Graphene like think films Synthesis from Bio-char using Wet Chemical Treatment Process

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Outline

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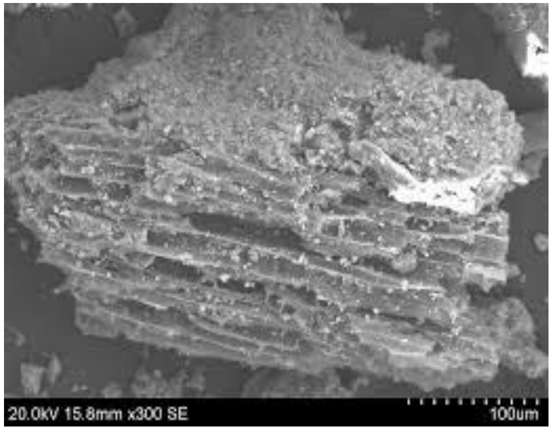
  - Current progress
  - Bio-char applications
- Experimental Methods
- Results
  - TGA,
  - Raman
  - AFM
- Conclusions

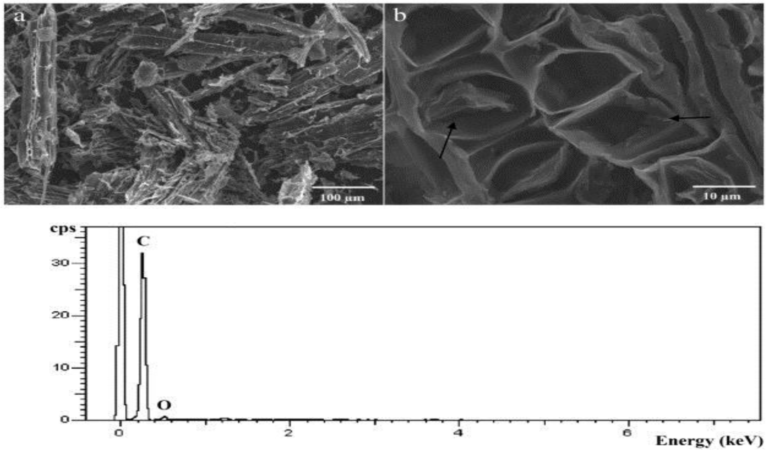
Bio-char?

- *Bio-char is a solid material obtained from the carbonization of biomass.*
  - *Usually a by product from pyrolysis or gasification process under reducing atmosphere*
- *Advantages*
  - *appreciable carbon sequestration value*
- *Applications*
  - soil amendment, carbon sequestration, adsorbents.

Recent Interests

- Increased interest to utilize bio-char as super capacitor, nano-composites.
- Limitation- Low specific surface area, pore size distribution, porous structure and electrical conductivity, surface functional groups significantly affect the electrochemical performance of carbon materials.

