Bio-oil Production from the Fast Catalytic Pyrolysis of Lignocellulosic Biomass

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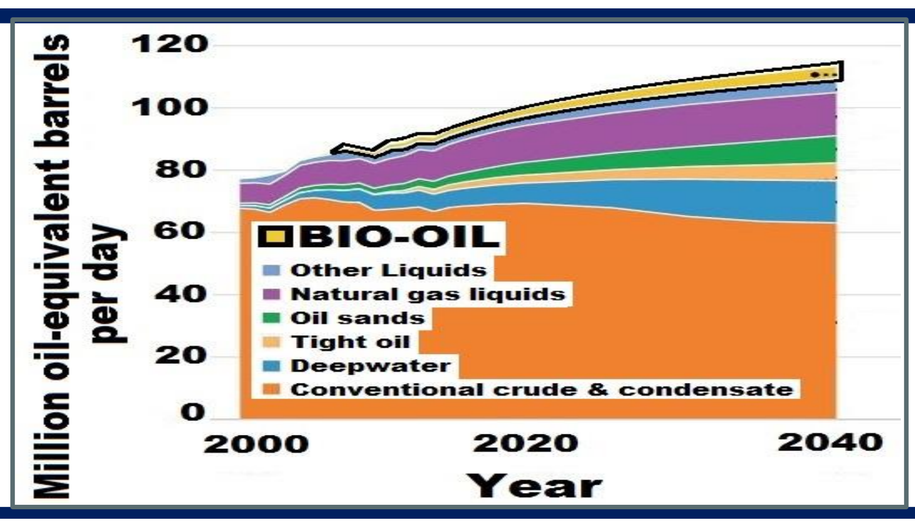
The Technology: Biomass fast catalytic pyrolysis

Feedstock: Renewable, non-food sources
Atmosphere: Inert gas atmosphere
Temperature: 400-600°C
Heating rate : 10–1000 K/s or higher
Purpose: Deoxygenate

	C	H	O	N	S	Cl	Ash
Pine sawdust	51.3	6.1	42.0	0.1	<.1	<.1	0.4
Switch grass	47.8	5.8	35.1	1.2	0.1	-	10.1
Arundo donax	47.1	5.8	42.8	0.6	0.1	0.2	3.4
Urban waste wood	51.6	6.3	36.6	1.5	0.2	-	3.2

The Market:

PROJECTED PRODUCTION GROWTH INDICATES LONG PRODUCT LIFE-CYCLE[1]



[1]http://www.exxonmobil.com/Corporate/energy_outlook_datacenter_eo13liquidssupply.aspx

[2] Atutxa, Alaitz, Et. Al. Kinetic Description of the Catalytic Pyrolysis of Biomass in a Conical Spouted Bed Reactor. *Energy & Fuels* 2005 *19* (3), 765-774.

MAIN DEFICIENCIES OF BIO-OIL[2]:

- Corrosiveness
- High Acidity
- Low Calorific Value
- Low Stability
- High Viscosity

STRATEGY TO INCREASE PRODUCT MONITIZATION FEASIBILITY

Optimize catalytic fast-pyrolysis process for the direct production of higher quality bio-oil

Objective: To investigate the effect of temperature, catalyst/biomass ratio, residence time on biomass fast catalytic pyrolysis product selectivity

Methods:

Spouted bed reactor

- Excellent mixing
- Fast heating rate
- Various particle sizes/densities
- Optimized feeding system
  - Low In-Situ Pressure Drop
  - Scale-up Compatibility

