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Happy 150th Anniversary
To The
Periodic Table of the
Elements
Women Chemists Meeting Saturday, February 16, 2019
Sugar-derived Lubricants: a High-performance, Ecofriendly Alternative to Petroleum-derived Lubricants

Speakers: Dr. Paula Vettel & Lynn Rice
Time: 10:30 – 11:00 a.m. Snacks and coffee,
11:00 a.m. Discussion and lunch.
Place: USDA, 800 Buchanan Street, Albany, CA 94720
Reservation: Please register (including lunch or for talk only) by email to office@calacs.org or by phone 510.351.9922. If mailing a check in advance, please make payable to: “California Section ACS” and send to CalACS Section office, 2950 Merced Street #225, San Leandro, CA 94577, postmarked no later than Feb 1, 2019.
Cost: $15 lunch ($7 for students and the unemployed), technical discussion is free.

Biography: Dr. Paula Vettel is Technical Director, Formulations and Regulatory at Novvi LLC. She has a Ph.D in Organic Chemistry from the University of Illinois at Urbana-Champaign. She had 11 years of experience with Amoco Petroleum Additives in the research and development of engine oil additives and formulation development and 16 years research experience with D.A. Stuart Company in the areas of automotive and industrial gear oils, hydraulic fluids, straight oils, forging compounds, and mining hydraulic fluids. She has been with Novvi LLC, in Emeryville California for 8 years, developing new industrial and automotive lubricants using renewable synthetic base oils. Dr. Vettel is an active member of ASTM, STLE, SAE, and ACS.

Biography: Lynn Rice is a Formulations Engineer at Novvi LLC. She has a M.S.E. in Chemical Engineering from UCLA and a B.S.E. in Chemical Engineering from Tulane University. She worked for over five years at Chevron Oronite in a variety of roles, including component development, ZDTP Process Engineering and Formulation of Gear Oils prior to joining Novvi.

Abstract:
It is time for an oil change. Did you know that traditional motor oil comes from a highly specific distillation cut of crude oil comprising < 1% of a barrel’s total volume? Synthetic oil comes from processing separate cuts of distillate that are also in limited concentrations in crude oil. Isn’t there a better choice? Thanks to Novvi LLC’s technology where motor oil is synthesized from plant-based starting materials, the answer is now “yes.”

In this presentation, Novvi’s NovaSpecTM base oils, biodegradable and renewable hydrocarbons that match the stringent performance requirements of synthetic base oils, will be introduced. The production of these oils from biosynthetically-derived Farnesene will be described. Their molecular structure and performance on critical tests will be compared to the structures and performance of traditional petroleum-derived base oils and alternative eco-friendly base stocks. Additionally, key tests that define base oil renewability will be explained.
Chair's Message

As the lunar New Year approaches (February 5), our 2019 calendar is starting to fill up with activities sponsored by CalACS.

In the current month, volunteers from the Section will be carrying out demonstrations at a science night at Korematsu Middle School on February 5. There is a Women Chemists Committee meeting on February 16 with presentations by Dr. Paula Vettel and Lynn Rice on "Sugar-derived Lubricants" at USDA Albany. California ACS volunteers will then be at Diablo Valley College in San Ramon for a “Expanding your Horizons” event to encourage young women in STEM career paths.

There is an ACS chemistry in a box event scheduled at the College of Alameda Science Annex around the periodic table since after all, this is the International Year of the Periodic Table #IYPT2019. Finally, there is a Section meeting around Chemical Emissions testing by Bud Offermann on February 28 (location tbd). Please check out our website for additional information regarding these events as well as future events scheduled this year. (calacs.org), Our efforts to modernize our communication has continued as our executive committee meetings consistently use teleconference for members who cannot attend physically. We leverage our volunteers to update our calendars as new events are planned, and @CaliforniaACS is our Twitter handle.

Looking forward, April will be a busy month as our councilors will just have returned from the ACS national meeting in Orlando.

At the Basque Cultural Center in S. San Francisco and in collaboration with the Silicon Valley Section, we will co-host "A Conversation with ACS President, Bonnie Charpentier: the ACS Community and Priorities for 2019"

The over-arching theme for the ACS presidential year of 2019 is collaboration. In keeping with that theme, this presentation is meant to be an interactive discussion of ACS priorities and programs. The presentation will include an introduction to ACS Presidential areas of focus for 2019, including Advocacy for chemistry and science education, safety and the environment, and plans for the International Year of the Periodic Table…

Also, a CalACS Section sponsored event around “Digital Chemistry” will occur in San Francisco. Stay tuned!

