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Application and Proposed Research of Gasification Technology with Carbonaceous Materials

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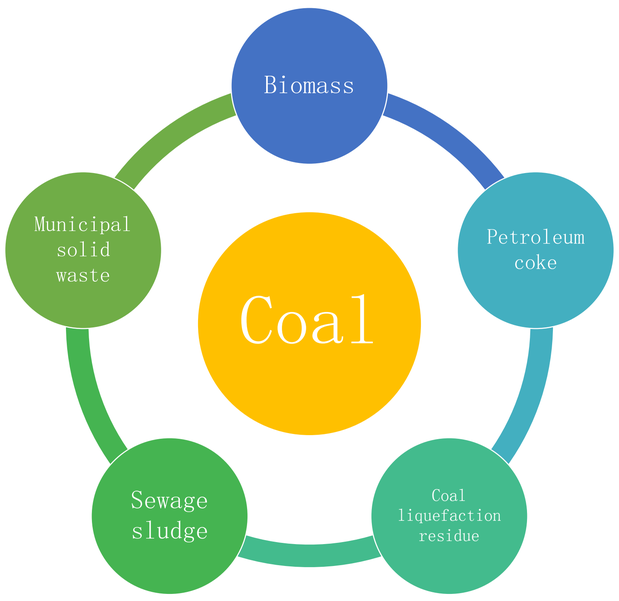
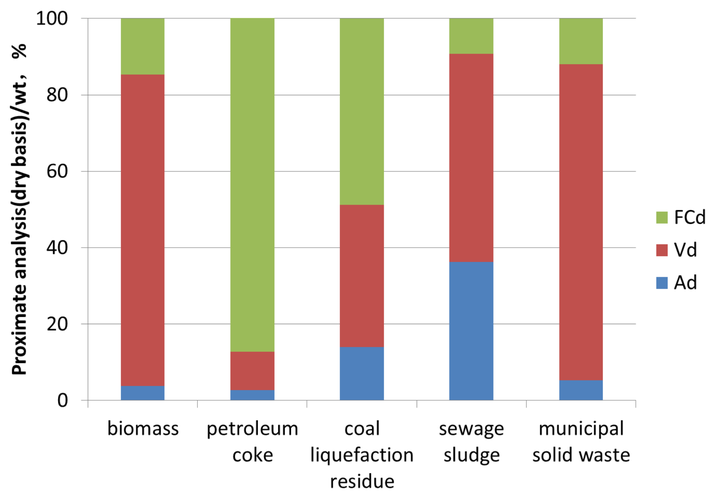
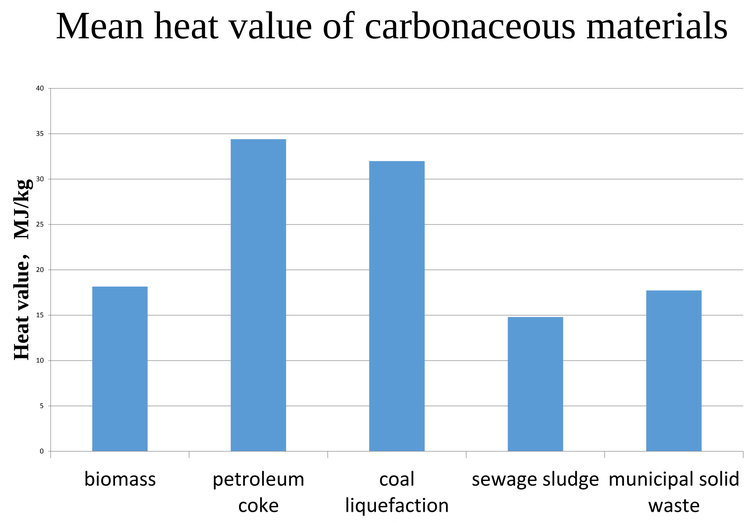
The properties of carbonaceous materials





Mean proximate analysis of carbonaceous materials



Carbonaceous materials gasification benefits:

- Well waste disposal；
- Coal consumption reduction；
- Generating clean syngas；
- Low equipment investment.

