

American Chemical Society AMA: We're Melody Bomgardner of Chemical & Engineering News and Anndrea Hermann of Hemp Technologies and The Ridge International Cannabis Consulting here to discuss the chemis

AmerChemSocietyAMA¹ and r/Science AMAs¹

¹Affiliation not available

April 17, 2023

Abstract

Hi! I'm Melody Bomgardner, Senior Business Editor for C&EN. I write about food and agriculture for the magazine, in addition to other topics like advanced biofuels and other environmentally-friendly technologies. Earlier this year I wrote an extensive cover story about plant-based protein sources [link "plant-based protein sources" to <http://cen.acs.org/articles/93/i6/Calling-Plants-Fulfill-Proteins-Promise.html>] and got the idea to write about hemp. Before I began research for the hemp feature, I didn't know very much about this crop, but I ended up learning much more than would fit in the story. I look forward to your questions. Hi, I'm Anndrea Hermann, M.Sc, B.GS, P.Ag., and I'm the President of Hemp Technologies, Sales and Business Development Officer of Hemp Production Services, Principle The Ridge International Cannabis Consulting and Founder/Host iHempRadio. I am the lead instructor of Oregon State University's course on Industrial Hemp, as well as a Health Canada Authorized Hemp THC Sampler and Canadian Hemp Licensee who has advised Health Canada on a wide spectrum of Cannabis projects (from 2001 to the present). I am a current board member of the Canadian Hemp Trade Alliance, President Emeritus and current board of the National Hemp Industries Association and special committee member for the European Industrial Hemp Association. I have assisted with creating and reviewing hemp regulations in Canada, the European Union, South Africa, Uruguay, Australia, New Zealand, India, Vermont, Virginia, Tennessee, North Dakota, Missouri, Colorado, California, Oregon and Michigan, for example. These regulations govern the hemp industry. While state initiatives have legalized two main types of Cannabis, marijuana for medical or recreational uses has gotten a lot of attention lately while the effort to revive industrial hemp production in the U.S. is much less well known. This ancient crop traveled with the colonists to North America and was a staple of agricultural production in the U.S. up to the 1930s. Since then it has been largely illegal to grow hemp in the U.S., though it was legalized in Canada in 1998. Now, though, the 2014 Farm Bill allows some controlled plantings of hemp in any state that has an agriculture department willing to oversee production for research purposes. Many vegetarians and vegans know the hemp seed – called grain – is rich in essential amino acids and fatty acids. For more about the potential for a hemp resurgence in the U.S., check out: [Hemp, No Longer Illegal, Is Poised For A Comeback In The U.S.](http://cen.acs.org/articles/93/i46/Hemp-Longer-Illegal-Poised-Comeback-In-The-U.S.) [http://cen.acs.org/articles/93/i46/Hemp-Longer-Illegal-Poised-Comeback.html] Update! I'm pleased to report that analytical chemist and hemp variety expert Jace Callaway will also be joining us today. We'll be back at 11 am EST (8 am PST, 4 pm UTC) to answer your questions, ask us anything! Hey all - it's now 12:07 and our official live hour is over. But I invite our experts to continue answering questions as they have time available. Please give a hemp-hearty thank you to Anndrea and Jace!

[REDDIT](#)

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Conventional concrete has a huge carbon footprint. Can we replace it with hempcrete using a microbial polymer for a binding cement, that can outperform the conventional material economically?

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CORRESPONDENCE:

DATE RECEIVED:
December 16, 2015

DOI:
10.15200/winn.145018.83002

ARCHIVED:
December 15, 2015

CITATION:
AmerChemSocietyAMA ,
r/Science , American Chemical
Society AMA: We're Melody
Bomgardner of Chemical &
Engineering News and
Andrea Hermann of Hemp
Technologies and The Ridge
International Cannabis
Consulting here to discuss the
chemis, *The Winnower*
2:e145018.83002 , 2015 , DOI:
[10.15200/winn.145018.83002](https://doi.org/10.15200/winn.145018.83002)

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[Uncle Charnia](#)

Hempcrete as an infill is not load bearing thus not able to replace all concrete i.e. parking lots. Hempcrete is a mix of lime, hurd (the inner core of the stalk) and water does out perform concrete in thermal mass, resistance to mold and acoustic properties just to name a few. You may find the research from U of Bath UK interesting http://www.bath.ac.uk/ace/research/cicm/news-and-events/files/BIOMATERIALS_AND_BINDERS_-_Lanos.pdf

Submitted by AH

Hey guys, a few questions. Feel free to only answer some of them if you don't have time.

