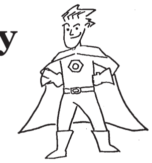
CHEM MAJOR NEWS

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



Volume 30, Issue 1 **October 1, 2020**

Welcome back everyone!

I hope you have all had the chance to get into the swing of things this semester. This is certainly a unique time in all of our lives, and it is important that we stay safe and healthy. Currently, many classes are still online or are just starting to come in person. A lot of clubs have also postponed or canceled fall meetings. We plan to keep the ACS going through this semester. While we will not be able to host meetings quite the same, we do still plan to hold meetings over Zoom, post monthly newsletters, and plan ahead for next semester. We hope that you all will keep in touch and look forward to what's ahead!

An addition we plan to add to this year's newsletter is a showcasing of TA experiences. Teaching is a great way to give back to the Pitt community, while still being involved in some of your favorite classes. It benefits students greatly to have more opportunities to discuss content and work through challenging concepts. We are excited to showcase some experiences from previous students, and more information on this will be provided later into the school year.

To all members, we currently have an opening for the Green Chemist portion of the newsletter. This experience can also be used to fulfill the writing-intensive requirement for graduation. Along with that, we have openings this year for Senior Affairs. If anyone is interested in either of these unique opportunities, please send us an email.

Overall, with everything adapted to pandemic times, I hope you still are enjoying your time at Pitt – whether on campus or remotely. We hope you stay healthy and safe, and that you all have a great semester!

Hail to Pitt!

Christopher Manko

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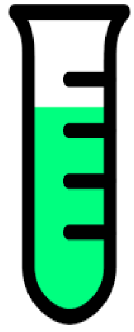

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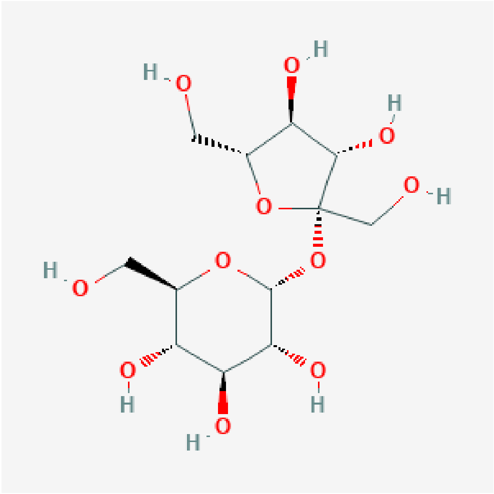
Visit us at http://www.chem.pitt.edu/acs-sa/

The Chemistry of Caramel – By: Christopher Manko

As fall approaches, I find myself shifting gears. School has begun, the weather is cooling down, and the leaves are changing colors. I see the season has changed. Along with this, festive fall treats come about again! I love the pumpkin pies, apple cider, pumpkin spice lattes, and of course caramel apples. This had me thinking about what causes the sweet and sticky caramel to be formed.

Caramelization occurs when you take sugars (commonly sucrose) and heat them at high temperatures. The length of heating as well as pH affect the caramelization process, and we can see that firsthand in the kitchen. If you do not watch your sugars as they melt and leave them for too long, they will go from a sweet-tasting, lovely-smelling caramel to a bitter mess.



Sucrose Structure Given Above – Image from PubChem

Looking closer at the caramelization process first requires understanding our starting materials – the sugars. Different sugars can overall lead to different colors and aromas. A common sugar we have at our disposal is sucrose. Sucrose, the table sugar found in your house, is a disaccharide that contains both glucose and fructose. When we heat up the sugar however, we are left with thousands of different products. The chemistry behind caramelization is actually quite complex, leading to many volatile and nonvolatile chemicals. Molecules in caramel include hydroxymethylfurfural, hydroxyacetylfuran, and dihydroxydimethylfuranone.

What causes all of these complex molecules to arise? The longer sugar chains (oligosaccharides) found in caramel can be formed through dehydration and hydration reactions. Other reactions occurring include enolization, dicarbonyl cleavage, retro aldolization, aldolization, and even radical reaction! Some of the types of chemicals found in caramel that give it its flavor include furans, furanones, pyrones, and carbocyclics.