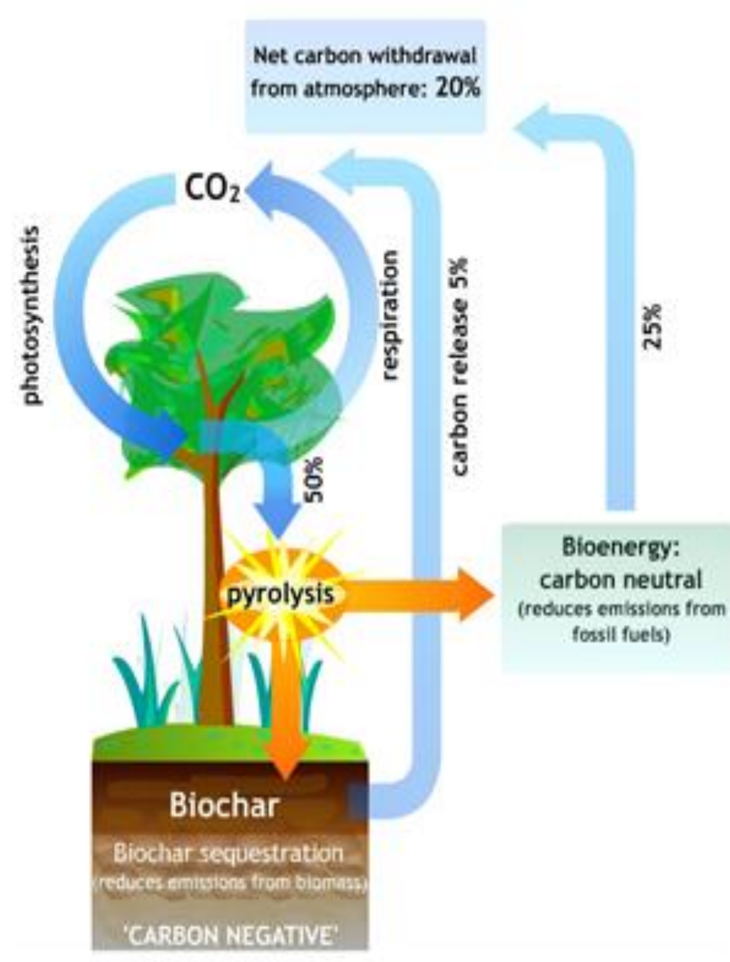




Why Use Bio-char?

- High cost of commercially available carbon based materials such as graphene, CNT, and carbon onions from metal carbide.

- Renewed interest in alternative energy
  - Biomass pyrolysis produces bio oil and bio-char



Experimental Methods

- Wet Chemical Treatment
  - Oxidation with HNO_3
    - 100°C and 90hrs
    - Solids washed, centrifuged and dried
  - Reduction with Hydrazine Hydrate
    - 100°C and 24hrs
    - Solids washed centrifuged and dried.
- Characterizations
  - CHN, particle size using zeta sizer, TGA, Raman, AFM

