CHEM MAJOR NEWS

In Conjunction with the American Chemical Society
Student Affiliates at the University of Pittsburgh

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November-December Schedule

November	**05**	Deadline to apply for April 2021 graduation
	20	Last day of Undergraduate Classes
	20	Last day to withdraw from ALL CLASSES **(412) 624-6480**
	23-24	Final Exams for Undergraduate Day Classes **IN PERSON FINALS ONLY**
	25-29	**Happy Thanksgiving**
December	**Nov. 03- Dec. 03**	Final Exams for Undergraduate Day Classes **REMOTE FINALS ONLY**
	04	Last day for continuing students to register for Spring Term 2214

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Michael Kane-*Green Chemistry*
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Visit us at http://www.chem.pitt.edu/acs-sa/

Here is a fun chemistry word search!

E	J	C	O	E	A	E	K	Y	I	X	E	H	J	B	B	S	N	N	X
N	N	I	D	M	L	I	N	E	L	D	S	Y	S	O	A	P	Q	V	M
R	P	Z	I	M	N	E	N	O	I	G	O	D	O	N	I	E	Y	U	N
G	D	D	Y	E	O	A	C	L	Z	O	C	R	D	D	F	C	G	K	M
N	E	S	T	M	K	L	O	T	P	O	U	O	I	O	M	T	M	L	N
A	C	I	D	L	E	S	L	G	R	N	L	G	U	N	I	R	D	C	S
V	C	I	A	Q	X	G	G	S	U	O	G	E	M	A	R	O	K	W	Q
S	E	J	A	J	A	J	S	C	J	M	P	N	C	X	A	S	D	J	A
O	B	H	N	S	M	D	L	L	Y	B	B	H	Z	I	L	C	E	P	G
M	K	D	E	G	T	E	O	U	Y	T	E	U	I	X	O	O	K	N	N
T	H	E	R	M	O	D	Y	N	A	M	I	C	S	L	P	P	L	O	G
T	J	H	T	P	M	P	E	N	L	I	W	L	X	A	E	Y	I	I	O
K	T	J	H	R	E	S	O	N	A	N	C	E	A	F	P	T	B	T	G
P	S	I	C	A	T	I	O	N	E	V	W	G	J	R	C	I	W	A	G
O	L	N	O	I	N	A	H	E	S	Z	O	H	W	U	I	K	Q	D	G
E	F	Z	J	T	S	V	D	X	I	B	N	G	D	H	B	H	H	I	E
R	E	M	O	I	T	N	A	N	E	G	B	E	A	O	X	G	C	X	L
R	S	S	Q	S	Y	Y	I	R	C	N	R	A	B	D	R	T	W	O	M
I	K	F	X	X	L	W	S	J	S	W	W	S	S	L	R	N	O	E	P
N	O	I	T	C	A	E	R	L	V	L	U	C	L	E	C	O	V	J	W

Word Bank Below:

- ACID
- ALKANE
- AMIDE
- ANION
- AVOGADRO
- BASE
- BENZENE
- BOND
- CATION
- CHIRALITY
- ELECTROPHILE
- ENANTIOMER
- ENZYME
- GAS
- GLUCOSE
- HYDROGEN
- KINETICS
- NUCLEOPHILE
- OXIDATION
- OZONE
- POLAR
- REACTION
- REDUCTION
- RESONANCE
- SODIUM
- SOLID
- SPECTROSCOPY
- THERMODYNAMICS

This crossword puzzle was created with:
http://puzzlemaker.discoveryeducation.com/WordSearchSetupForm.asp

Colors and Chemicals

by: Christopher Manko-*Newsletter Co-Editor*

Throughout this fall season, we can see a vibrant array of colors outside. The leaves are changing to orange and red colors, decorations for thanksgiving are coming up, and our styles in fashion adjust to the cold weather. When we walk outside, we can see pretty quickly that there is a huge variety of colors that people can wear. Really, our imaginations are our only limits when it comes to choosing our fashion sense. This train of thought had me wondering, what is the chemistry behind the color of our clothes?

Our clothes come in a variety of different materials, from cotton, to nylon, to wool, etc. With these different materials, we can add dyes to bring color to the material. What makes dyes so interesting is that different dyes work best on different materials. For example, a disperse dye would work well for polyester since the two are hydrophobic and thus mix well together. However, this also means that disperse dyes would not work well on cotton which is more hydrophilic.

The obvious solution for cotton would then be to add a dye that is hydrophilic, right? Well, not exactly. While a hydrophilic dye may have an affinity to cotton (and other cellulosic fibers), the issue is that the dye could fade anytime you try to wash your clothes. One way scientists have gotten around this is through vat and sulfur dyes. What happens in this case is the dyes are converted to water soluble forms (and thus can bind to cotton), and then later converted back to water non-soluble forms.

For the cases of nylon, wool, silk, and leather, we turn our attention to ionic bonds. As we know from chemistry, ionic bonds are caused by a coulombic attraction between oppositely charged species (such as Na^+ and Cl^- in table salt). The materials I listed above tend to hold a positive (cationic) charge. As such, we can dye these materials with negatively charged (anionic) dyes.

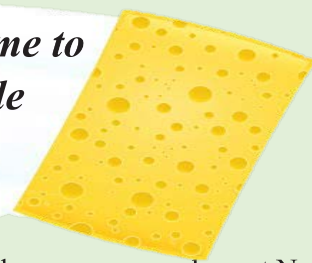
Overall, we can see there is some interesting chemistry going on in our clothes. Knowing the concepts of hydrophobic vs hydrophilic, and cationic vs anionic starts to give us a better sense of what dyes to use. From our blue jeans, to our warm red sweaters, our color choices exist because of well thought-out dyeing chemistry.