As we can see, a lot is going into the chemical composition of caramel. Now whenever we pick up a caramel-coated apple or have that sweet caramel sauce on our ice cream, we can start to marvel at the great complexity that exists in our sweet treats.

References:

http://kurtos.eu/dl/Caramelisation_in_food_and_beverages.pdf
https://pubchem.ncbi.nlm.nih.gov/compound/Sucrose#section=2D-Structure
https://pubs.acs.org/doi/full/10.1021/jf204807z

Green Chemistry

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

Beginning next month, our new Green Chemistry contributor, Michael Kane, will be sharing the latest advances in this important area of science with you. This month we just want to remind you of the principles of green chemistry as shared by a former graduate and Green Chemistry Contributor-Drew Warburton.

Green chemistry is a heavily studied and funded field in science ever since our very own Pittsburgher, Rachel Carson published her extremely successful and influential book Silent Spring, changing the way communities and industries view their impact on the environment for the following decades.[1] Green chemists and engineers are working to take their research and innovations out of the lab and into the board room through the creation of viable industrial products that can be embraced by today's industry leaders including but not limited to, reducing waste, improving energy efficiency, replacing hazardous substances, switching to renewable feedstocks, and designing products which degrade into innocuous chemicals after they have fulfilled their role; however, even with such great advancements in technology and discovery, more than 98% of all organic chemicals are still derived from petroleum.[2]

The Twelve Principles of Green Chemistry[3]

1. **Prevention**—It is better to prevent waste than to treat or clean up waste after it has been created.
2. **Atom Economy**—Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.
3. **Less Hazardous Chemical Syntheses**—Wherever practicable, synthetic methods should be designed to use and generate substances that possess little or no toxicity to human health and the environment.
4. **Designing Safer Chemicals**—Chemical products should be designed to affect their desired function while minimizing their toxicity.
5. **Safer Solvents and Auxiliaries**—The use of auxiliary substances (e.g., solvents, separation agents, etc.) should be made unnecessary wherever possible and innocuous when used.
6. **Design for Energy Efficiency**—Energy requirements of chemical processes should be recognized for their environmental and economic impacts and should be minimized. If possible, synthetic methods should be conducted at ambient temperature and pressure.
7. **Use of Renewable Feedstocks**—A raw material or feedstock should be renewable rather than depleting whenever technically and economically practicable.
8. **Reduce Derivatives**—Unnecessary derivatization (use of blocking groups, protection/ deprotection, temporary modification of physical/chemical processes) should be minimized or avoided if possible, because such steps require additional reagents and can generate waste.
9. **Catalysis**—Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.
10. **Design for Degradation**—Chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.
11. **Real-time analysis for Pollution Prevention**—Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.
12. **Inherently Safer Chemistry for Accident Prevention**—Substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions, and fires.

1. *History of Green Chemistry. https://www.acs.org/content/acs/en/greenchemistry/what-is-green-chemistry/history-of-green-chemistry.html (accessed August 11, 2016).*
2. *Green Chemistry Definition. http://www.acs.org/content/acs/en/greenchemistry/what-is-green-chemistry/definition.html (accessed August 11, 2016).*
3. *Principles of Green Chemistry and Green Engineering. https://www.acs.org/content/acs/en/greenchemistry/what-is-green-chemistry/principles.html (accessed August 11, 2016)*

REGISTRATION

Spring Term 2214

SET DATES:

October 20:	Monitored withdrawal (2211) deadline-call (412)-624-6480.
October 26:	Registration begins for Spring Term 2214 based on earned credits. You will receive your registration appointment from the Registrar.
October 26:	Add/drop begins for Spring Term 2214.
October 31:	Happy Halloween!
November 5:	April 2021 (2214) graduation applications are due.
November 24-29	Thanksgiving Recess. **NO CLASSES!!**

Have a great Holiday!

IMPORTANT: WHEN SHOULD YOU SEE YOUR ADVISOR?

Advisees who already have a permanent advisor should make their registration appointments with that advisor on or after October 15.

Advisees who (via an email to be sent October 01) were asked to select their permanent advisors should do so after October 07. Please call George Bandik at 412-624-8212.

New advisees (those who have NOT registered with the Chemistry Department before) should make an appointment with George (Room 107 Chevron), Dr. Huston or Dr. Ward on or after October 14. We will be using the Pathway System. Details will be emailed to you.