

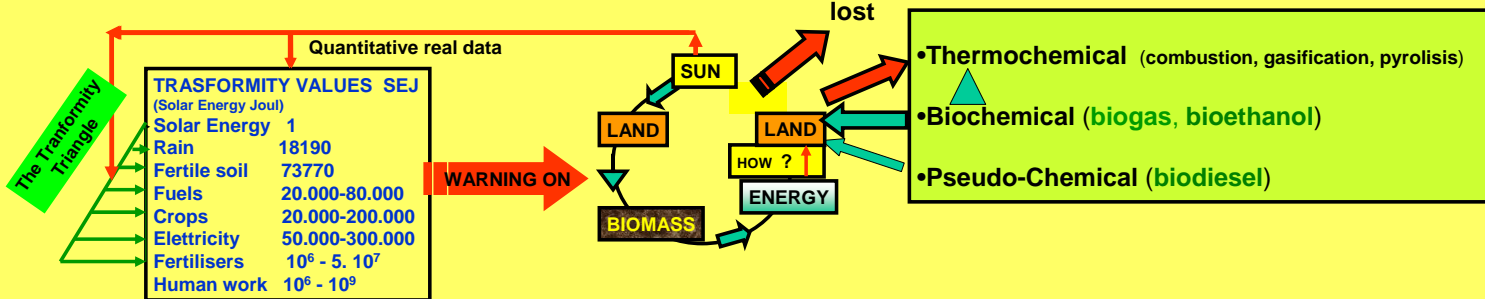


ANAEROBIC DIGESTION OF SWEET SORGHUM BAGASSE AS A STRATEGY TO INCREASE THE VALUE OF THE CROP IN THE CONTEXT OF A BIOENERGY SUPPLY CHAIN



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SORGHUM : MAIN CROSSOVER EFFECTS and OBJECTIVE BENEFIT ON LAND

TECHNOLOGY T1	TECHNOLOGY T2	T1 and T2	Integration effect on	Integration effect on	main to LAND benefit from
Thermochemical Bagasse gasification	Biogasification	T and Bg	T + gas energy value some by-products to Bg ⁽¹⁾	Bg + possible thermophilic	B org. matter T ashes (*)
Thermochemical Bagasse pyrolysis	Biogasification	T and Bg	T some by products to Bg	Bg + possible thermophilic	B org. matter
Thermochemical Bagasse combustion	Biogasification	T and Bg	----	Bg + possible thermophilic	B org. matter T ashes ⁽²⁾
Bioethanol	Biogasification	Be and Bg	Be + electrical power	Bg + good substrate	Bg
Biodiesel	Biogasification	Bd and Bg	Bd + electrical power	Bg + good substrate	Bg

BIOGASIFICATION SEEMS TO BE A NICE BRIDGING BETWEEN BIOENERGY AND LAND

- (1) To be proved with biogasification experiments
 (2) To be used carefully, may be a long-term environmental problem

BIOGASIFICATION OF SORGHUM (Bicolor L. Moench, Keller Variety) 4 liters (hydrolysis reactor) + 10 liters (methanogenic reactor)

Substrate characteristics

Bagasse typical chemical analysis Variable with storage time			Fresh sweet sorghum extract Variable with material dimentions and storage time		
Dry Matter 105 °C	%	31.4	Initial sugar content of whole plant	% d.m.	35 - 48
Humidity	%	68.6	Sugar content after 48 h	% d.m.	32 - 43
D.M 550°C		90,7	TSS	g/l	1.75 - 2.06
Organic Carbon	% d.m.	67.5	VSS	g/l	1.68-1.94
Lignin	% d.m.	17.8	KTN	mg/l	21 - 26
Avl. Org. Carbon	% d.m.	49.7	P total	mg/l	31 - 38
C. Org - Lignin			Carbohydrates	g/l	15.2 - 22.6
P total	mg/kg d.m.	1809	Total COD	g/l	16,7 - 24.3
KTN	mg/kg d.m	8917	Soluble COD	g/l	14.6 - 20.3
Org. Carbon	% w.m.	21.7			
Avl. Org. Carbon*	% w.m.	15.6			
P total	mg/kg w.m.	568			
KTN	mg/kg w.m.	2800			
COD 10g/200 ml	mg/l	1240			
C/N		75.8			
C. avl : N		55.8			
C:N:P		373:5:1			
C. avl : N:P		276:5:1			

* ±15%

Continuous Biogasification Results

Bagasse				Fresh sweet sorghum extract			
Process type	Biogas yield l/g VSS _{add}	CH ₄ %	HRT days	Process type	Biogas yield l/g VSS _{add}	CH ₄ %	HRT days
35-37 °C				35-37 °C			
One-phase CSTR	0.24-0.27	65-67	16	One-phase CSTR	0.28-0.30	66 ±2	12
One-phase CSTR	0,28-0,30	66-67	10	One-phase CSTR MPC*	0.32-0.35	68 ±3	15
Thermal Pre-hydrolysed bagasse (60-65°)				Two-phase CSTR	0.34-0.35	69±3	1+8
One-phase CSTR	0.26-0.27	67-68	16	Two-phase CSTR**	0.34-0.35	70±3	0.5+8
lab sonicated bagasse				Hydr. 45°C		H ₂ 18 %	
(1) One-phase CSTR + bovine rumen (5- 30%)	0.35-0.41	70-73	16	Methan. 37° C			
(2) One-phase CSTR MPC	0.33-0.38	63-66	16				
Two-phase CSTR	0.30-0.32	69-72	2+8				
(3) Two-phase CSTR		69-72					
Hydr. 45°C	0.37-0.40		0.5+8				
Methan. 37° C		H ₂ 14 %					

work in progress on fermentative H₂ generation followed by AD with CH₄ production

see G.Antonopoulou et al. *Bioresour Technol* 99 (2008) 110-119 and ref. therein

- (1) SerecoBiotest-RR Process
- (2) SerecoBiotest-MPC reactor (Microbial Proximity Concept) no mixing applied
- (3) To attain max yield the parameters of the process (pH, temperature, flow rate of transfer from H to M reactors) needs to be real time controlled (ANN control implemented).