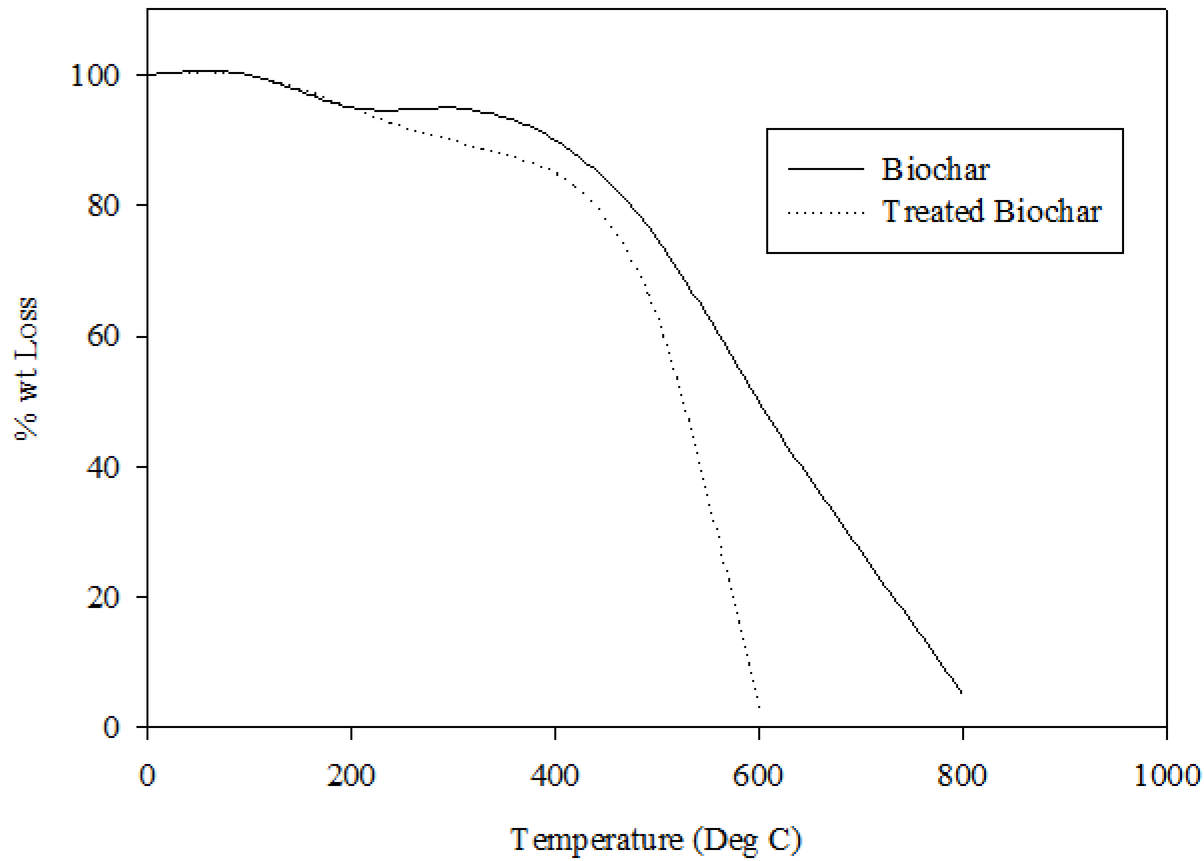
Preliminary Results

Parameters	Units	Biochar	Treated Biochar
Carbon	%	85.75	51.7
Hydrogen	%	1.42	1.92
Nitrogen	%	0.48	7.4
Size Distribution	nm	800-1000	80-200

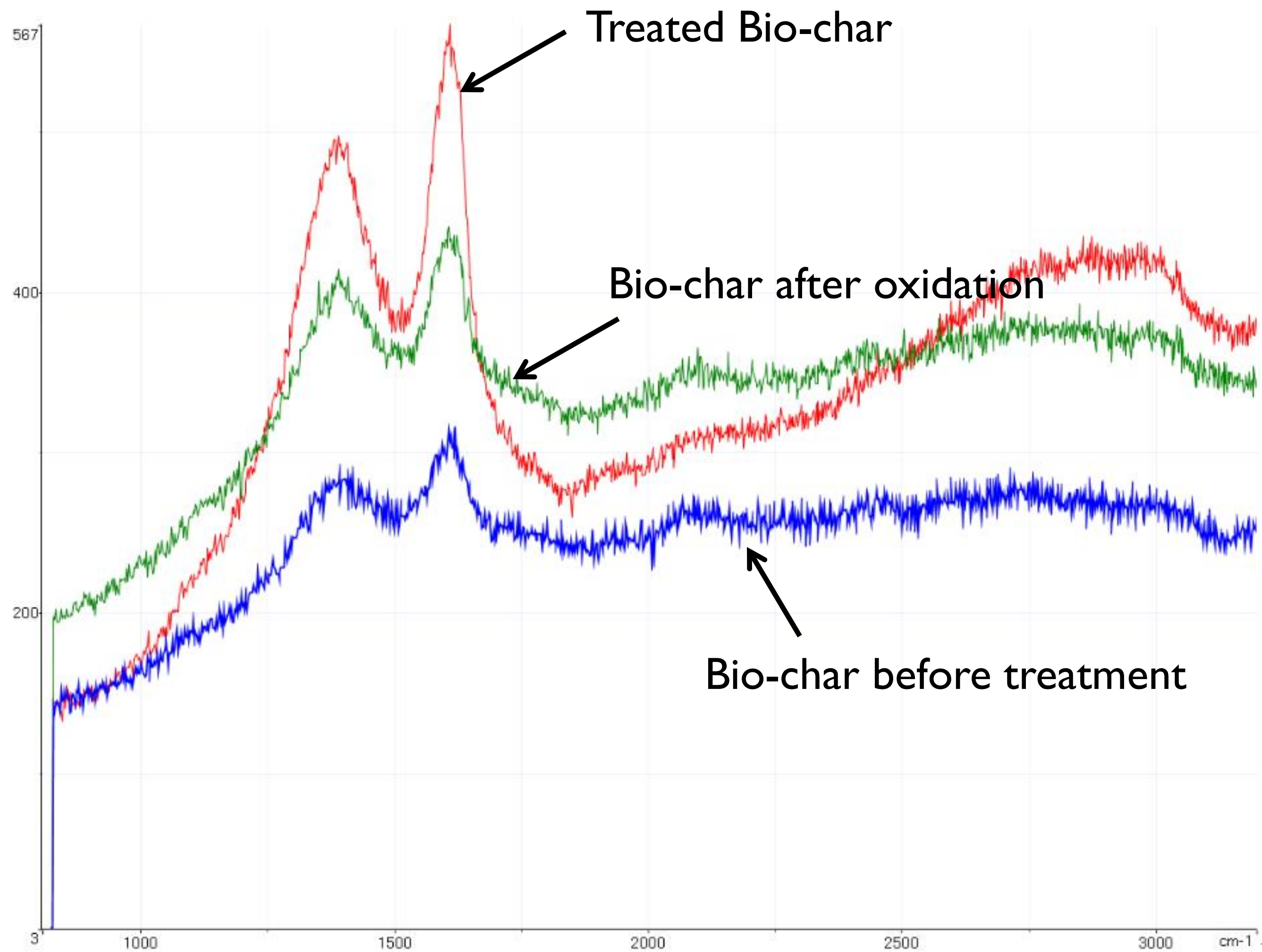
Particle size distribution by Zeta Sizer

