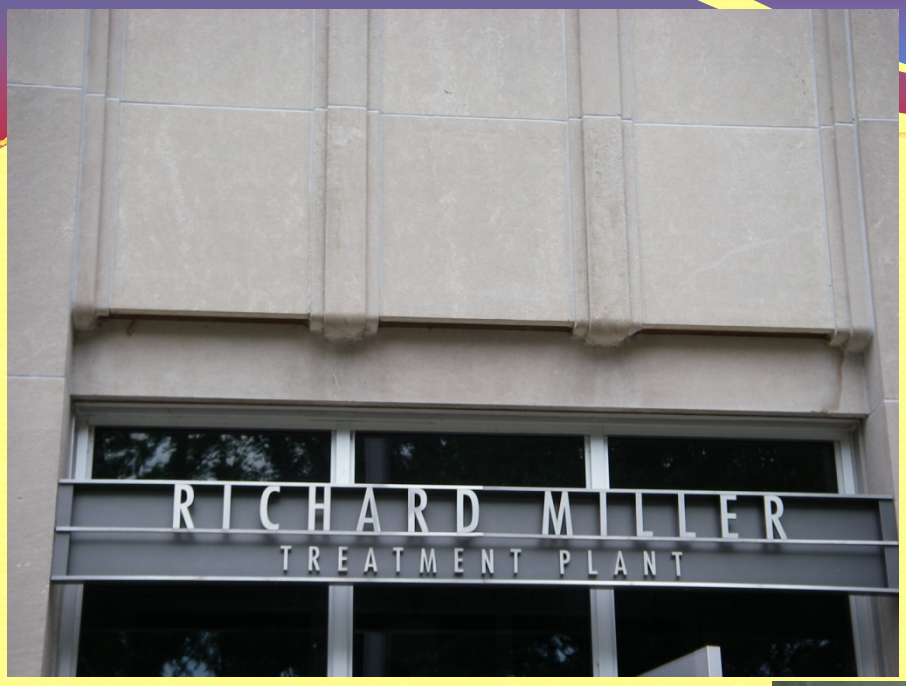
Making "Yucky" Water Clean

Summer Research 2009

Meeting our Mentors & Learning about our Project

Want a drink?

Wespionage/Flickr



Water treatment plants work hard to make it drinkable

Their secret weapon against dirty water…..

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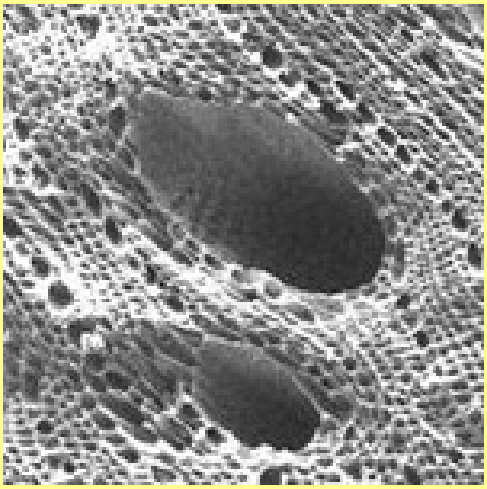

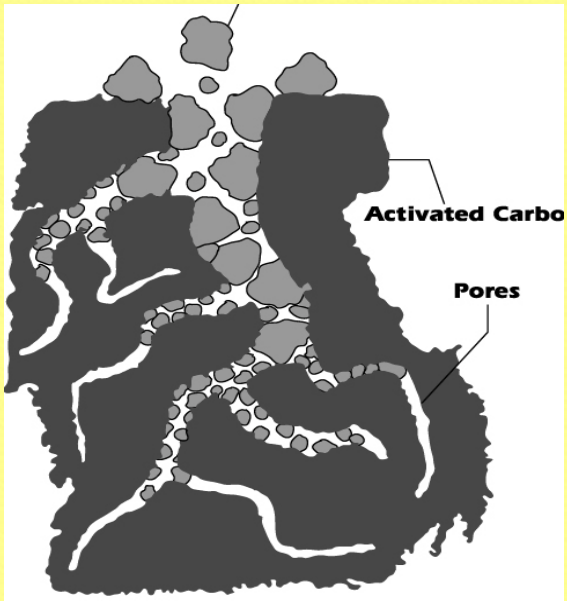

ACTIVATED CARBON!

