the WINNOWER

REDDIT

American Chemical Society AMA: I'm Lee Polite, founder and President of Axion Labs and Axion Training Institute, I specialize in Analytical Chemistry (Chromatography), AMA!

AMERCHEMSOCIETYAMA R/SCIENCE

[removed]

CORRESPONDENCE:

DATE RECEIVED:
March 23, 2016

DOI:
10.15200/winn.145864.46590

ARCHIVED:
March 22, 2016

CITATION:
AmerChemSocietyAMA , r/Science , American Chemical Society AMA: I'm Lee Polite, founder and President of Axion Labs and Axion Training Institute, I specialize in Analytical Chemistry (Chromatography), AMA!, *The Winnower* 3:e145864.46590 , 2016 , DOI: 10.15200/winn.145864.46590

Recent graduates with a bachelor's in chemistry have a hard time finding a meaningful job and a job that pays well in the field. What tips do you have for graduates when we barely get instrument time during our schooling? Should BSs settle for a life of being a lab tech or is there a way to increase employment opportunities without increasing their highest level of degree.

Also I have left the lab I worked at after 3 years to teach high school chemistry. What advice do you have for my students and what could I teach them to be ready for higher scientific education?

langis_on

Good morning/afternoon Redditors! I'm online, and ready to answer questions.

It seems like there is a bunch of interest in career advice for would-be scientists. There have been some great answers so far. With the disclaimer that this is my advice, here it goes. I'm a big fan of education and a firm believer that it is never wasted. The real goal of education is not to memorize a bunch of stuff, but to learn how to think and solve problems. I remember my mentor (Professor McNair) used to tell us that "you are not chromatographers, but problem solvers". Science education gives you that quantitative reasoning that is so important in life. Scientists look at the world in a different way: We observe, gather data, form hypothesis, develop further experiments to gather more data, and then come up with a conclusion to accept or reject that hypothesis based on those observations and real data. That is the same process used to run an HPLC system, solve a marketing problem, or predict a stock price. So I think the science background give you those quantitative skills. On top of that, it sets you apart from the crowd. Very few people get degrees in science, and the science degree is almost universally impressive to non-scientists. You can get a real job with a bachelor's degree in chemistry and work as a real scientist. You will have to work your way up the ladder, but that is part of life. I am a big fan of pursuing the Ph.D. It is not for everyone, but I talk about my graduate school experience as a 4.5 year vacation. You get to play in the lab with really cool equipment (there is very little classroom work), and not just work on cutting edge technology, but actually develop what will become cutting edge. That to me is exciting. Also keep in mind that if you want to go to professional school, the BA/BS in science sets you apart from the other applicants. Imagine applying to law school or business school. The vast majority of applicants have the same background, but you will stick out. The science degree opens doors, but then it is up to you to walk through. I think that's a key take away, you still have to

work hard in life. It's just that the science degree sets you apart from the crowd (my apologies to all business, communications, history and English majors!).

What do you expect the job market to be like in 10 years. Chemical engineering or material science, does it make a difference? Why and when did you first get into chemistry? Thank you for your time!

Darkblazefire

If I had a crystal ball…. Great question. I think the world will always need scientists, because by definition, we are always moving forward. I like material science (polymers, etc.). Think about all the new materials that have come out (the Boeing 787 Dreamliner uses polymers to replace much of the traditional aluminum, because the polymers are lighter, stronger and more corrosion resistant). Now think about computer chips, cell phone components, cars, bicycles, medical implants, etc. It is all about new materials. There is lots of fertile ground out there. I lean towards the material science instead of engineering, but that really depends on your personality. Material scientists are charged with the task of coming up with new materials (something that no one else has ever made). Engineers take what is already known, and apply it. No question that the engineer makes more money with a 4-year degree, but the salary lines come closer to converging with the Ph.D. I've always been intrigued by the "do something that no one else has ever done" part of the science.

