

Bagasse Charcoal for Water Treatment: Preliminary Work

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Introduction:

In Many Developing Nations,

1. Dirty water = Disease

Various health problems arise from microbes, metals, ions, pesticides, and industrial waste in drinking water.

2. Charcoal production = Deforestation

Trees cut down to make wood charcoal for cooking and heating

3. Sugarcane fiber (Bagasse) = Waste

Bagasse burned in the fields as waste.

Proposal for Change:

Using Sugarcane Bagasse Charcoal(BC) to Help Treat Water

1. Cleaner Water

Improved water quality after filtration

2. Less Deforestation

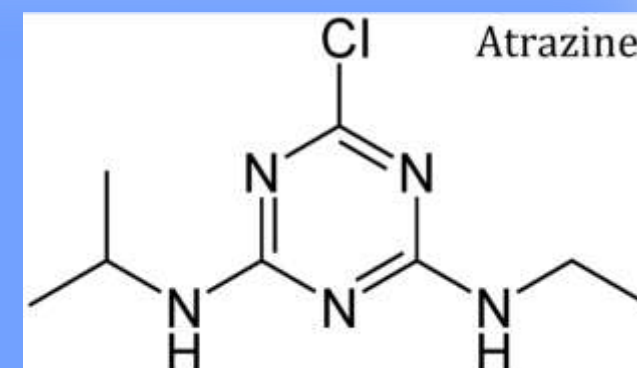
Charcoal produced from sugarcane, not trees.

3. Less Waste

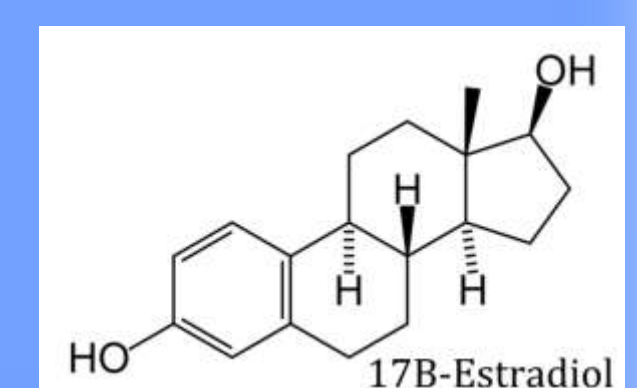
Bagasse useful for water filtration and fuel.

Chemicals Tested:

1. Atrazine, one of the world's most common pesticides



2. 17β-Estradiol, a female hormone, found in drugs for people and animals



Pyrolization:

Charcoal made through a process called carbonization or pyrolization.

Organic material heated above 600F, but deprived of oxygen. This volatilizes much of the material, leaving carbon/charcoal.

Charcoal burns at higher heats and with less smoke than the original organic material.

Charcoal's surface rough, filled with tiny holes; high surface area to volume ratio (500m²/g)

Sorption:

Interaction between solid particles and compounds dissolved in liquid. The compounds, or "sorbates," adhere to the particles, the "sorbents."

The Freundlich sorption isotherm describes this interaction. q , the mass of sorbate per sorbent is graphed versus C , the equilibrium concentration of compound still dissolved in the liquid.

The Freundlich isotherm is a power relationship, with constants of K and n :