It can even "snag" nasty little chemicals like trichloroethylene – TCE


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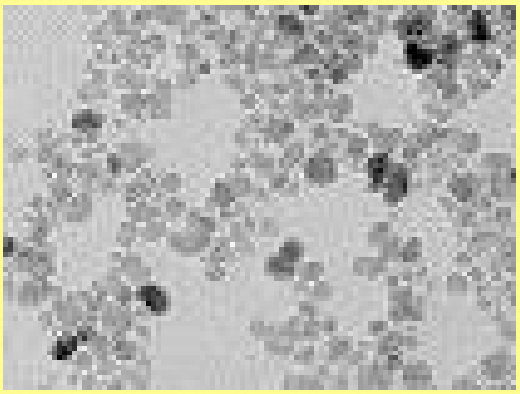
But….

What if the carbon can’t adsorb everything we need it to?

Is there something else in our water?



Teeny, tiny little nanoparticles, like iron

This helped us come up with our challenge…

Hmmmm……

Could the nanoparticle iron be preventing the carbon from adsorbing TCE during water treatment?

To help us get ideas, we checked out what other people have done using the library

Then we came up with an idea about what we believe is happening.

This is the idea we will test .....

If there is more nanoparticle iron in the water, then less TCE can be adsorbed by the carbon – which means the water will still be "yucky"

Our mentors helped us to create a test to explore our ideas

Let's

1. Put samples of water in bottles
2. Add carbon, TCE and nanoparticle iron
3. Mix them for 14 days
4. Test to see how much TCE actually got adsorped

We decided to change only one thing about the experiment ….

The amount of nanoparticle iron – half the bottles would have 1.0 mg, and half would have .5 mg

We made sure everything else stayed the same in our samples….

- The type of bottles
- The water
- The amount of TCE
- The amount of time we mixed the bottles

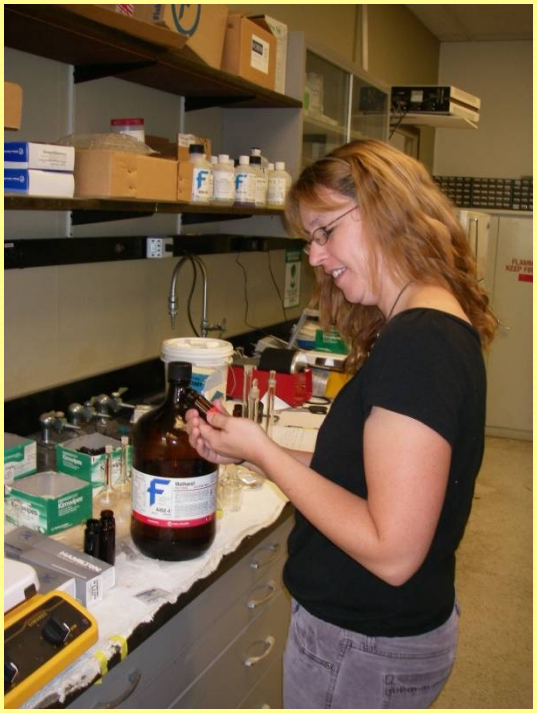

PYREX®
WARNING
PARAFILM
PARAFILM

We decided to do the experiment 16 times (8 bottles with 1.0 mg iron and 8 bottles with .5 mg iron) to make sure the results are not just a "fluke"

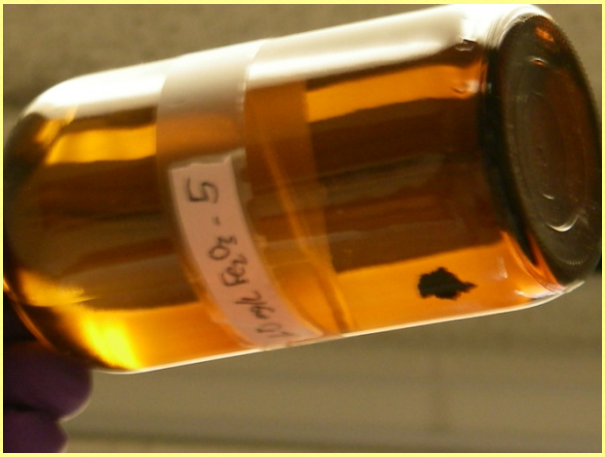
We also made bottles 2 without any carbon and 2 without any carbon or iron.

We called these BLANKS – this way we would have something to compare to our sample results.