Peak Analysis by intensity			
Peak	Area	Mean	Width
1	30	80.9 nm	20
2	70	160.3 nm	91.3
Peak Analysis by volume			
Peak	Area	Mean	Width
1	69.2	78.9 nm	53
2	30.8	171.1 nm	63.1
Peak Analysis by number			
Peak	Area	Mean	Width
1	100	65.4 nm	39.1

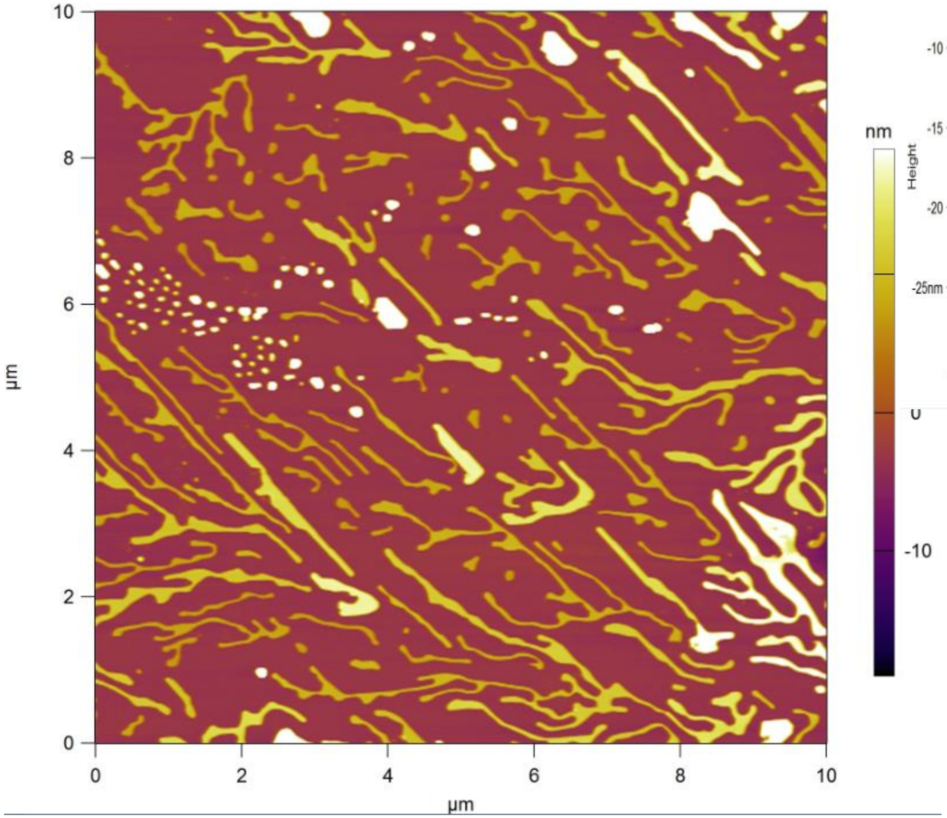
Thermogravimetric Analysis (TGA)