Patrick S. Lee, Ph.D.
The Marin Society of Artists in San Rafael, with artists and curators Gail Morrisson and Betsy Kellas, have organized an exhibit of outstanding artworks, to celebrate the beginning of the International Year of the Periodic Table of the Elements (IYPT). More than sixty artists exhibited their work there, with pieces of art relating to “elements” in various ways, be it to chemical elements like gold, silver, copper, oxygen, even Livermorium, or to more ancient, classical understandings of “element” as in water, fire, earth, air. Collages, sculptures, oil paintings, and mixed media were all part of the displays. The exhibit experience was enhanced by background music that included the “Mercury Symphony” by Franz Joseph Haydn, “The Age of Gold”, by Shostakovich, and “Plutonium” and “Neptunium” sounds from NASA Voyager.

Members of our executive committee were part of about one hundred people who celebrated the beginning of the exhibit and with it the start of the IYPT at the festive reception. Introductory speeches by the curators and by prize jurors William Torphy, fine arts, and Christiane Stachl, UC Berkeley, Chemistry Department were part of the evening. “Elements” was a great combination of arts and the sciences and provided a special and most attractive celebration for the beginning of the International Year of the Periodic Table.

Greti Sequin
More than 4,700 PFAS (per- and polyfluorinated alkyl substances) are currently known to exist and many have been released to the environment through past and current manufacturing and disposal practices. Once in the environment, many long-chain PFAS can transform into highly persistent short-chain PFAS that tend to be more water soluble and therefore may be more easily transported through soil to contaminate surface-water, groundwater, and ultimately drinking water. In part 1 (December 2018 Vortex), I discussed some of the general characteristics of PFAS and in part 2 (January 2019 Vortex) I focused on more common PFAS abbreviations and specific characteristics of perfluorooctanoic acid (PFOA). In this part, I’ll discuss some aspects of perfluorooctane sulfonate and perfluorooctane sulfonic acid (PFOS).

**PFOS Chemistry and Use History**

PFOS (also known as perfluorooctane sulfonic acid or C8; C₈HF₁₇O₃S; CAS No.: 1763-23-1) is the conjugate base for perfluorooctane sulphonate (C₈F₁₇SO₃⁻; CAS No.: 2795-39-3) an anthropogenic fluoro-surfactant and global pollutant. Like other fluorocarbons, the C₈F₁₇ subunit (“tails”) of PFOS is hydrophobic and lipophobic, whereas the sulfonic acid/sulfonate group (“head”) is polar. In industrial applications and in the environment, PFOS is an exceptionally stable chemical because of the effect of its aggregate carbon–fluorine bonds. As a fluoro-surfactant, PFOS lowers water’s surface tension more than other hydrocarbon surfactants. Although attention is typically focused on the straight-chain isomer (n-PFOS), which dominates commercial mixtures and environmental samples, there are 89 linear and branched congeners that are expected to have different physical, chemical, and toxicological properties.

PFOS and PFOA, have been used in aqueous film forming foam (AFFF) used in firefighting and alcohol-type concentrate foams. PFOS compounds have also been added in some components for textiles, paper, and leather impregnation agents; for general usage in waxes, polishes, paints, varnishes, and cleaning products; in metal surfaces, and carpets. In the semiconductor industry, PFOS was added in multiple photolithographic chemicals.

PFOS was a major ingredient in 3M’s fabric protector Scotchgard™ and other stain and water repellents. In 1949, PFOS-based compound production by 3M began with electrochemical fluorination that resulted in production of the synthetic precursor perfluorooctanesulfon fluoride. By 1968, organo-fluorine compounds were detected in human blood serum and in 1976, these were identified as either PFOA or PFOS. In 1997, 3M’s research detected PFOS in blood collected from global blood banks, however, the company’s internal documents indicated that they had knowledge of this information in the 1970s. After receiving data on PFOS global distribution and toxicity, in 1999, the U.S. Environmental Protection Agency (U.S. EPA) began an investigation of perfluorinated compounds. In May 2000, under continuing U.S. EPA pressure, 3M, announced phaseout PFOS, PFOA, and PFOS-related product production. However, PFOS and PFOS-related chemicals are still manufactured and used in China. In May 2009, PFOS was added to Annex B of the Stockholm Convention on Persistent Organic chemical compounds.

