

Adsorption Interactions of Micropollutants with Granular Activated Carbon

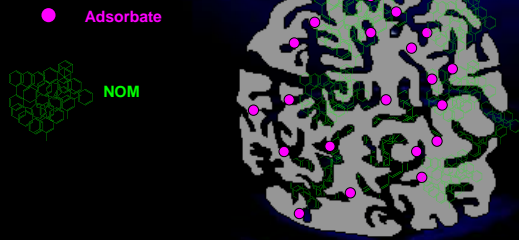
Austa Marie Parker
advisors
 Christopher Corwin, Prof. R. Scott Summers
 August 7, 2008

Background

- GAC has shown to be effective for micropollutant removal
- Competitive Adsorption
 - Same molecular weight
 - Different molecular weights
- Natural Organic Matter

GAC

Granular Activated Carbon



Objectives

1. Evaluate the removal of low concentrations of Erythromycin and Diclofenac by (GAC) Granular Activated Carbon adsorption
2. Improve the lifetime of GAC beds by preoxidizing NOM (Natural Organic Matter)

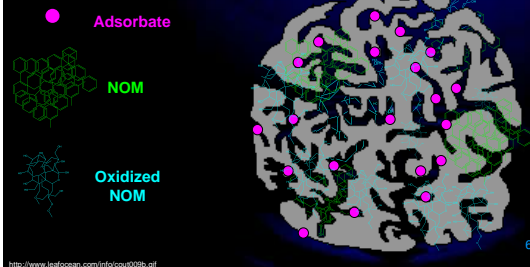
Probe Pollutants

General Chemical Properties

Compound	Formula	MW (g/mol)	pKa	Radiolabel
Diclofenac	$C_{15}H_{10}Cl_2NNaO_2$	318.1	4.15	^{14}C
Erythromycin	$C_{27}H_{47}NO_{13}$	733.9	8.88	3H

GAC

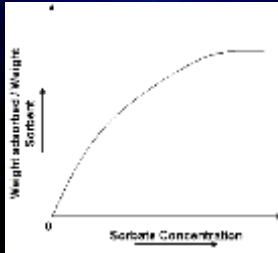
Granular Activated Carbon



Adsorption Isotherms

$$Q_e = \frac{(C_0 - C_e) \times V_{\text{total}}}{M_{\text{GAC}}}$$

Equilibrium Test



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Experimental Approach

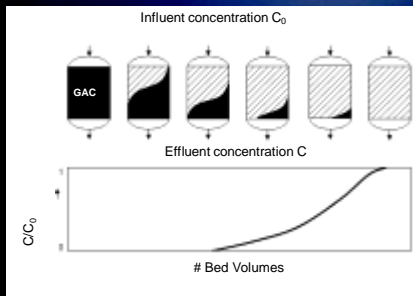
- Oxidize Boulder Creek water

	Volume Influent Water (L)	Dose of Oxidant (mg/L)	Residual Concentration (mg/L)
Control	60	0	0
ClO ₂	60	1.1	0.06
KMnO ₄	60	2.2	1.7
HOCl	60	2	0.7

- Quench oxidant using Sodium Thiosulfate
- Dose water with pollutants
- Dose 250 mL bottles with GAC from 0 mg to 84 mg for isotherm test
- Rotate isotherm bottles for 7 days

