

Adsorption lab, Group homework assignment

1. Determine  $U_{Mac}$ , the unit mass of the activated carbon ( $g/cm^3$ ), using information given in the equipment list.  
 $U_{Mac}$  is the mass of activated carbon per unit volume, i.e. bulk density.  
First, Determine the cross sectional area,  $A$ , and volume,  $V$ , of a column using information given in the equipment list.
2. Determine the porosity of the GAC, assuming it takes 13 minutes to fill a GAC-filled column at a flow rate of 22 ml.min.
3. What is the material density of a GAC particle (i.e., density of the material that comprises GAC)?  
Describe sources of error and uncertainty related to your estimate.
4. Given the Bed depth-Service time figure (10% line only) estimate the amount of GAC used up in the bench-scale system each day.
5. Given a 22 ml/min flow rate, what is the flux in the bench-scale setup (i.e., flow rate / column cross sectional area)?
6. If a full scale system must operate at the same flux, columns of what diameter are needed to treat 10 L/min?  
How many kg of GAC are used up per day?
7. If the bed depth versus service time 10 and 90 % lines have the following equations, what is the length of the adsorption zone?  
How many 2-meter high columns would be needed?
8. Given the following data, how much GAC was trapped in the benchscale set up over the 28 day experiment?

Day	$C_o$ , mg/L	$C_e$ , mg/L	Flowrate =	22 ml/min
1	22.4	0.2		
2	22.4	0.5		
3	22.4	1		
4	22.4	2		
5	22.4	3		
6	22.4	3.5		
7	22.4	4.1		
8	22.4	4.8		
9	22.4	5.2		
10	22.4	5.9		
11	22.4	6.4		
12	22.4	6.9		
13	22.4	7.3		

14	22.4	8
15	22.4	8.5
16	22.4	9
17	22.4	9.2
18	22.4	9.7
19	22.4	9.9
20	22.4	10
21	22.4	10.1
22	22.4	10.3
23	22.4	10.5
24	22.4	10.7
25	22.4	11
26	22.4	11.2
27	22.4	11.3
28	22.4	11.5