Currently, it seems as though Manitoba Harvest is dominating the Canadian market (though this may not be accurate, I'm only going based off of what I see at the grocery store) and when you compare their prices on protein powder to other brands there is still miles of difference. What are the largest obstacles to economic production of hemp seed and food products in Canada? Is it simply an issue of achieving economies of scale, or are there other issues (ie, superfluous regulation, distribution channels, technological limitations, etc...)?

Personally, I think we'll be seeing a lot more alternative foods within the next decade or so, especially with the advent of products like soylent. There's exciting research being done into algae based food products, and very, very slow but growing acceptance of insect based protein sources. Where do you see hemp fitting into our evolving foodscape in the next decade?

There are many very food-insecure regions of the world (and even inside of Canada (say, Inuvik NWT, where 43.3% of the population cannot get enough nutrition to lead a healthy life)); in the near term, do you see hemp playing a role (globally or domestically) in addressing these issues? If so, how?

Lastly, with the Trudeau government announcing they will be legalizing cannabis for recreational use and what will most likely be a public becoming increasingly warm to cannabis products, how does the industry anticipate regulations will change, and how is it preparing for what may explosive growth in demand?

[Rexport](#)

I spoke with Manitoba Harvest and got a bit of insight into how their business works. The most important thing is that they are "vertically-integrated." They contract with farmers in advance for an amount of hemp grain. So presumably each year they estimate the demand and set the supply - that means they have a lot of flexibility to maintain a profit margin, and prices for this niche food product are pretty steep - about \$24/kilo. There is a question of how low prices could go with economies of scale.

But demand for hemp products from the US really jumped in 2015. If more buyers get into the market and contract with more growers, there will be more competition, and prices will drop. That may help it become less of a niche product - and maybe set off a positive feedback loop.

Hemp protein is a truly unique product (whether sold as protein or in the seeds). If it were a cheaper form of non-animal protein, it could really take off - plant-based diets are hot, hot - even meat eaters report they are eating less meat (flexitarians). MB

Hemp can be grown in Northern climates (but not sure how close to the Arctic). It could be a great subsistence crop - though very small plots tend to get eaten up by birds (or so farmers tell me). MB

Hey guys, a few questions. Feel free to only answer some of them if you don't have time.

Currently, it seems as though Manitoba Harvest is dominating the Canadian market (though this may not be accurate, I'm only going based off of what I see at the grocery store) and when you compare their prices on protein powder to other brands there is still miles of difference. What are the largest obstacles to economic production of hemp seed and food products in Canada? Is it simply an issue of achieving economies of scale, or are there other issues (ie, superfluous regulation, distribution channels, technological limitations, etc...)?

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[Rexport](#)

What are the largest obstacles to economic production of hemp seed and food products in Canada? As with all "specialty" and organic crops we are all working to contract acres. There is limited certified organic land and growing need for more. This opens an opportunity for transition to organic.

Where do you see hemp fitting into our evolving foodscape in the next decade? I see a growing need for the approval of hemp in the livestock sector. It is not approved but sound research is setting the stage. This is driven by the Canadian Hemp Trade Alliance.

Do you think hemp fibers have a realistic chance of seeing widespread use in the electronics industry?

[I Own A Fedora AMA](#)

Melody here - no idea but scientists are looking at this. Back in 2013, C&EN reported on efforts to make a graphene-like material from hemp to be used in next-gen batteries. [Energy-Storing Nanomaterial Made From Hemp](#)

Graphene is a single-atom thick layer of graphite (just carbon!). It has amazing properties for electronics, and the creators of single-layer graphene won a Nobel. But there's a lot of hype around graphene and uses of it for electronics are still in the early R&D stage.

Do you think hemp fibers have a realistic chance of seeing widespread use in the electronics industry?

[I Own A Fedora AMA](#)

Yes everything from composites to packaging materials. AH

What do you see as the most commercially viable hemp product(s) in the near future? What hemp product(s) have the most potential to positively change an industry, if approved/legalized?

[GT_ED](#)

This is Melody- as a business reporter, this is a question that was at the top of my own list. Hemp is not yet a commodity crop, so the target markets are what we'd call small volume/high margin. Food uses are top - grain (with or without the hull) and hemp oil. Second would be personal care - again hemp oil. And the health care uses of cannabidiol would also fit the in the high margin bucket

I would say that as more hemp is grown, specialty materials, like high-value building materials (renewable cabinet facings, etc) might be viable.