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Breakthrough

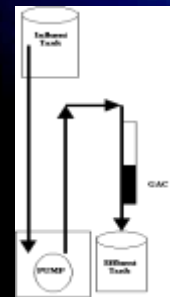


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RSSCT

Rapid small-scale column test

EBCT= 5 minutes

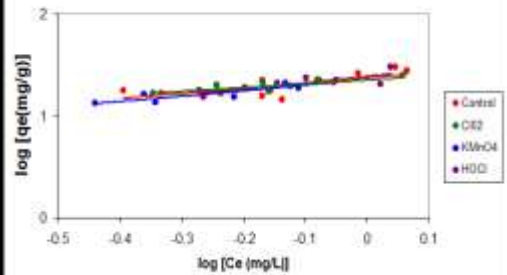


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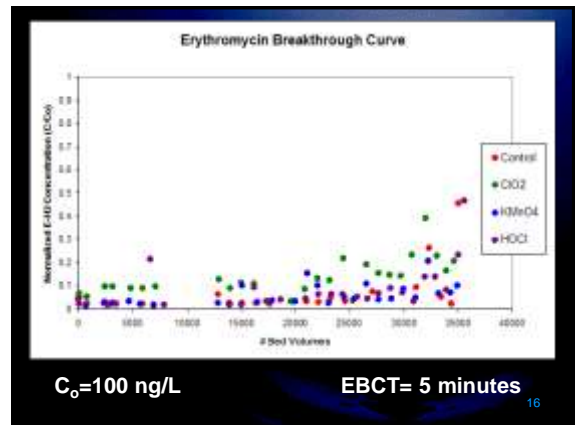
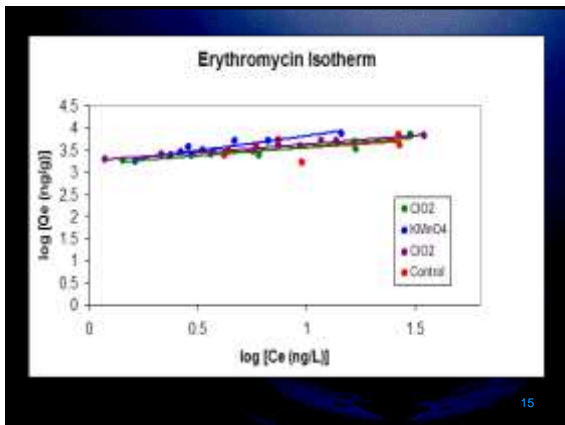
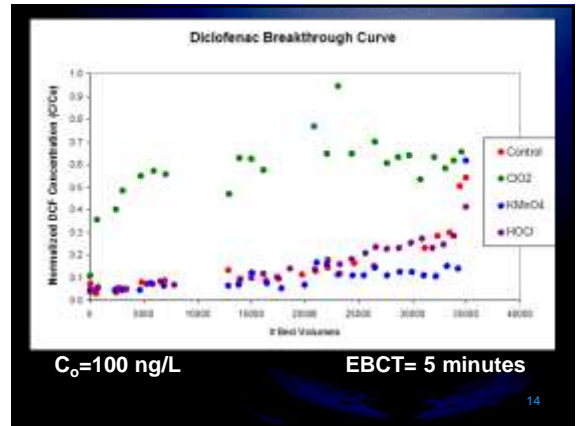
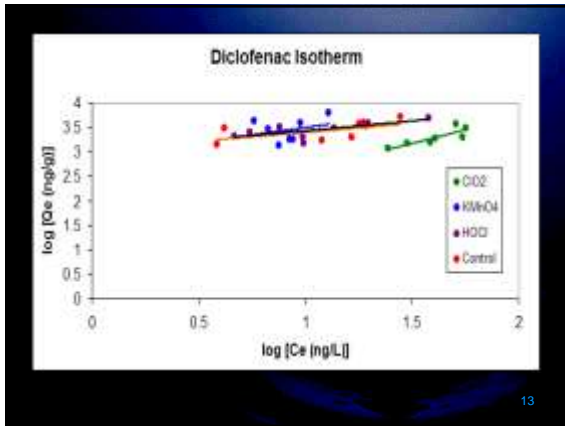
RESULTS

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TOC Isotherms



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Conclusions

- GAC adsorption has the ability to remove micropollutants
- Oxidation of NOM
 - GAC has less adsorption capability for DCF when the NOM has been oxidized with ClO₂
 - KMnO₄ oxidized water may be effected
 - Oxidation strength
- Charge
 - Of micropollutant and oxidized NOM

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Future Work

- Continue RSSCT sampling
- Stronger oxidants and doses
- Broader range of adsorbates

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Acknowledgments

- Christopher Corwin
- Prof. R. Scott Summers
- Prof. Angela Bielefeldt
- Amanda Kohler
- NSF
- REU students

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Questions

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