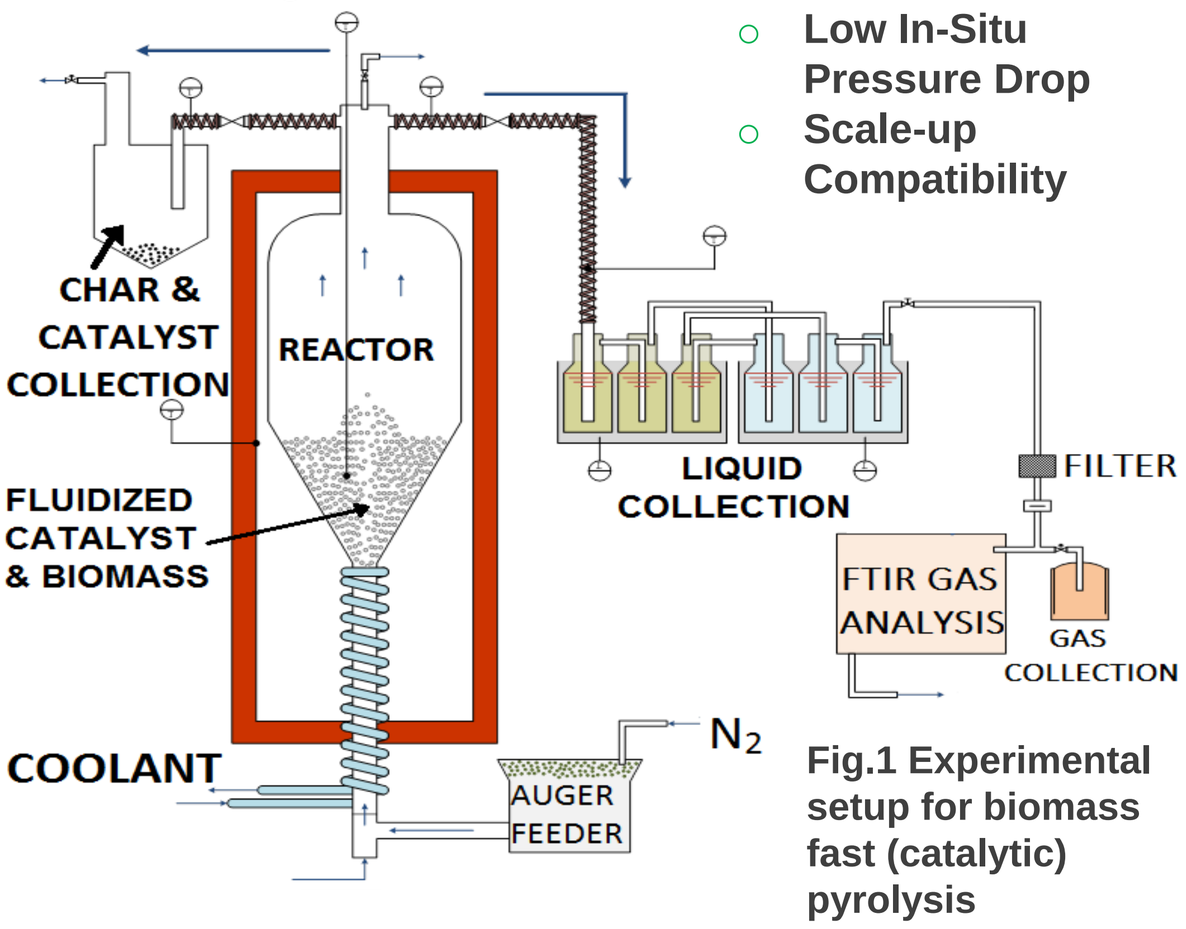


Fig.1 Experimental setup for biomass fast (catalytic) pyrolysis

Experimental conditions

- 4-20 gr catalyst (ZSM-5)
- 4 gr biomass (pine sawdust)
- 400-600°C Temperature
- 6 Impingers for liquid collection
- FTIR for on-line gas analysis
- GC-MS liquid analysis
- SEM solid analysis

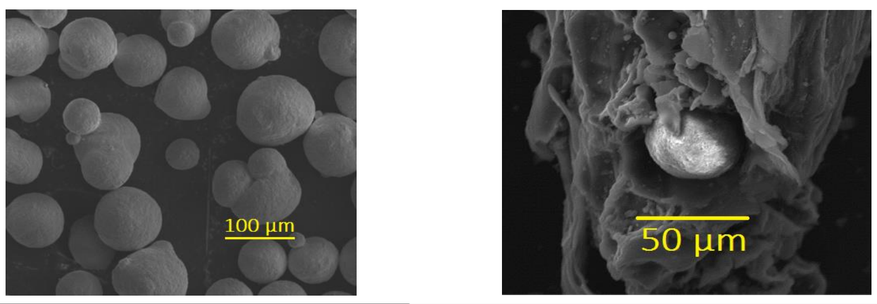
Conclusions:

- For the pyrolysis in spouted bed reactor, higher temperature (600°C) and greater catalyst to biomass (5:1) is favorable for better bio-oil quality.
- Significantly increased yields of valuable carbon percentages may be a result of unique conditions inherent to reactor novelties
- Continued testing and validation of results are required.

