



Commercial applications of Activated Bio-carbon for Air and Water Filtration

Agenda

Introduction to Continental Carbon Group, Inc.

Activated Carbon Base Material

Activated Carbon Properties and Types

Bio-Waste to Bio-Carbon route

Potential Applications for Bio-carbon

Final takeaways

ABOUT CONTINENTAL CARBON GROUP, INC.



Continental Carbon Group (CCG) is a turn-key solutions provider for all air, soil, water and wastewater



Offices in Hamilton, ON and Columbus, OH for sales, engineering, project management and field/technical services



Four divisions: Air treatment, Municipal Services, Soil treatment and Water Treatment



Technical staff has a cumulative experience of over 100 years in Municipal and Industrial applications market

SOIL-WATER

01

Two phase separation
Sludge treatment
Liquid treatment and re-use

SOIL-AIR

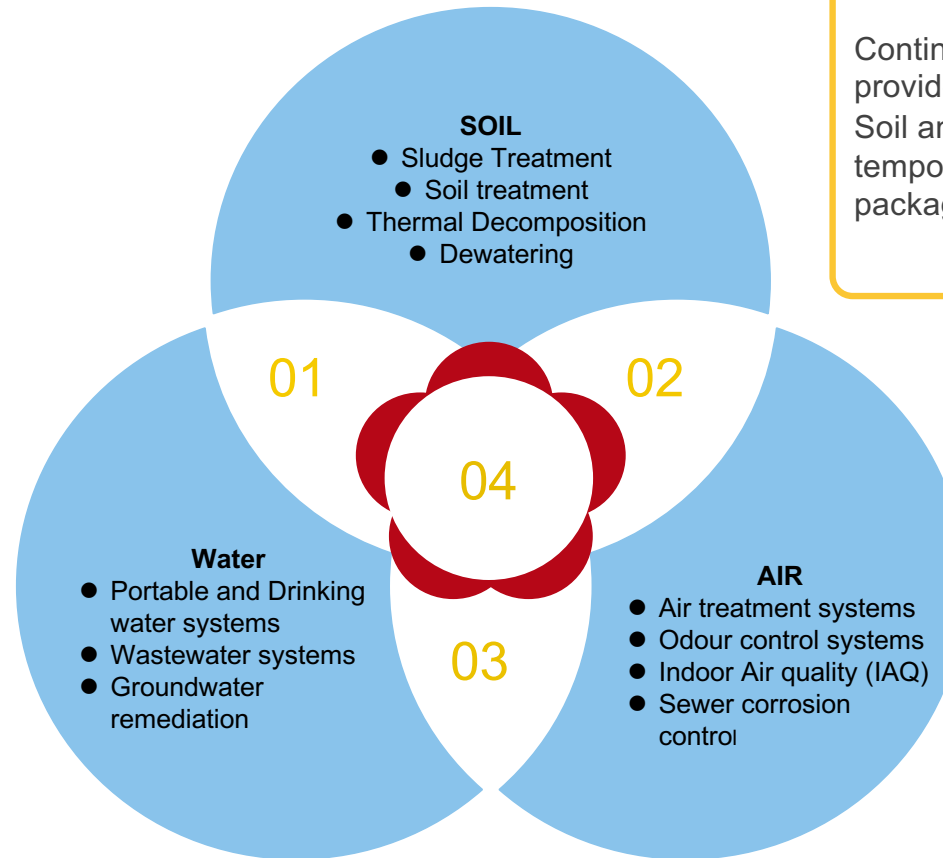
02

Two phase separation
Thermal oxidation of air
Soil re-use

WATER-AIR

03

Two phase separation
Air stripping



Continental Carbon Group (CCG) provides clients with solutions for Air, Soil and Water needs utilizing temporary and permanent packaged systems

04

ACTIVATED CARBON BASE MATERIAL



Coal

Bituminous
Lignite
Anthracite



Coconut Shell



Wood

Agricultural waste
Lignin



ADSORPTION PORES IN CARBON

Macropores

- Pore size range: 500-2000 nm
- Transport channel for contaminant

Mesopores

- Pore size range: 2-50 nm
- Large molecular contaminants get adsorbed onto these pores

Micropores

- Pore size: Less than 2 nm
- Adsorption energy strongest in these pores



ACTIVATED CARBON PROPERTIES

Particle
Size

Surface
Area

Pore
Volume

Iodine
Number

Molasses
Number

Bulk
Density

Abrasion
Number

Apparent
Density

ACTIVATED CARBON TYPES



Granular

- Primary use for water filtration and treatment
- Common contaminants: PCB's, PFAS, Pesticides etc.