Reference: https://www.ncbi.nlm.nih.gov/books/NBK385442/

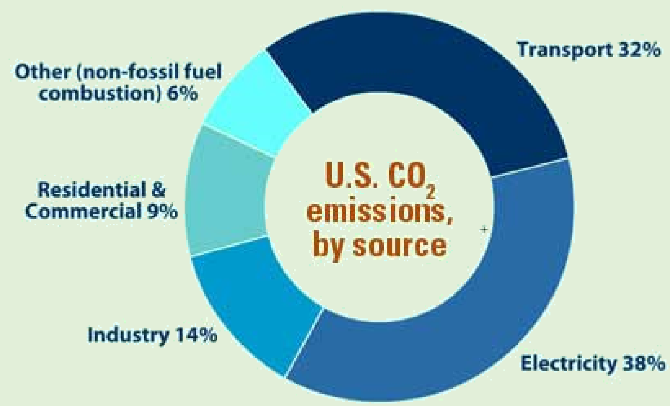
Green Chemistry

***by:* Michael Kane**-*Green Chemistry Editor, 2020-2021*

Grab your sponges, it's time to do some carbon dioxide scrubbing.



Using sponges to scrub doesn't seem extremely innovative… however researchers at Nanjing University of Information Science & Technology and many others are investigating an innovative approach to carbon dioxide scrubbing, one that involves porous metal-organic frameworks (MOF's). Carbon dioxide makes up the majority of greenhouse gases by emission from human activities each year. Created as a product of the combustion of hydrocarbons as fuel, carbon dioxide is emitted by electricity power plants burning fossil fuels, transportation, and many other human activities. However, the amount of carbon dioxide emissions from man made sources are dwarfed by nature's biggest emitter: the ocean. In fact, the emission from man made sources make up a small percent of the total carbon dioxide in the air and the ocean. So why are we so worried about such a small contribution?



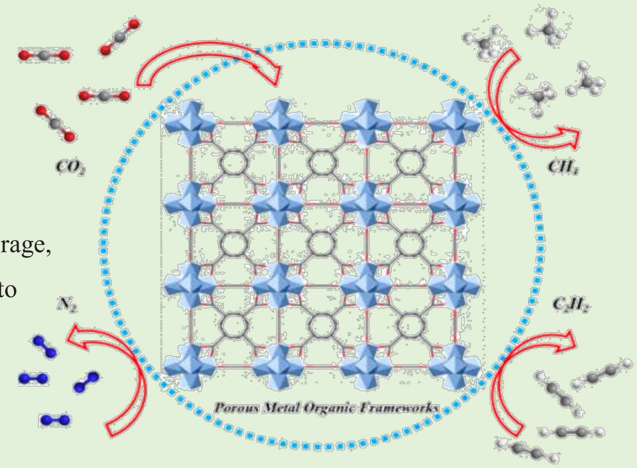
Source: Carbon Dioxide Emissions, EPA
http://www.epa.gov/climatechange/ghgemissions/gases/co2.html

> "You could not remove a single grain of sand from its place without thereby … changing something throughout all parts of the immeasurable whole." - Fichte

A quote from *The Vocation of Man* (1800) puts this effect into more elegant terms than I could ever hope to write, "You could not remove a single grain of sand from its place without thereby … changing something throughout all parts of the immeasurable whole". This means our small contribution to the carbon dioxide levels turns out to be not that small at all. To think in terms of chemistry, the ocean and air are in an equilibrium. The ocean captures carbon dioxide from the air while it simultaneously releases some back. When this equilibrium is affected, say by emission from humans, the result can incite a domino effect. The greenhouse

gas traps heat and raises the temperature of the planet, causing ocean plant life to die, specifically plant life that stores carbon dioxide. This death causes a huge release of carbon dioxide back into the air, and combined with the already increased concentration of carbon dioxide, heats the planet more- i.e. bad news.

Now that we have made it through "the end is near" section of environmental papers, let's get to the hopeful part. Carbon dioxide scrubbing is the process of removing carbon dioxide from the air using specialized equipment like MOF's. MOF's work like a sponge, selectively trapping molecules in its highly porous structure as a way to separate the carbon dioxide from the air and store them. The metal ions and clusters that make up MOF's have a great range of diversity, allowing precise manipulation of the pores.[1] MOF pores are specific to the structure and connectivity of the molecules, meaning only the molecule of interest will be adsorbed.[2] The diversity also gives rise to many uses for MOF's such as fuel storage, purification, and others.[3[These molecules are also stable to up to nearly 200 °C, making it a promising scrubber for use in high temperature power plants. In the past, carbon dioxide scrubbers such as liquid amines have been used to react with acidic gases like carbon dioxide to remove them from systems. The liquid amines are corrosive however, and can degrade equipment over time. MOF's have also been found to have greater abilities to be regenerated after use, meaning a recyclable scrubber.[2] For these reasons, MOF's show great potential as a replacement for previous harmful methods of carbon dioxide scrubbing. Although MOF's are not the answer to all of our environmental problems (we can't just pour the stored carbon dioxide on a plant and call it a day), they are certainly a step in the right direction, and provide great promise in the battle against ourselves.



Depiction of a carbon dioxide selective MOF[1]

Zhong Li et al. ACS Sustainable Chemistry & Engineering

Read more about MOF's:

1. Zhong Li et al, Porous Metal–Organic Frameworks for Carbon Dioxide Adsorption and Separation at Low Pressure 2020

2. Sneddon, G. et al, The Potential Applications of Nanoporous Materials for the Adsorption, Separation, and Catalytic Conversion of Carbon Dioxide.

3. Yabing He et al, Porous metal–organic frameworks for fuel storage. 2018