Part 2 of your question is great: My mom had a BA in chemistry and worked as a research chemist for Wrigley. My dad also had a BS in chemistry and then went on to medical school, but it was my grandmother (with a high-school degree) that got me interested in chemistry. When I was a little kid (4 years old?), my grandmother showed me how to "shine" pennies with salt (NaCl) and lemon juice (citric acid). I remember being fascinated by the change. I knew it wasn't magic, but it was the closest thing to that. I felt that I really wanted to understand how that "magic" worked. So what is the takeaway from this? You can learn something from anyone (not just from advanced degreed folks), and we should all be more like children in terms of our interest to learn more about the world around us. (I think we should teach quantum mechanics to first graders! They get it. Adults have mental blocks about how "complicated it is". To a first grader, learning how to spell is just as complicated as quantum mechanics...and usually they're right!)

A few years ago, a shortage of acetonitrile had a dramatic effect on HPLC use. What caused this shortage and is it still going on? Has the shift to UPLC stuck?

nallen

Finally! A technical question! (I actually love the career discussion going on as well). So around 2008 we experienced a shortage of acetonitrile (ACN). That is the most popular mobile phase in HPLC. The shortage got so bad that not only did companies raise the price, but they started rationing! The story I heard from my friends in the industry was this: Acetonitrile is a 2-3% byproduct of acrylonitrile manufacturing. Acrylonitrile is used to make polymers that go into the automotive industry and also synthetic fabrics. So when the economic downturn happened, there was no demand for new car parts, no demand for synthetic fibers and hence no demand for acrylonitrile. Therefore, the major source of acetonitrile shut down. That was a very scary time for the HPLC industry. Fortunately there is an alternative: Methanol. Acetonitrile and Methanol are not identical, but the way I put it: If you separation works with ACN, you have an 85% chance that it will work with MeOH and visa versa. To understand this better, let me explain the role of ACN and MeOH in reversed phase HPLC. These act as the "strong solvent" are are blended with water in order to adjust the solvent strength. In all forms of chromatography, you need to make the mobile phase week enough to encourage the analytes to interact with the stationary phase (that is where the separation occurs). So the primary function of ACN/MeOH is to adjust the solvent strength. They have very similar strengths, and therefore are nearly

interchangeable for mobile phase strength modification (although ACN is usually about 10% stronger, but not always). The second purpose of the mobile phase is to help with the "selectivity" term in HPLC, or the ability of the system to differentiate between your molecules. In this role, MeOH and ACN have different chemistries. The key word here is different: not better or worse. Methanol tends to be a lot cheaper than ACN, but nearly interchangeable. I will admit that ACN is slightly stronger, slightly lower UV cutoff (190 nm vs 210 nm for MeOH), but MeOH is much cheaper. Therefore, MeOH is our primary choice (because I have to buy my own solvents!), but if cost is not an issue, the industry leans towards ACN.

Lee!!!! I had you for the Agilent GC Practical Course last November! (My BF got hit the face at a bar, I missed a day because of being in the hospital overnight~) To anyone who does read this comment, I can attest that his courses are incredible, they are very hands on with instrumentation and I strongly believe that regardless of your level of knowledge with GC or HPLC, 99% of you will walk away with something you can apply to your own studies/experiments/methods etc. If your work will pay for it or if you have any interest at all, GO TAKE THE CLASS! Im trying to convince my boss to send me up for the advanced class this year

I actually do have a question though! What book did you show us that classified already known compounds with all the different columns you can use? I have a project coming up looking at quinone fingerprinting~

Also how is the Helios Sunburst working so far!? Before I actually decided on chemistry for a major, I had planned to go into Bioresource Engineering and did a lot of work with lignins and cellulose breakdown. Still try to keep up with it as I can.

trumanthepug

Great to have a former student on here. Clearly you were one of the smarter ones! So during our hands-on training courses I share lots of my best kept secrets. One of them is to look up applications in column company catalogs (or column company websites). There are thousands of applications already done, and they are FREE! They include the column length, diameter, film thickness, chemistry, temperatures, flows, etc. You can go to the websites of: Agilent, Shimadzu, Waters, Phenomenex, Restek, Thermo, Perkin Elmer, etc. (I'm sorry to all my friends at all the column companies that I forget to mention!.