$$q = K \times C^{1/n}$$

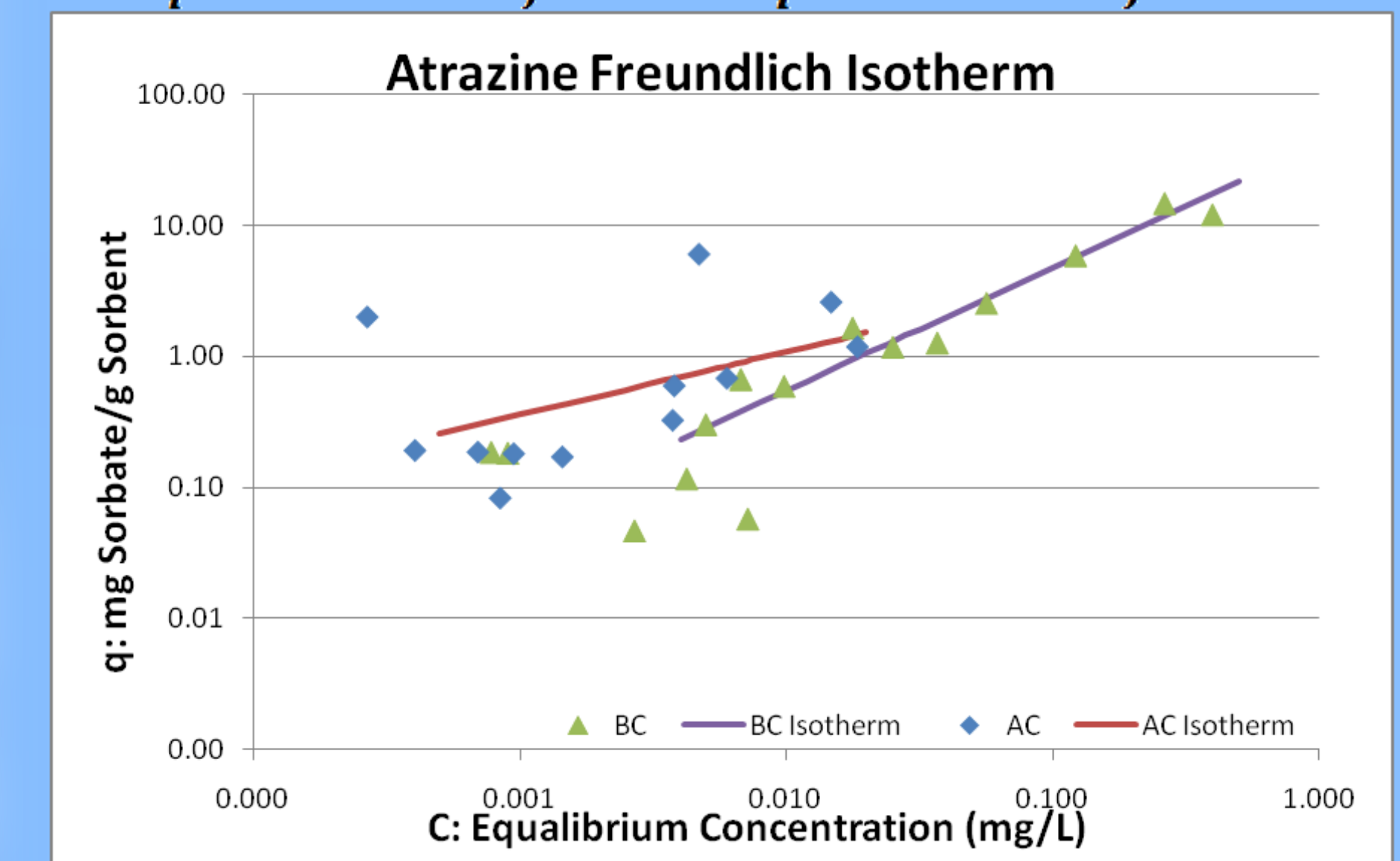
Summer Results:

Bagasse Charcoal (BC) Shows Promise;

- Preliminary batch testing data obtained
- C measured with immunoassay kit
- q derived from C and initial concentration
- Freundlich isotherms fitted
- Activated Carbon (AC), a common sorbent was used as a standard.
- BC and AC sorption capacity were found comparable

