affordable
- is compliant with international quality standards
- is scalable for big producers & small farmers
- can be integrated in existing drying systems

BIOCHAR, A NATURAL SOIL ENHANCER WITH A "SPONGE" EFFECT

- Raising pH to an optimum level
- Reduce fertilizer needs
- Reduce waterlogging and increase drought resistance
- Improve soil structure, increase the reproduction of soil organisms
- Reduce erosion and nutrient loss

A CLIMATE POSITIVE TECHNOLOGY!

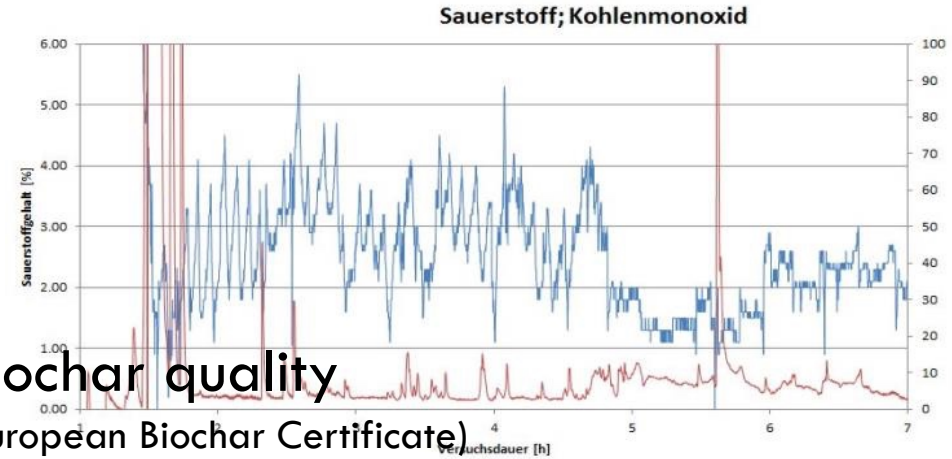
- Burning biomass is considered as carbon neutral
- With the pyrolysis technology applied e.g. to coffee, 0.5 kg of **CO_2 is stored in the biochar** for each kWh produced !
- This energy production can therefore be considered as "**climate positive**"

Thank you for your attention at our presentation

Back-up slides

Developing the prototype in Switzerland

- Emission



- Biochar quality

(European Biochar Certificate)

Projekt: Pflanzenkohleanalytik gemäß EBC-Richtlinie
Untersuchung nach Biochar according to European Biochar Certificate (Auswahl)

Parameter	Einheit	BG	Grenzwerte GW 1	Grenzwerte GW 2	Probenbezeichnung / Labornummer / Methode	PPP "gut" 29.9 Nr.1 / 116083046 / anl	wf
Bestimmung aus der Originalsubstanz (</= 2mm gebrochenes Material)							
Wasserhaltekapazität	Ma.-%				DIN EN ISO 14238, Anhang A (SB99 /f)	-	134,2
Schüttdichte	kg/m³				DIN 51705 (FR-JE02)	175	-
spezifische Oberfläche BET-Verfahren	m²/g				DIN 66132/ISO 9277 (S826 /f)	-	234
Reindichte	g/cm³				DIN 66137 (S826 /f)	-	1,72
Gesamtwasser	Ma.-%	0,1			DIN 51718 (FR-JE02)	4,2	-
Aschegehalt 550 °C	Ma.-%	0,1			analog DIN 51719 (FR-JE02)	10,5	10,9
Brennwert (Ho,V)	kJ/kg	200			DIN 51900 (FR-JE02)	29016	30293
Heizwert (Hu,p)	kJ/kg	200			berechnet nach DIN 51900 (FR-JE02)	28639	30007
Wasserstoff	Ma.-%	0,1			DIN 51732 (FR-JE02)	1,28	1,34
Kohlenstoff gesamt (TC)	Ma.-%	0,2	> 50	> 50	DIN 51732 (FR-JE02)	80,9	84,5
Stickstoff gesamt	Ma.-%	0,05			DIN 51732 (FR-JE02)	1,13	1,18
Sauerstoff (Diff.)	Ma.-%				DIN 51733, berechnet (FR-JE02)	2,0	2,1
Carbonat-CO2	Ma.-%	0,4			DIN 51726 (FR-JE02)	2,70	2,82
Kohlenstoff, organisch	Ma.-%				berechnet (FR-JE02)	80,2	83,7
H/C Verhältnis (molar)	ohne		< 0,6	< 0,6	berechnet (FR-JE02)	0,19	0,19
H/Corg Verhältnis (molar)	ohne		< 0,7	< 0,7	berechnet (FR-JE02)	0,19	0,19
O/C Verhältnis (molar)	ohne		< 0,4	< 0,4	berechnet (FR-JE02)	0,02	0,019
Schwefel gesamt	Ma.-%	0,03			DIN 51724-3 (FR-JE02)	0,03	0,03
pH-Wert (CaCl2)	ohne		≤ 10	≤ 10	DIN ISO 10390 (FR-JE02)	9,0	-
Leitfähigkeit	µS/cm	5			BGK Kapitel III. C2 (FR-JE02)	1640	-
Salzgehalt	g/kg	0,005			BGK Kapitel III. C2 (FR-JE02)	8,66	9,05
Salzgehalt, berechnet mit Schüttdichte	g/l	0,005			BGK Kapitel III. C2 (FR-JE02)	1,52	1,58
Thermogravimetrie TGA 950°C unter N-Atm.	ohne				TGA 701 D4C (FR)	siehe Anlage	-
Bestimmung aus dem Mikrowellendruckaufschluss nach DIN 22022-1 (FR-JE02)							