Thanks for asking about Helios. Things are going great. For those of you who don't know, my other research interest is renewable energy/chemicals (cellulosic ethanol). Someday we will realize that we can't keep using non-renewable resources (sounds like such an obvious statement). Cellulose (plant material) is the world's most abundant organic material, it renews itself continuously by converting sunlight and CO2 into energy rich sugars. We can take those sugars to lots of products like ethanol and other useful chemicals...along with cleaning up greenhouse gasses! What's not to like! Our new partner (Sweetwater Energy) is in the process commercializing this technology. Stay tuned for a 2016 groundbreaking.

I'm a biochem undergrad and have been looking into possible lab positions for after graduation and have noticed most require HPLC experience or familiarity. I will be taking AChem next fall, which includes a lab course. My question is how prepared should I expect to be from a one hour credit lab course, when applying to lab positions? Is HPLC particularly site-specific or is knowing the general method sufficient for an entry-level position? Also, is there any way to independently access a professional course such as the ones you've taught to prepare for a career in an analytical-based job?

karaokestar76

Historically, most undergraduate programs do not spend enough time on chromatography to be used as experience in a professional setting. You may see a professor make a GC injection once while having no concept of what's actually going on inside without being able to apply the theory from lectures. Our courses work because they take 4 days to do both: teach the theory behind the chromatography and allow the students to use the instruments to apply the theory. HPLC is not site-specific in that knowing the techniques is applicable to any industry. Things like column chemistry and mobile phase may be more application-dependant, but any courses you would be able to take via the ACS would be much more in depth and a great resume builder for an entry level position (and are open to any level of chromatographer, professional or aspiring). Unfortunately, the courses are not cheap (I believe ACS is offering a 20% discount somewhere on this AMA), so most of our customers are sent here by their employers. How about looking for an internship? Even an unpaid one would give you lots of hands-on experience. That's actually how I got my start. I worked in a medical school lab for a neuropharmacologist doing rat-brain surgery, but the thing that caught my attention was that magical HPLC system in the corner.

Hello Lee, I work in this field, predominantly gas phase products. In recent years I've seen a trend in Australia that has frustrated me immensely. There seems to be a tendency towards not wanting/needing to understand the theory behind an instrument. Instead, most users are becoming, or are being forced to become, button pushers operating a black box which they don't necessarily understand. Personally I find it frustrating since I really enjoy it and want others to see that. But more importantly, it concerns me that a generation of analysts is being groomed to pick up a phone for any/all problems. They are lacking the critical thinking and understanding necessary to resolve such problems. I did not intend to ramble. Can I get your opinion on my observations regarding future trends in the industry? Do you see a future with greater need for third party development work and troubleshooting?

dragank

Amen, brother! I think that it is important to understand what the "blackbox" is doing. Not just for job satisfaction, but understanding the technology is the basis of improving the analysis and troubleshooting. I like to use a lot of car analogies. We all know how to drive a car, but very few of us understand how it works. If we better understood things like the fuel air mixtures gear ratios, we can make our cars go faster, burn fuel more efficiently, and better match the vehicle to the task. Even the latest and greatest analytical instruments out there still require us to appropriately set the column length, diameter, film thickness, stationary phase, flow rate, temperatures, etc. If we truly understand these parameters, we can turn our old instruments into "race cars"...and enjoy our work a little more.

My primary function is assay development (mostly HPLC) for our separations group at a large biopharma. What are the top three most common mistakes the general population of HPLC operators make during method development?

roatit

Here's my short version of method development.

Step 1: Look in a column catalog for an existing method (don't reinvent the wheel).

Step 2: What is your sample soluble in? That will look like your mobile phase. For example, samples that are soluble in methanol and acetonitrile tend to work by reversed phase. Things soluble in hexane tend to work by normal phase. That is not a coincidence!