Extruded

- Air treatment applications
- Common contaminants: VOC's, H₂S, Ammonia, Mercaptans etc.



Powdered (PAC)

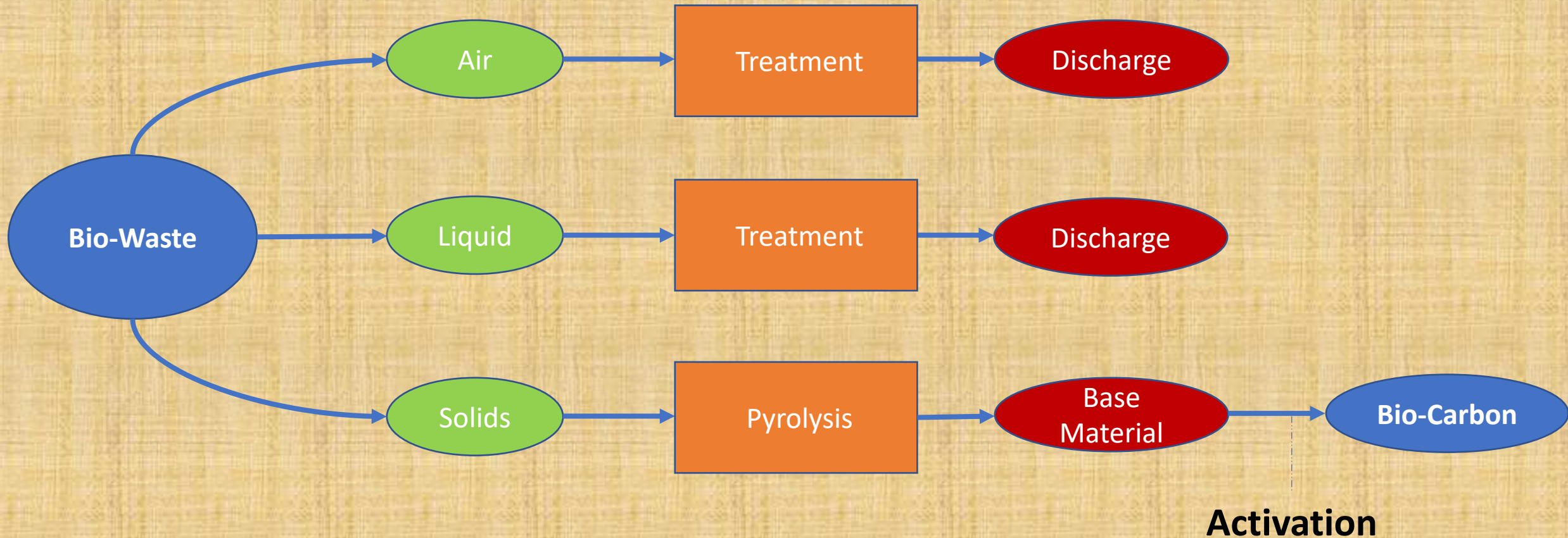
- Taste, colour and odour removal from water
- Targeted contaminants: Dyes, Natural organics (Tannins)



Carbon Molecular Sieves (CMS)