VIẾT HIỆN sofies

Swiss - Vietnamese knowledge transfer workshop in Switzerland (2015)

Sharing a vision: Combining the pyrolysis system with a Combined Heat and Power (CHP) Unit

50 kW electric power, 200 to 320 kW heat, 340 tons biochar per year

Technology Transfer to Vietnam
Pilot Implementation

Collaboration between

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CƠ KHÍ - CƠ ĐIỆN CÔNG NGHIỆP CÀ PHÊ

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Technology Transfer and Testing at Viet Hien

International support for pilot implementation

(2016-2017)

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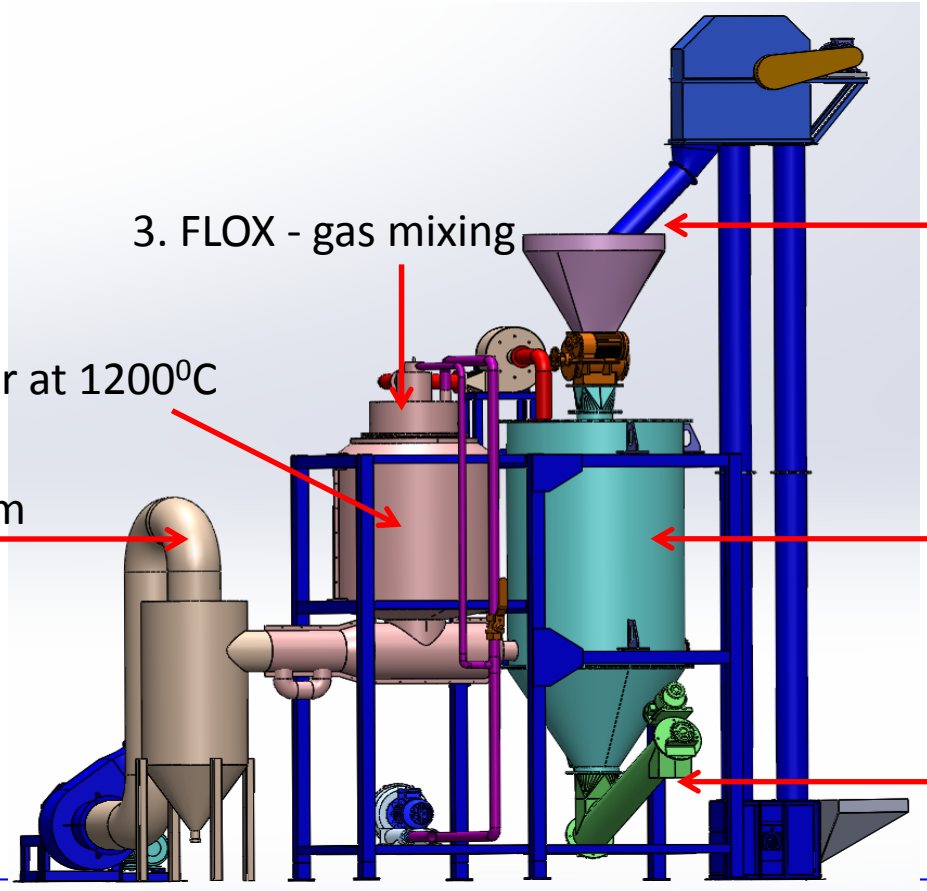
V. OPERATION PRINCIPAL OF PYROLYSIS AND FLOX



Under pyrolysis process, being transferred from burner to reactor, biomass will produce gas and resupply back to burner. Because of FLOX (flameless combustion) process, burner chamber will not have flame but only generate thermal radiation with high temperature and provide circularly to reactor. Because the combustion does not occur directly with material and burned carbon so oxygen doesn't have chance to make contact with carbon to form CO2.
The gas combustion occurred with FLOX condition makes a complete burn, result in low CO and NO_x concentration.

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