Step 3: Here is a good generic method development approach: Most HPLC applications end up in the

reversed phase mode (more versatile, etc.). Do a scouting run on a good base-deactivated C18 column by doing a gradient from 10% to 100% acetonitrile (or methanol). At the end of one run, you will know a lot more about the sample. The initial mobile phase strength will be where the first peak elutes. The final mobile phase strength will be where the last peak elutes. The gradient time will determine the resolution (space) in between the peaks. The shorter the gradient time (steeper) leads to faster analysis but lower resolution. So you can choose the amount of resolution that you want, and the amount of time you are willing to wait.

Where do you see the field of analytical chemistry going? What are some of the upcoming breakthroughs? I know that nano scale is huge right now, but always wondered if there were other things up and coming. Thank you for your time !

DamnYouLister

We will always need analytical chemistry to tell us what's in stuff, otherwise we are flying blind. To that end, we will always trend towards faster analyses and lower detection limits. Let's say we can do complete analysis in less than 1 second (currently possible, but not common). With that analysis time, you could generate almost instantaneous results. So if you're monitoring the component in a reaction vessel, imagine how great it would be to give an answer while there is still time to do something about it...instead of just telling the folks, "that batch you made yesterday was bad). I used to design bomb detectors back in the late 80's (little handheld GC's). That is when it really hits home that time and sensitivity are important.

Your course sounds absolutely amazing and exactly what I'm interested in as I'm starting up a lot of nutraceutical and cosmetic industry hplc. Do you have any specific readings you'd recommend aside from your course to help out in building up this kind of knowledge?

Ever since I started actually working as a chemist, I started to love working on LC'S. It would be amazing to know what resources you recommend. Ahhh, wish I could take this class!!! lol

xplaceb0

Thanks for the great question. I like reading "applied" journals like LC/GC Magazine, Analytical Scientist, etc. They do a great job of talking about practical stuff, without skimping on the details. I wrote the LC chapter in a book for the pharmaceutical industry (Analytical Chemistry in a GMP Environment published by Wiley). It was a very popular book because they got a totally practical/applied scientist to write each chapter. I tend to steer clear of the purely theoretical LC books (this is a practical topic!).

We'd love to have you in one of our courses any time if you can make it to Chicago: http://axionlabs.com/courses/

Hi there,

I was wondering if you could potentially help me, in my research group we synthesise a lot of NHC's (in their salt form). do you know of an efficient and easy to way to purify compounds like this on a column of some sort, I know it is possible on normal silica but it is not easy to get them off and requires a lot of strong polar solvents, also the isolated yields aren't great. we mainly use compounds such as IMesHCl, iPr.HCl etc..

thanks for this AMA

KMA

kma181

I'm not sure where to go with this one, but let me give it a shot. If you can separate something by HPLC on the analytical scale, you can use the same approach for purification. You just need to increase the scale. Do the methods development on a small scale (1 mL/min on a 4.6 mm ID column) and then scale up by a ratio of the column diameters, squared. For example, moving from a 2.1 mm ID to 4.6 will result in a 5 fold increase in the flow rate and sample size. One other quick trick with prep scale is that we generally like to grossly overload the column until the peaks are nearly merged. If you want high purity, just collect the front/back of the peak.

Where do you see the the field of LC separations going after nano-LC systems? Is it possible to go to picoliter systems or is that too small? Nano-LC systems seem difficult to diagnose & fix issues by users and often require company help(see $$$) in order to deal with issues - I could only imagine pico-systems would lead to even more difficulties for users. Do you see a move to open tubular columns like GC columns as a possibility?

Also do you guys have any free online resources for users?