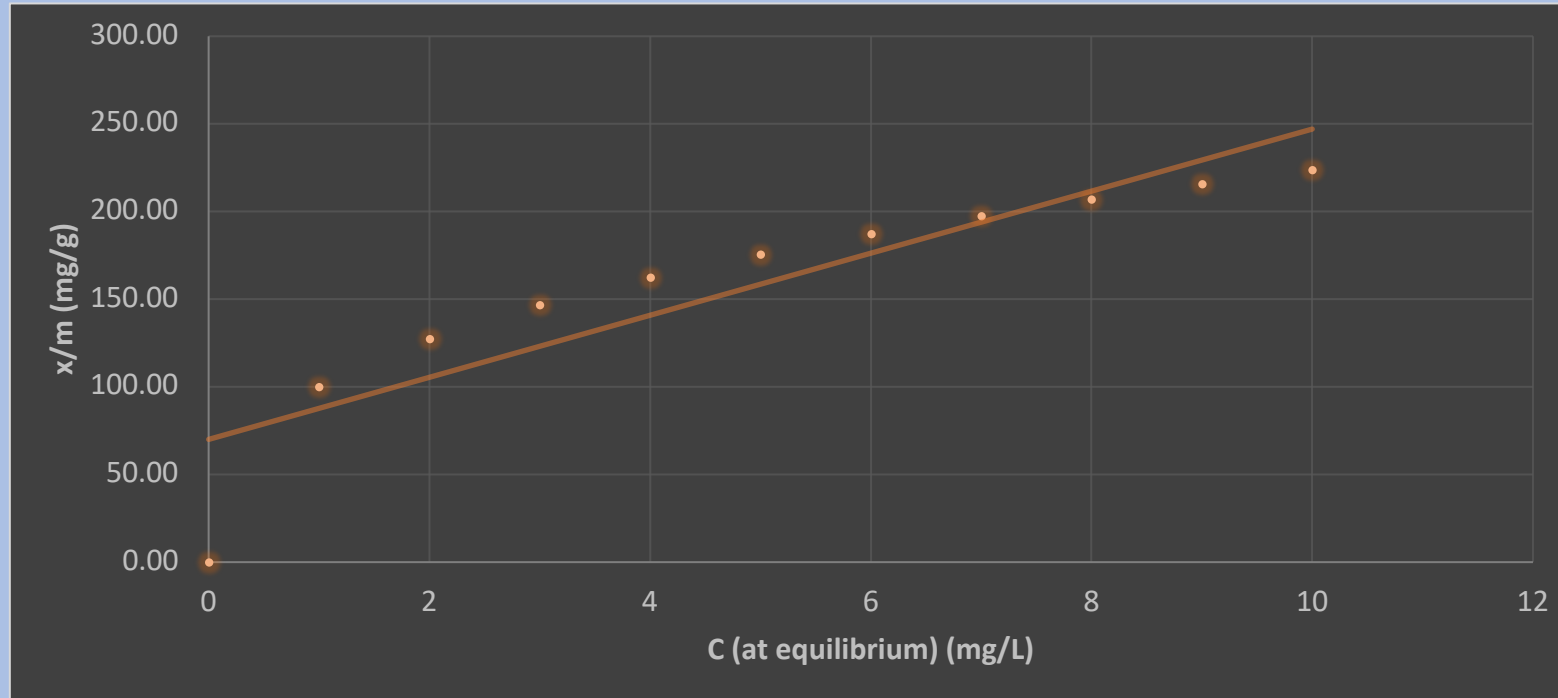
- Medical air treatment: Nitrogen gas purification
- Used primarily for O₂ and CO₂ removal

Bio-Waste to Bio-Carbon Route



ADSORPTION STRENGTH OF BIO-CARBON

$$\frac{x}{m} = K C^{1/n} \quad (\text{Freundlich Isotherm})$$



$x \rightarrow$ Amount of solute/ contaminant adsorbed (μg , mg, g, lbs)

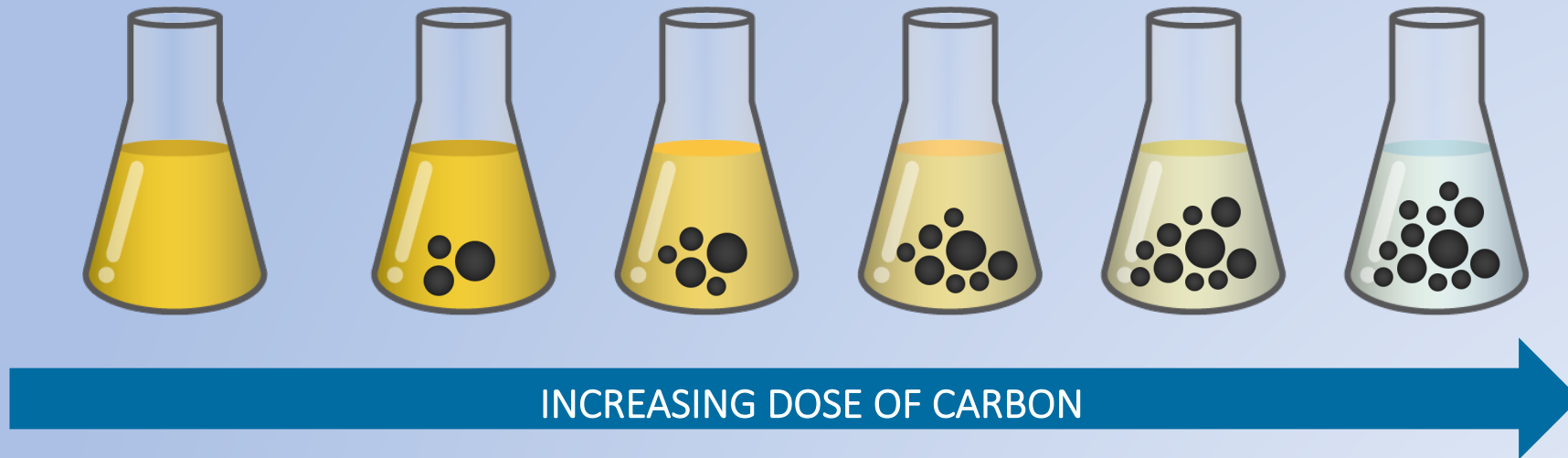
$m \rightarrow$ Mass of Biocarbon used (mg, g, lbs)