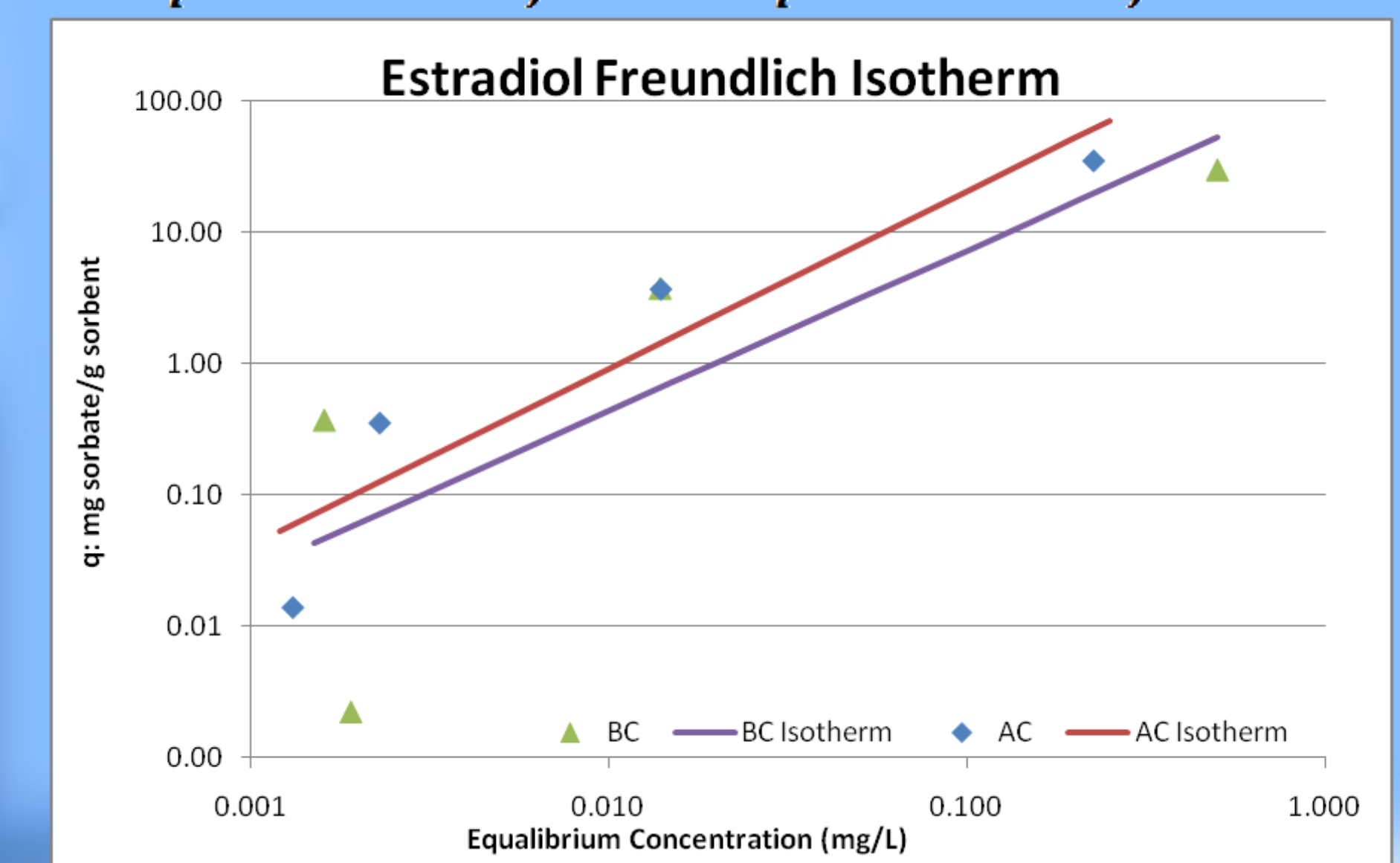
Freundlich Isotherm for Atrazine:

$$q = 41.6 \times C^{.94} \text{ for BC} \quad q = 9.9 \times C^{.48} \text{ for AC}$$



Freundlich Isotherm for Estradiol:

$$q = 120 \times C^{1.2} \text{ for BC} \quad q = 460 \times C^{1.4} \text{ for AC}$$



CALVIN
MINDS IN THE MAKING

200lbs of Sugarcane Bagasse arrived from Florida in garbage bags



And looked like mulch, but smelled a bit sweeter.



To dry it, we took over the floor of the Engineering Building.



We pyrolized (charcoalized) it at 500-1300°F.



After grinding, the charcoal was graded in sieves.



75-106um Bagasse charcoal fines



Batch reactors, with charcoal and pollutants inside, on a shaker table.



The samples were read with a UV-vis microplate spectrophotometer.