Thank you.

onemanlan

We are trying to post more free resources on our website. Right now, we have a great description of GC using my favorite shopping mall analogy (http://axionlabs.com/media/). Stay tuned for more free stuff. As to where HPLC is going, I said earlier that it should get faster and more sensitive. Another logical extension would be to smaller columns and therefore lower flow rates. Unfortunately, the customers just don't seem to be moving in that direction. For example, 2.1 mm ID columns came out in the early 80's. There is almost no technical reason not to use them (they do the exact same separations with 80% less mobile phase). But here we are 30 some years later, and they are a very small percentage of the population (other than LC/MS). Also, capillary LC systems have been commercially available for 15+ years, but again, very few of them are out there. My one explanation is that the bigger systems are more "forgiving" in terms of having too much tubing, or too many fittings (something we are all guilty of). So, just about anyone out there could cut their solvent usage by 80%, just by converting from 4.6mm to 2.1m columns. Note that in LC when we say "capillary" it is really a packed capillary (just a smaller ID packed column). True open tubular LC has a bit of a theoretical limitation: mass transfer through liquids is about 10,000 times slower than gasses. So for this to work, you would need outrageously slow flow rates (and a lot of patience!). There are some professor-types that have done some beautiful work...but with severe practical limitation.

Hi, Dr. Polite! I had the pleasure of taking your Fundamentals of GC course at Axion in Chicago a few years ago (if anyone reading this is looking for a good intro to gas chromatography, I highly recommend it!).

Our lab is looking to purchase some books for our library. Can you recommend some good basic reference material for gas chromatography and/or HPLC to have on hand? The users of our lab are generally technicians and geoscientists, often with little to no training in analytical chemistry.

tectonic_fever

Thanks for the kind words and recommendation!

I like reading "applied" journals like LC/GC Magazine, Analytical Scientist, etc. They do a great job of talking about practical stuff, without skimping on the details. I wrote the LC chapter in a book for the pharmaceutical industry (Analytical Chemistry in a GMP Environment published by Wiley). It was a very popular book because they got a totally practical/applied scientist to write each chapter. I tend to steer clear of the purely theoretical LC books (this is a practical topic!).

Also, remember you can look up applications in column company catalogs (or column company websites). There are thousands of applications already done, and they are FREE! They include the column length, diameter, film thickness, chemistry, temperatures, flows, etc. You can go to the websites of: Agilent, Shimadzu, Waters, Phenomenex, Restek, Thermo, Perkin Elmer, etc.

Hello Dr. Polite,

I am a first year undergrad studying biochemistry at Penn state with the goal of one day acquiring my PhD. I am already involved in research in a lab on campus but found out after a few months that it is definitely not the area I want to pursue. In high school I took an organic chemistry course and found it to be extremely fascinating. As organic chemistry is intrinsically rather advanced and in practice dangerous, many PI's will not take undergrads until later in their collegiate career. What advice do you have for someone like me that is looking get into organic chemistry, but can't get into a lab yet?

Best,

Tutut125

Good for you for pursuing your dream! Don't give up. Tell the professors you'll work for free! Unfortunately at a great school like Penn State, they have lots of post-docs, graduate students and upper class students to choose from...and they are in line ahead of you. Just as a side note, there is at least one great chromatography company nearby: Restek. See if you can get an internship.

I work in an analytical lab where we constantly run into problems developing methods on UPLC for benzalkonium chloride, especially in the presence of salicylic acid. Any tips?

singmyselfawake

OK...I have to scratch my head on this one. My knee-jerk reaction is by answer to most HPLC method development problems: ACN gradient from 10-100% in 15 minutes on a good, base-deactivated C18 column. My other standard answer is to look it up with a column company. So I just cheated and looked it up. I found a publication talking about this exact application. They are using a C8 with IPA, but I'd still try a good C18 with ACN or MeOH. http://www.ncbi.nlm.nih.gov/pubmed/16719494

I used to be a pharmaceutical chemist. The most egregious HPLC method I ever saw took over 30 minutes to run and all the peaks overlapped with contaminates from gloves (they were unable to wear nitrile or latex gloves in any part of the sample prep). I thought it was ridiculous that they were unwilling to make a faster run that let them wear gloves. How do you combat bad/dangerous lab management in regards to chromatography?