Gasification reactivity of carbonaceous materials

Petroleum coke
Generated from delay coking
Compacted structure
Poor gasification reactivity

Coal liquefaction residue
Generated from coal liquefaction process
Gasification reactivity: close to coal

Sewage sludge
Well gasification reactivity

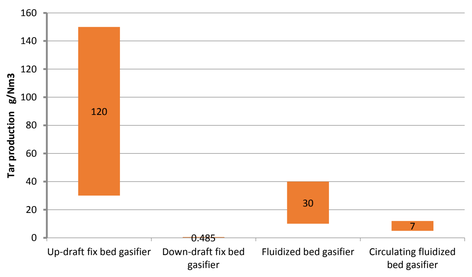
Coal
Conventional gasification feedstock
Different gasification reactivities with kinds of coals

Biomass
Abundant reserves
Well-developed pore structure
Well gasification reactivity

Municipal solid waster
Complex component
Well gasification reactivity

Application of carbonaceous materials gasification

- Fix bed and fluidized bed gasification with single carbonaceous material

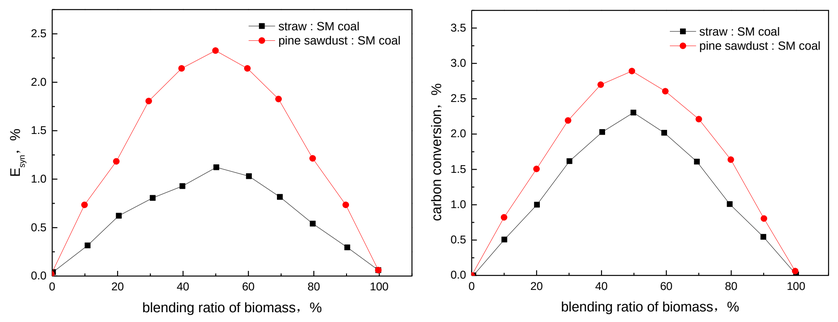


Materials	Gasifier type	Temperature	Results	Tar production
Long stick[38-39]	Up-draft fix bed	700~800℃	（$CO+H_2$）~25%；	1~5%
Biomass[40]	Modified up-draft fix bed	750℃	gasification efficiency 90%；heat value of syngas 6.7%MJ/m^3；	2%
Municipal solid waste[41]	Up-draft fix bed	850~930℃；	Carbon conversion74.5~85.9%	9.2~22.5g/m^3
Sawdust[42]	Double fluidized bed	700℃	heat value of syngas：12~13 MJ/m^3；	0.5~2g/m^3
Crop straw[43]	Internal Circulating Fluidized Bed		heat value of syngas：5.8MJ/m^3；	0.024g/m^3
Sewage sludge[44]	Fluidized Bed	900℃	（$CO+H_2$）42%	-

Industrial Application：
Biomass
Sewage sludge；
Municipal solid waste.

- Low temperature；
- Tar production；
- Small scale；
- Low carbon conversion

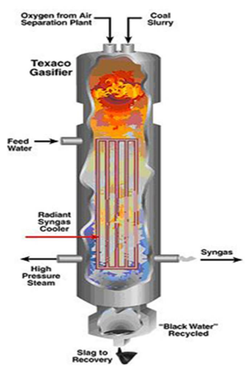
- Fix bed and fluidized bed gasification with carbonaceous material blending



Industrial Application：
Biomass & coal

- Higher temperature；
- Low tar production；
- Small scale；
- Higher carbon conversion
- Higher gasification efficiency due to synergistic effect

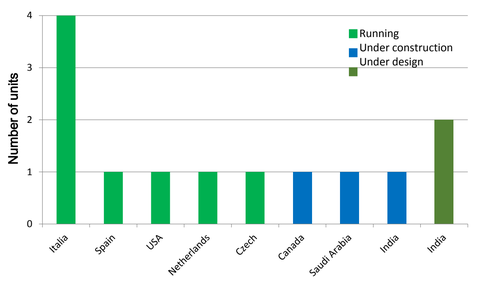
- Entrained flow gasification with single carbonaceous material

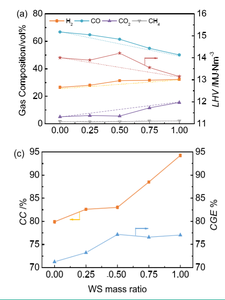


- High temperature；
- Non-tar production；
- large scale；
- Unstable gasification efficiency due to unstable feedstocks;
- Difficult in preparing and conveying of feedstocks.

Study in lab：
Biomass；
Coal liquefaction residue.
Industrial Application：
No report.

- Entrained flow gasification with carbonaceous material blending





Study in lab：
Biomass & coal;
Biomass & PC;
Sewage & PC.
Industrial Application ：
PC & coal.

- High temperature；
- Non-tar production；
- Large scale；
- Stable feedstocks;
- Well gasification reactivity.

Expectation of carbonaceous materials gasification

Blending of carbonaceous materials

Entrained flow gasification technology

- ☐ Gasification kinetics study on reasonable blending ratio
- ☐ Slurry properties & conveying characteristics study on reasonable blending ratio
- ☐ Pilot scale study
- ☐ Industrial application study

Study on carbonaceous materials gasification in NICE

Reasonable blending ratio study

Dense-phase pneumatic conveying study under high pressure

Flow field experiments

Entrained flow gasification pilot plant experiment