$K, n \rightarrow$ Constants, to be determined for each type of carbon

$C \rightarrow$ Concentration of solute remaining in solution after adsorption is complete (at equilibrium) (mg/L or ppm)

PILOT TESTING OF BIO-CARBON

Batch Testing



Very basic test to estimate carbon performance for a given contaminant

$$D = \frac{C_i - C_e}{(x/m)}$$

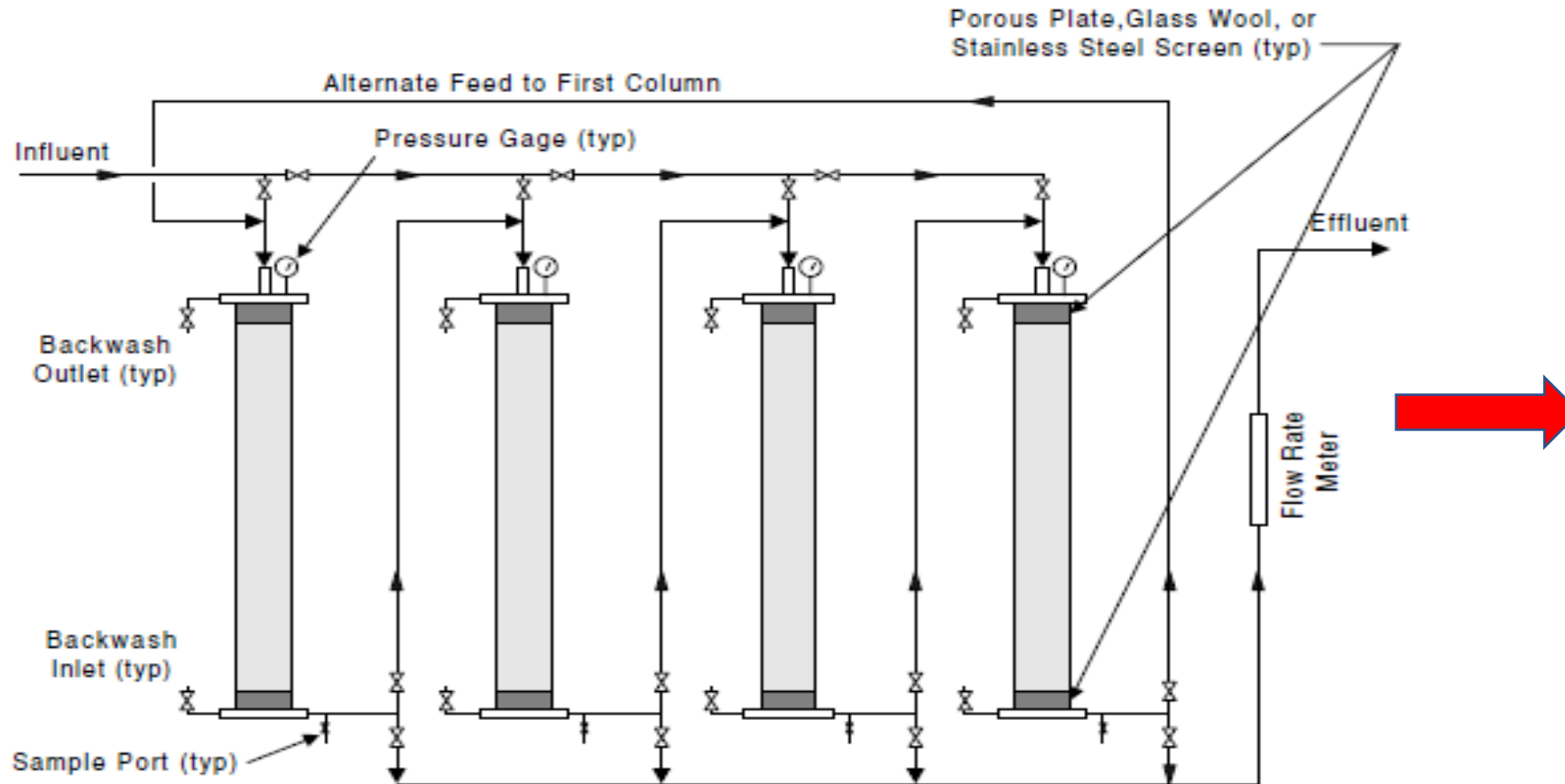
$D \rightarrow$ Carbon Dosage Rate (g/L)