chestylaruegal

Chromatography is easy...personalities are not! No easy answer, as sometimes making "improvements" is seen as condemning the current methods (and therefore those who developed and ran those methods). It shouldn't be that way. I remember I had a great boss at Amoco. He did my job (LC group leader) for 15 years, when he was promoted and hired me to take his job. Imagine: any

improvement I made would indict the person who came before me (by boss!). During the first week on the job, he addressed it brilliantly by saying, "I was the one who hired you, so any improvements you make will make me look good." That is the way things should be. Here is one approach. Approach the boss and say something like, "I've read about some new approaches that may be able to separate out the glove impurities and reduce the analysis time, Can I try that on a backup instrument?". If it works, run the two methods in parallel for a month. Compare results, and show that the new method gives the same results as the old method, but it is better/faster. Then your boss makes the smart move to move to the new method. You both come out looking great.

Thanks for the AMA Lee! Have you found that participants of your hands-on training courses had greater success in the industry following the course? As a low-level analyst in a lab that does almost exclusively HPLC with a Bachelor's degree, I'm looking for anything, short of the massive investment of higher education, that will allow me greater success in my industry.

GrizzlyRhyme

I don't have any statistics to share with you, except to say that all of our customers are repeat customers. That is to say that the employers find that the employees come back after the 4-day course much better equipped to do their job. I find the participants are also much happier, because instead of just pushing buttons, they totally understand why they're pushing the buttons. One of the frequent comments we'll get at the end of the course is, "I wish I took this course 5 years ago. I wasted a lot of time focusing on the wrong parameters. Now it seems so simple."

When I was running GC for an environmental lab company we were hit with continually increasing prices for helium to use as a carrier gas. We tried running hydrogen (edit: it was nitrogen, not hydrogen) for a while instead and found that it had much crummier resolution. As helium becomes more scarce and expensive, do you think there will be alternatives to using it as a carrier gas while maintaining the high resolution that helium provides?

rycar88

Fantastic question. Our lab presented a poster on alternative carrier gases at PittCon 2014, and the poster subsequently became a feature article in Gases and Instrumentation. Here's a link to the full article, "The Practical Impact of the Use of Alternative Carrier Gases for Gas Chromatography": http://axionlabs.com/wp-content/uploads/2016/03/Carrier-Gas-Paper-Reprint-of-Published-Article-Original.pdf

Hi there! I am currently studying catalytic conversion of biomass (wood) to biofuels. We are using supercritical water along with cellulose and a catalyst.

In some cases we are only looking at the conversion of cellulose to glucose and other polysaccharides.

So here is my question.

Is it possible to do derivatization on an aqueous media containing polysaccharides and polyols?

I am interested in finding out more specific what anhydrous sugars we have etc.

We have a hplc-ms (esi-ms) outfitted with a agilent ca duo column. We observe a low resolution, with main peaks between 5-15 minutes looking like a mountainside. Possible due to the many different compounds and isomers. Max temperature is 80 degrees. Mobile phase is pure deionized water. We

observe mainly Na+ adducts.

We also have gc-ms with EI ionization.

About qualitative analysis using gcms, what software do you reccomend? And how to identify peaks? Deconvolution/AMDIS?

We use NIST-11 as our spectral library along with masshunter and/or chemstation.

haagiboy

Another question near and dear to my heart. Keep fighting the good fight for renewable fuels! So here's my take on sugars: they are difficult! They don't vaporize, so GC is not straightforward. They have no UV chromophore, so HPLC is not straightforward! You can derivative to get them through a GC, but that usually involves going after the active hydrogen with something like a silylation reagent, unfortunately water is full of active hydrogens! IF you take the GC approach, you either have to remove all of the water (not easy), or put in an outrageous amount of reagent. LC is generally the approach with RI detection and a "Biorad" column (runs at high temperature with water as the mobile phase). So as simple as sugar analysis sounds, it is really difficult.