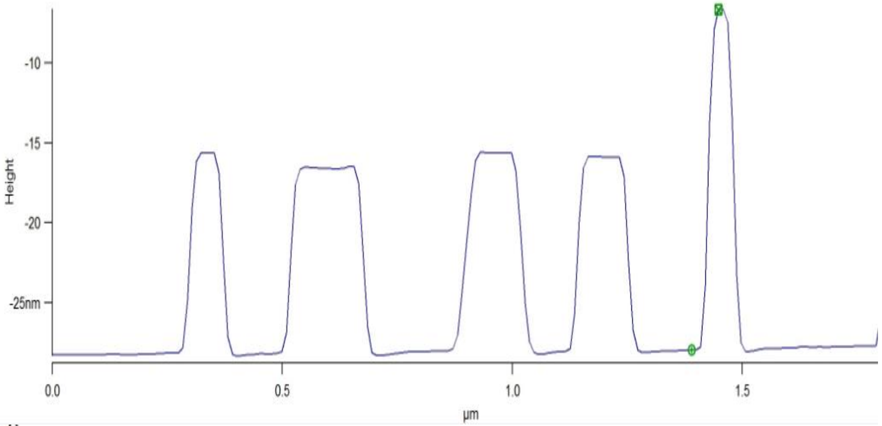


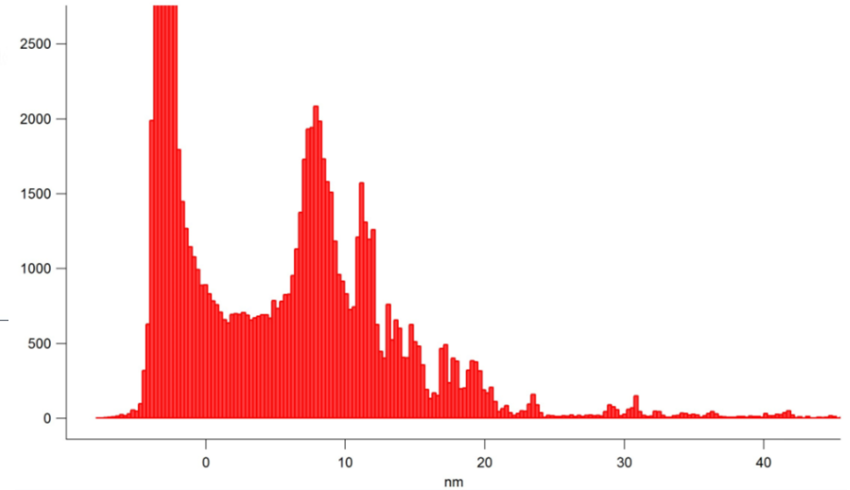
Raman Spectroscopy



Atomic Force Microscopy (AFM)







Conclusions and Future work

- Demonstrated the wet chemical treatment process for bio-char
- Results indicate the formation of thin layers
- The approach has several advantage over conventional GO oxidation and reduction and is industrially scalable
- The potential application as nano-composites/ filler materials
- Detailed characterization including SEM, TEM and XRD will be studied
- Optimization and scale up study will be conducted

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