Results:

Fig.2 Pine sawdust, glass impingers, filtered liquid & solid product

Fig.3 SEM pictures for catalyst before (left) and after (right) catalytic pyrolysis



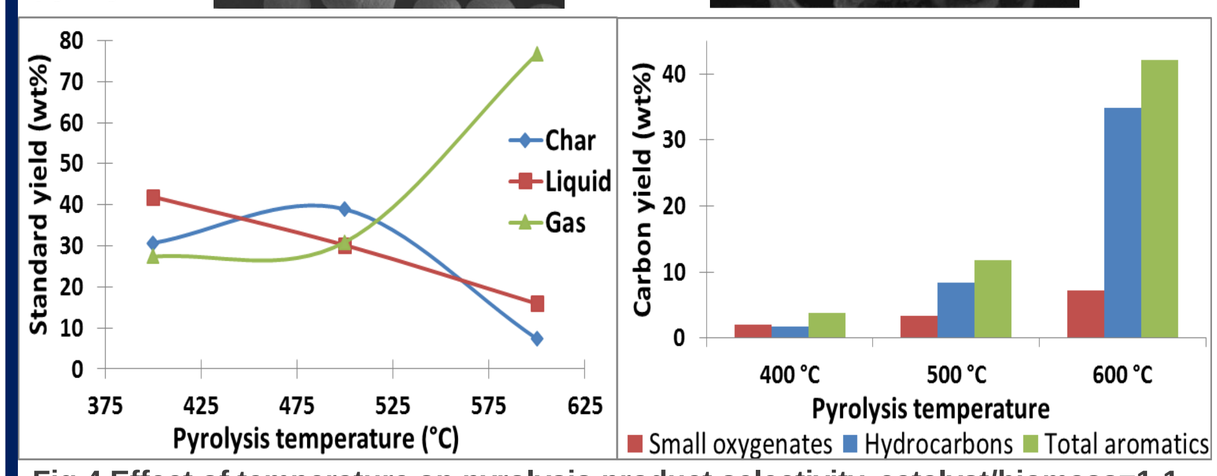


Fig.4 Effect of temperature on pyrolysis product selectivity, catalyst/biomass=1:1

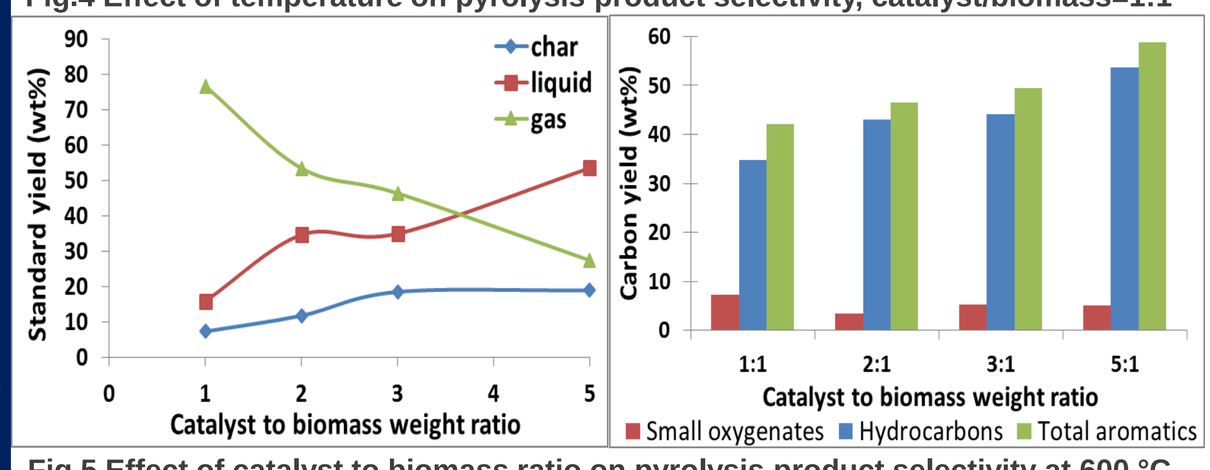


Fig.5 Effect of catalyst to biomass ratio on pyrolysis product selectivity at 600 °C

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