Building Soil Carbon Via Biomass Pyrolysis

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Biochar: Faster and more efficient than building soil organic matter

**Slow vs fast pyrolysis**

*Slow pyrolysis*
- Lower capital costs
- Higher yields of biochar (20-40 wt%) vs fast pyrolysis (10-20 wt%)

*Fast pyrolysis*
- Higher throughputs
- Higher value co-products improve economics

**Is biochar really the same thing as “soil carbon?”**
- Biochar exhibits many of the same benefits to soil fertility as soil organic matter
- Biochar already makes up part of the natural complement of soil carbon, produced by forest and prairie fires

*Biochar value depends upon market size*

Adapted from Laird and Mba Wright
Concept for Fast Pyrolysis Biorefinery

Lignocellulosic Biomass → Pyrolysis Reactor → Product Recovery

First Generation Products
- Ethanol
- Bio-asphalt and marine fuel
- In-plant thermal energy
- Soil enrichment & sequestration of carbon

Potential Future Products
- Pharmaceuticals
- Polymers
- Alcohol-to-jet fuel
- Renewable diesel
- Octane enhancers
- Biobased chemicals
- Acetone
- Acetic Acid
- Bio-cement
- Slow release fertilizer
- Activated carbon

Iowa State University
Bioeconomy Institute
First Demonstration Project

- Partners: Stine Seed Company, Frontline Bioenergy and Iowa State University
- Technology: ISU *autothermal pyrolysis* technology incorporated into modular system
- Approach: Pilot scale research to guide design of 50 ton per day demonstration plant using corn stover as major biomass feedstock

Pyrolysis Products

- Phenolic oil
- Pyrolytic sugar (later phase)
- Prilled biochar

Autothermal pyrolysis pilot plant (15-20 kg/h) supported design of demonstration plant

Autothermal pyrolysis demonstration plant (50 ton per day) near completion in Redfield, IA