$C_i \rightarrow$ Influent Concentration (mg/L)

$C_e \rightarrow$ Desired Effluent Concentration (mg/L)

PILOT TESTING OF BIO-CARBON

Column Testing



POTENTIAL APPLICATIONS OF BIO-ACTIVATED CARBON



Granular



Extruded



Powdered (PAC)



Carbon Molecular Sieves (CMS)

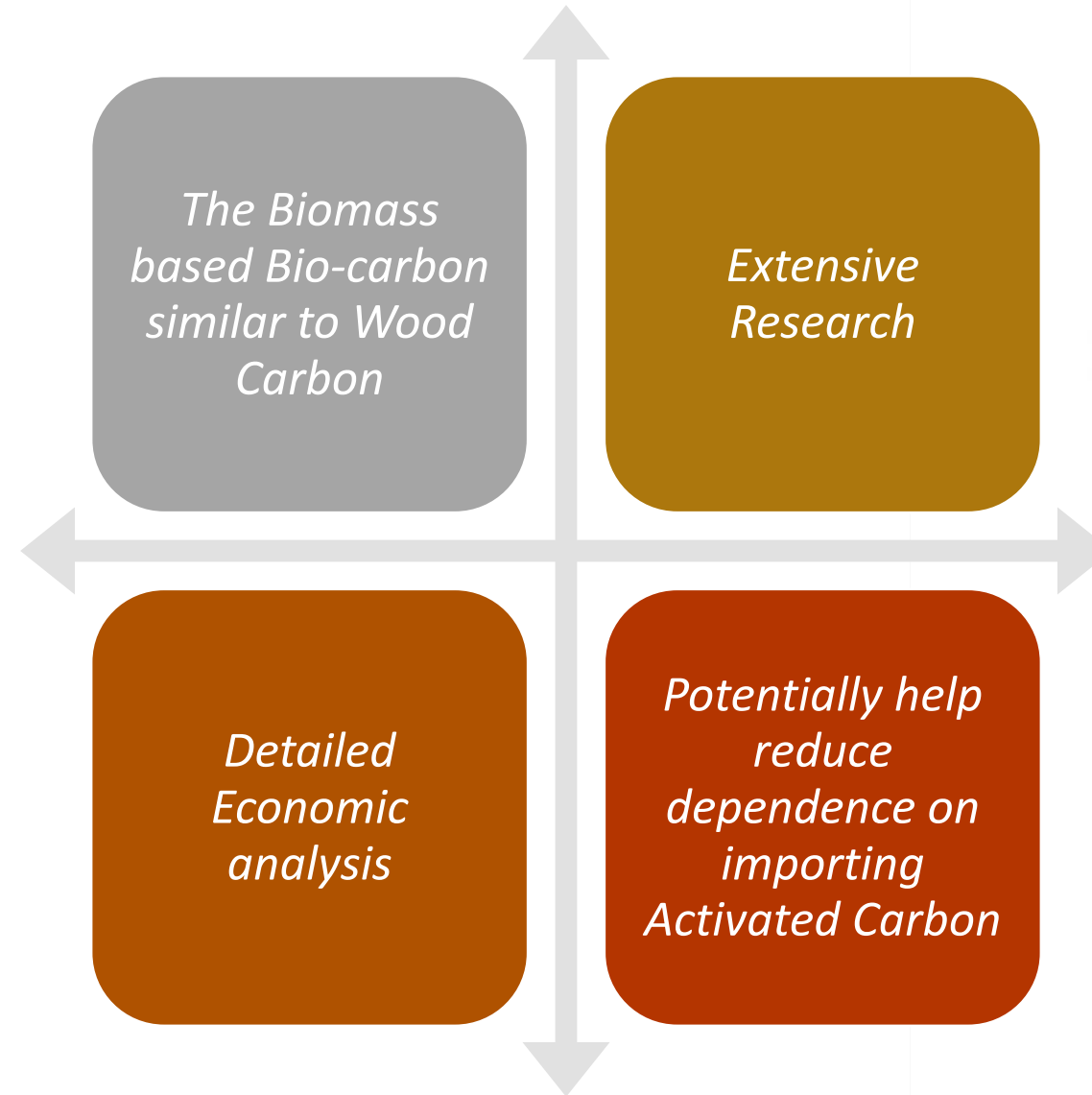
Air Contaminants

- Ammonia
- H₂S
- Mercaptans
- VOC's

Water Contaminants

- Chlorine
- PCB's
- PFAS
- THM's
- Organics
- Oxidizers

CONCLUSION



Questions?

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