We measured, mixed, poured, and labeled all of our sample bottles, then placed them in the tumbler to mix for 14 days

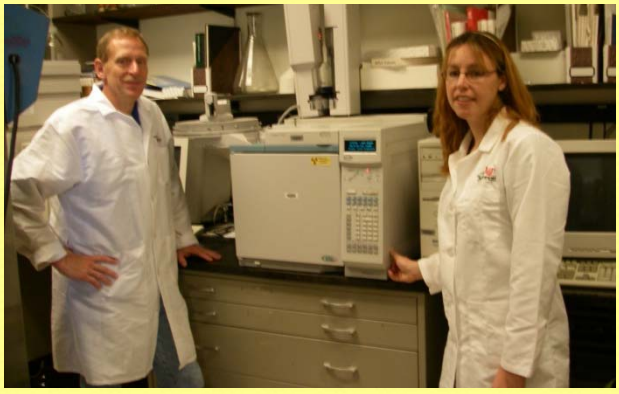


Along the way, some unexpected things happened…



But we kept on working

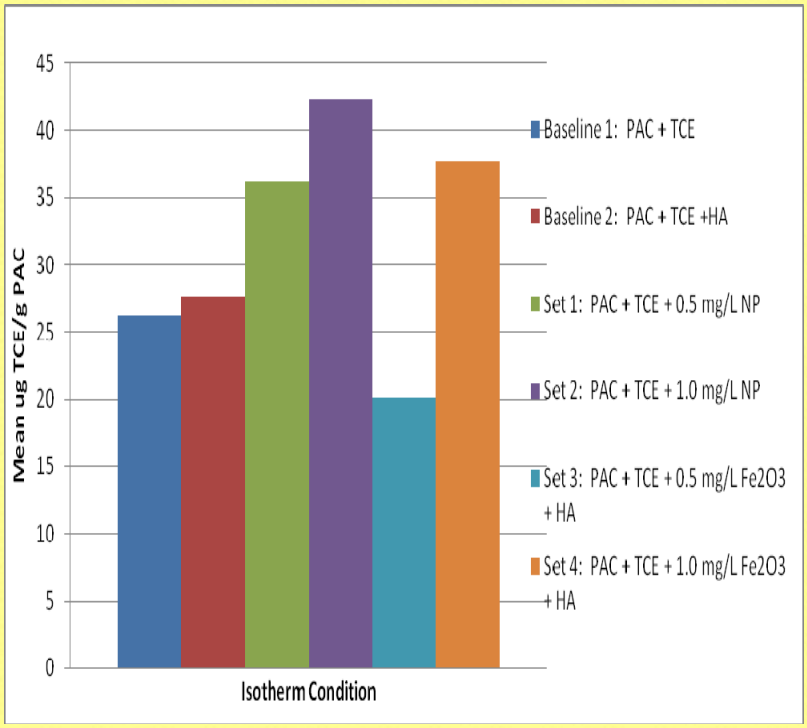
We filtered our samples, poured them into vials and used a machine to see how much TCE was left in the water.



Then we took all of our numbers and tried to make sense of them all!

What we got…

Sample #	TCE Area	PCE Area	TCE/PCE	Cal. Curve slope	TCE Concentration (ug/L)	Mass of Carbon (g)	q_e (ug TCE Removed/gPAC)	Log Ce	Log qe	Avg. ug Removal of TCE/gPAC
Blank 1 (no PAC)	66.651	13.74125	66.6506	1.7	1133.0602	0				26.2155
B1	45.971	10.72786	45.97156		781.51652	1.8	48.82551111	2.892938	1.688647	
B3	45.778	10.94253	45.778		778.226	3.8	23.34435526	2.891106		
B4	65.605	13.29797	65.60543		557.646155	5.4	26.63953912	2.746359	1.425527	
B6	60.652	9.94956	60.65233		206.217922	9.4	24.65006059	2.314326	1.391818	
B7	46.385	10.46491	46.38488		157.708592	12.4	19.66434694	2.197855	1.29368	
B8	39.728	10.62764	39.72803		67.537651	18.8	14.16918283	1.829546	1.151345	



What We Figured Out

Nanoparticle iron actually adsorbs some of the TCE so it doesn't get trapped by the carbon.... it can go back into our drinking water.....

YUCK!!!!

Time to tell
everyone else about it

Then we thought about what we could do next…

- Do other nanoparticles do the same thing?
- Can we use a different type of activated carbon to treat the water better?