PFOS is currently detectable in the blood serum of almost everyone in the U.S. However, because of PFOS phase out, blood serum concentrations have been decreasing over time. Conversely, continued PFOS usage in China blood levels appear to be rising. PFOS levels in pregnant women have been associated with preeclampsia – a disorder characterized by high blood pressure onset and often a significant amount of protein in the urine. In adults, increased concentrations have also been associated with altered thyroid hormone levels and elevated cholesterol risks. One U.S. study

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noted that in children aged 12, there was a 60 percent associated increased risk of attention deficit hyperactivity disorder (ADHD). A 2009 study determined that women with elevated PFOS and PFOA took longer to become pregnant than those with lower levels, suggesting that these chemicals impacted fertility.

In the next part we’ll discuss some of the aspects of PFAS sample collection and analysis and some possible forensic techniques for source identification.

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How did the US EPA and IARC reach opposite conclusions about glyphosate’s genotoxicity? Published: 14 January 2019

New analysis shows EPA relied on secret industry studies, which found ‘no effect’ from glyphosate, rather than published studies, which mostly found the chemical was genotoxic. Many people around the world still struggle to understand how and why the US EPA and the European Food Safety Authority (EFSA) concluded that the herbicide active ingredient glyphosate is not genotoxic (damaging to DNA) or carcinogenic, whereas the World Health Organisation’s cancer agency IARC came to the opposite conclusion. IARC stated that the evidence for glyphosate’s genotoxic potential is “strong” and that glyphosate is a probable human carcinogen.

These agencies’ opposing views on glyphosate’s genotoxic potential played a crucial role in their differing conclusions about glyphosate’s carcinogenicity, since genotoxicity is one of two mechanisms through which glyphosate was deemed by the IARC to be carcinogenic (the other being oxidative stress).

Now a new peer-reviewed article answers the question of how and why the US EPA and EFSA reached diametrically opposed conclusions to IARC about glyphosate’s genotoxicity.[1] The article shows that the EPA relied on unpublished industry studies, 99% of which found that glyphosate was not genotoxic, whereas IARC relied on published studies, 74% of which found that glyphosate was genotoxic.

The EPA’s "no genotoxicity risk" on
glyphosate was essential to its "no carcinogenic risk" classification of the chemical. The article shows that only by framing and constraining its genotoxicity assessment in a highly selective and biased way was the EPA able to conclude that glyphosate was not genotoxic. It also demonstrates that the EPA's cancer classification – as well as EFSA’s, which was based on the same data and was reached in a similar way – is scientifically baseless. Overall, the article shows that the way pesticides are assessed for risk is not fit for purpose and exposes people and the environment to unacceptable risks.

The paper is authored by Dr Charles Benbrook and is published in Environmental Sciences Europe.

The article’s key findings in detail are as follows:
1. EPA relied on secret and biased industry studies, whereas IARC used published studies:
   While IARC referenced only peer-reviewed studies and reports available in the public literature, EPA relied heavily on unpublished regulatory studies commissioned by pesticide manufacturers. In fact, 95 of the 151 genotoxicity assays cited in EPA’s evaluation were from industry studies (63%), while IARC cited 100% public literature sources.

   There is a stark difference in the outcomes of industry-sponsored assays versus those in the public literature. Of the 95 industry assays taken into account by EPA, only one reported a positive result (i.e. that
glyphosate had a genotoxic effect), or just 1%. Among the total 211 published studies, 156 reported at least one positive result, or 74%!

A closer look at the assays referenced by EPA but not IARC, and by IARC but not the EPA, also helps explain why EPA and IARC reached opposite conclusions.

EPA cited 109 total assays not included in the IARC report, 87% of which were regulatory studies commissioned by industry, and all but one was negative (i.e. no genotoxic effect).

IARC included the results from 67 assays not included in EPA's analysis, all of which were from peer-reviewed publications, and 82% of which had at least one positive result for genotoxicity.

2. EPA analyzed a substance that almost no one is exposed to, whereas IARC looked at the real thing:

Another important difference is that EPA focused its analysis on glyphosate in its pure chemical form, or “glyphosate technical”. The problem with that is that almost no one is exposed to glyphosate alone. Applicators and the public are exposed to complete herbicide formulations consisting of glyphosate plus added ingredients (adjuvants). The formulations have repeatedly been shown to be more toxic than glyphosate in isolation.

IARC, in contrast to the EPA, placed considerable weight on 85 studies focused on formulated glyphosate-based herbicides that people actually use and are exposed to. A massive 79% of the glyphosate-based herbicide assays published in the public literature reported one or more positive result.

While the EPA did list studies on formulated glyphosate-based herbicides in Appendix F of its report, EPA acknowledges it placed little to no weight on glyphosate-based herbicide assay results. This difference is reflected in the overall percent of positive assays. Just 24% of the 151 assays cited by EPA reported positive results, while 76% of those cited by IARC had at least one positive result.