When I google "Axion Analytical Labs", a lot of the hits I get are for law enforcement officers performing forensic crime scene analysis who are citing their training at Axion Analytical Labs as part of their CV. In recent years a lot of evidence that has become standard LEO testimony has been shown to be compromised or lacking scientific credibility (e.g. blood spatter pattern analysis, hair fiber pattern matching). While these aren't directly relevant to gas chromatography, can you provide some detail on how the processes you have developed and trained LEOs to use are relevant to criminal forensic investigations? Where these techniques are used as evidence in a court of law, how has the scientific credibility of the test results been demonstrated to support the conclusions they're used for in court?

shiningPate

Wow! Another great question...but I better be careful the way I answer it! We've had lots of great forensic lab folks come through our classes. They have a tough and important job. I may be biased (maybe just the cream of the crop come through the courses), but there are some sharp individuals out there. We also get folks from the defense side of our legal system. They are also sharp and motivated. I believe a lot of what you are seeing in the headlines now are examples of the forensic lab business making continuous improvements (just like the rest of us). Our legal system is adversarial by design. I think the theory is that if both sides fight really hard, the truth will come out. I think it is a healthy approach. As scientists, we always question everything. That is our job.

Hello, Dr. Polite! I graduated last May with a BS in chemistry and now I work in field service for a large instrument manufacturer and I specifically work with LCMS systems. I have had a great year learning all about LCMS and visiting a variety of customer labs, seeing how many different industries apply LCMS to address their specific concerns. It's interesting stuff (and very complicated -- sometimes overwhelming!)

My question for you is this: What do you see on the horizon for the LCMS community? Are there any new developments or improvements that you think we're getting close to achieving (or that you'd like to see achieved)? Any pitfalls or problems that might slow down the growth of this industry?

Thanks for your time!

seanshawnshaun

Congratulations on snagging a great job. LC/MS is arguably the most powerful analytical tool out there. I think the growth of that technique is astronomical. Here's why I say that: The GC/MS is considered to be the "gold standard" in analytical chemistry. If a lab has to be certain of the identity of a compound, they turn to GC/MS (forensic labs, doping control, environmental, etc.). But a GC/MS is still a GC. GC is limited to volatile compounds. Only about 20% of all the known organic compounds can be vaporized under reasonable conditions. The other 80% of the analytes are out of luck. That is where LC/MS comes in. So the future for LC/MS? Make them cheaper (they've come down from $1 million to about $100,000), more reliable (they used to require 2 days of maintenance for every 1 day of running samples), and more user friendly (they are still a bit intimidating). Also, while I'm giving my wish list, let's add a searchable spectra library!

Hello Dr. Polite,

I am a physician who occasionally sees patients taking supplements not regulated by the FDA. Some of these companies sell the products as cures for cancer or other diseases. I am concerned that they might contain harmful pharmaceuticals or toxins like lead. Is there an analytical chemistry service that would allow me have these supplements screened to see if they contain harmful substances? I cannot pursue all of these fraudulent companies, so I would like to focus on the ones doing the most harm.

Thank you, Anonymous MD

SafeMD

Great question, but I don't have any great answers. We certainly have analytical techniques to find things like lead (a should out to my Virginia Tech brethren who were the first to measure and confirm the lead contamination in Flint Michigan water). Unfortunately, I can't think of an inexpensive way to get it done. One thing I've often thought about is matching up those who have the capabilities, with those who have the needs. For example, lots of chemistry departments have instrumentation like AA and ICP for metals analysis, and HPLC/GC's for organic analysis. They are often looking for practical projects for their students. It is a true win-win. I know my major professor in graduate school would rent us out for peanuts to work on projects for local industry (the term "pimp" comes to mind!). We did things like analyzing well water from local farms looking for pesticides to measuring additives in tractor paint, etc. We hated it at the time, but every single one of us benefited greatly from the practical experience. I hope that helps both you, and some lucky professor and student!

If any of these pique your interest, would be great to get your thoughts. Thanks!