3. The EPA didn’t consider occupational exposure, whereas IARC did

The EPA's analysis was limited to typical dietary exposure to the general public as a result of legal uses on food crops, and did not address occupational exposure and risks.

IARC’s assessment encompassed data from typical dietary, occupational, and elevated exposure scenarios. Elevated exposure events caused by spills, a leaky hose or fitting, or wind are actually common for people who apply herbicides several days a week, for several hours, as part of their work.

In an unusual step, the editor-in-chief of Environmental Sciences Europe, Prof Henner Hollert, and his co-author Prof Thomas Backhaus, weighed in with a strong statement in support of the acceptance of Dr Benbrook’s article for publication. In a commentary published in the same issue of the journal, they wrote, “We are convinced that the article provides new insights on why different conclusions regarding the carcinogenicity of glyphosate and GBHs [glyphosate-based herbicides] were reached by the US EPA and IARC. It is an important contribution to the discussion on the genotoxicity of GBHs.”

Profs Hollert and Backhaus explained that it is usual practice to send manuscripts submitted to the journal to 2-4 peer reviewers. But due to the fact that the discussion on the carcinogenicity of glyphosate has become a “toxic issue”, the journal sent the article to no less than 10 reviewers, all but one of whom recommended publication.

Journal editor and co-author call for reform of pesticide approvals:

In their commentary, Profs Hollert and Backhaus offered a list of “lessons to be learned” from Dr Benbrook’s article for the risk assessment of pesticides and other chemicals. Those lessons include recommendations for reform – many of which have long been demanded by GMWatch.
and other NGOs. In sum, these are:
* Studies relating to both glyphosate and glyphosate-based herbicide formulations must be taken into account in risk assessments.
* The problem formulation step of the risk assessment is critical to an understanding of the outcome. Thus it must be made clear to everyone, including laypersons, which substance is being assessed – as well as which exposure scenarios, endpoints, and protection goals are being considered.
* As different evaluators give different weights and reliability scores to different studies, all studies used in the risk assessment and the data underlying them must be made public and thus available for independent scrutiny. Thus the problem formulation, assessment protocols and data analysis also must be published. Pesticide assessments should implement the systematic review methodology already promoted by EFSA.
* New studies must be registered, in the same way as clinical trials, to ensure that ‘no effect’ findings (which are notoriously hard to publish in journals), as well as unwelcome results, are equally considered in the assessment.
* Given that glyphosate-based herbicide formulations are more toxic than glyphosate alone, mixture effects must be considered during the risk assessment, in line with Article 4.3(b) of the EU’s pesticide regulation 1107/2009. However, this poses a challenge to transparent assessment, since the co-formulants in commercial pesticide formulations are not generally disclosed by manufacturers and are largely unknown.

NGOs and EU Parliamentary committee back editor’s call for reform
GMWatch welcomes Dr Benbrook’s article and the Commentary by Profs Hollert and Backhaus as highly informative analyses of what is wrong with the regulatory assessments of pesticides and how the system needs to change. These new publications reinforce and, in many aspects, reflect the demands for reform of the pesticide risk assessment process put forward last year by Citizens for Science in Pesticide Regulation, a coalition of 120 NGOs, including GMWatch.

Further support for many of these measures comes from the European Parliament’s PEST Committee, which was set up in response to the concerns raised by the European Citizens’ Initiative to ban glyphosate, the Monsanto Papers (internal Monsanto documents disclosed in cancer litigation in the USA revealing how industry has subverted science), and the discrepancies in the cancer assessments of glyphosate between the European institutions and IARC.

Note: Since September 2017, Dr Charles Benbrook has served as an expert witness in litigation involving the contribution of Roundup (a glyphosate-based herbicide) to non-Hodgkin lymphoma. He testified on behalf of Lee (Dewayne) Johnson during his trial in San Francisco in the summer of 2018.

References

Gifts & Donations
It is easy to select the ACS programs you want to support. Call or email lr101898@aol.com and find out how your contribution can be used.
Sidney Harris Cartoon Contest for ACS Members

A contest will be held in which ACS members only can submit "one original cartoon caption" of 35 words or less. Cartoonist Sidney Harris will draw a cartoon based on the winning caption. The grand prize winner will receive the original cartoon based on the winning caption. The runner-up will receive a personally autographed copy of one of Harris's most famous cartoons chosen by Harris. For more information and the required contest submission form, http://acshist.scs.illinois.edu/index.php. The deadline for receipt is no later than April 1, 2019.
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