When you were honing your skills at Amoco and working with hydrocarbonn mixtures, did you rely on ASTM or GPA methods using GC?

I'm not an analytical chemist, but do rely on the results of these analyses and have been struggling to understand the issues associated with obtaining accurate analyses of mixtures containing larger (C15+) hydrocarbons. I imagine you came across many such issues at refineries and am wondering if there are certain sample characteristics you look for or rules of thumb you employ to provide a sense of sample quality?

Lastly, have you had experience analyzing pressurized hydrocarbon samples? If so, do you have some sense of where/when the greatest opportunity for errors to be introduced are in the process? Do you also QA/QC your results against simulation programs, looking at expected phase behavior (e.g. proximity to equilibrium)? Have a sense of the accuracy of employing such checks?

alchemicgod

This is a tough question, but let me take a stab at it. ASTM methods are very popular in the petroleum industry (and other industries as well). I used to sit on a couple of ASTM committees. The great thing about ASTM is that the committees are made up of real analysts currently working in the field. The general idea is to come up with common methods that everyone in the same industry can share. They are usually really good methods, with plenty of round robin testing and statistics to go along with the data. The higher hydrocarbons can be a challenge if this is a gas sample, as they are not very volatile, so they tend be left behind. The higher boilers can also be preferentially lost even in a liquid injection (discrimination of high boilers). Make sure the injection temperature is hot enough to get all of them, and use an autosampler if you are making a liquid injection. I also want to point out one major challenge with pressurized samples (sample bombs, in the petroleum industry lingo). Make sure that the pressure of the sample in the sample loop is consistent. We don't think much about compressibility when we make liquid injections because liquids are barely compressible. But the amount of gas sample you inject is proportional to the pressure (PV=nRT). So make sure you are using some sort of a back-pressure regulator on the outlet of your sampling valve. There is a great company called "Wassen ECE" that specialized in valved GC injection. They are a great go-to source for such things.

Hi. I am working in a lab and was hoping to get experience using hplc and GC. Now it turns out that I am only getting experience in IC. Do you think IC looks better or worse on a resume for chemical company's eyes? I think IC is my favorite form of chromatography given how the ion suppression membrane works. I thought it was genius. Just wondering if employers look at having experience in that over hplc the same.

YourPureSexcellence

Join the club! I too love ion chromatography (IC), and also think the invention of the chemical suppressor was genius. Here's a shout out to Hamish Small from Dow Chemical company who invented it in 1975, which led to the company "Dionex" (still the world's leaders in IC and now a division of Thermo). So my first statement is "IC is HPLC". HPLC has a bunch of different modes (reversed phase, normal phase, ion exchange, hydrophobic interaction, hydrophillic interaction, etc.). So IC is just one of those modes. In a way it is more complicated due to the chemically suppressed conductivity detection, so if I were you, I'd take credit for that. Also, my philosophy is that "chromatography is chromatography", meaning that every type of chromatography works the same way (GC, HPLC, IC, SFC, CE). You have a mobile phase, and a stationary phase. You always want to weaken the mobile phase enough to encourage your analytes to interact more with your stationary phase (that is where the separation occurs). In each form of chromatography, we have a different way to weaken the mobile phase. In GC, we lower the column temperature. In reversed phase HPLC, we reduce the % of ACN or MeOH. In IC, we reduce the amount of "salt". If you get that, you are now a universal chromatographer!

Wait a minute! Did you have a Gas Chromatography maintenance course in Chicago around 2001?! If so, I was in your class. Also, I remember the day you came in so happy and showed the class your new deed to the single parking spot you just bought for 30 grand!!! Excellent course by the way.

Browneye9000

Yup...that was me! That is just about when we first moved to our current location (16 years ago!). What a great memory. Just for the record, I paid $20K for that parking space (our lab is downtown Chicago), which I thought was outrageous at the time...now they're going for $35K and in great demand, so I wish I had bought the whole parking lot! As an added kicker, I run the 3 miles to work just about every day...so I don't even use the space!