It would take a while, but with a more commodity-sized crop, one could see more hemp-based textiles (so that they are less a specialty item). Cotton has gotten pretty expensive and hemp could eat into that market, especially if it's organically grown.

More R&D could potentially create opportunities for structural composites made with hemp. Automotive interiors, building exteriors, etc, even structural things like today's oriented fiber board.

What do you see as the most commercially viable hemp product(s) in the near future? What hemp product(s) have the most potential to positively change an industry, if approved/legalized?

[GT_ED](#)

Hemp products such as foods derived from the kernel/grain/seed (achene) are federally legal products in the USA if they contain 0% THC. Thankfully HIA vs DEA lead the way. I see the need for natural fibres growing as the research is supporting its use.

Submitted by AH

Hi! I'm an i502 Tier 2 Producer/CO2 Processor in Washington for both medical and recreational purposes. Great to see you guys doing an AMA!

I'm so excited for what hemp means for a new cash crop, especially in farm areas that have been hurting. What geographical areas do you think these crops will be most profitable? We chose our location based on utility costs and local laws, living expenses, etc. I can't wait to see hemp being an option for farmers who otherwise would lose their land. What will be the differences for changing over for them?

[lakehairdontcare](#)

Hemp can be grown in many places if the right variety is chosen (length of dark hours in the growing season determines seed production, for example). Fiber hemp was grown in northern and southern climates in the U.S., and without irrigation. Jace Callaway's variety, Finola, was developed for Finland if that gives you any ideas.

To have a viable local hemp industry, you probably need to rotate it with commodity crops (so you won't only grow hemp). And you'd want to have access to seed pressing equipment/services to sell hemp oil (like for canola oil). Eventually, if a fiber industry rebounded, you'd need access to the machinery that processes and spins hemp fiber.

To sell the grain for food, you'd need a buyer. These are the kinds of economic systems that need to be set up in each state with help/guidance from the state's dept of ag. MB

Hi! I'm an i502 Tier 2 Producer/CO2 Processor in Washington for both medical and recreational purposes. Great to see you guys doing an AMA!

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[lakehairdontcare](#)

The profitable areas will depend on the product desired. If growing for food then mostly likely look to areas where other grain crops are grown. The transition will depend on the existing infrastructure. AH

I recall plenty of articles, going back as far as a 1930's piece in Popular Mechanics, which suggested that hemp could replace approximately 80% of the worlds fuel needs.

Is that a viable goal to strive for utilizing hemp? Would that compete with hemp as a food source, or would they be compatible programs?

[NegligentKarma](#)

Most likely using hemp for fuel would compete with the more profitable food market. I say that because the likely route to fuel would be to make it from the seeds. <http://cenblog.org/cleantech-chemistry/2010/10/uconn-researchers-find-new-biodiesel-feedstock/>

It's a very tough, fibrous plant so I'm not sure if the non-seed biomass would make for a good cellulosic fuel feedstock. However, if there were a biomass gasification plant, hemp residues could be used to make fuel, energy and/or heat. MB

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[NegligentKarma](#)

Currently hemp is a functional food and is too high valued as a food over fuel. Can hemp be used to create a fuel/energy source yes! Luckily hemp can be dual purpose i.e. for food/grain production and fibre.

AH

What ecological/environmental effects will an overall increase in hemp production bring? The plants applications I know are boundless; but how will it effect top soil and crop rotation? Will it's ability to remove heavy metals from top soil play a factor?

[thinkharderr](#)

Hemp like other crops should not be mono-cropped. At this time few to limited use of pesticides are allowed however this could change. Hemp's long tap root helps the soil to stay intact and for water to reach further down in the soils profile. It rotates well with pulses, other grains and green plow downs. If

grown in area of heavy metals the plant is know to update and would change the market place for the harvest.

AH

how goes any practical development of using hemp-crete in large scale construction?

[Jackets298](#)

Hempcrete in the North America is picking up mostly in the residential and private home sector with that said a growing number of commercial building have been build in the EU and UK. The interest in commercial building in NA is on the rise!! AH

AH

In Virginia, we still have a tobacco economy, although the heyday is long past. From the perspective of a small Virginia farmer, can hemp replace tobacco as a primary crop?

[Jalfred_Prufrock](#)

Virginia can look to Kentucky and monitor how that crop is doing. The hemp growers there are very enthusiastic and are learning how to grow hemp profitably. Tobacco is a difficult crop to replace because it has been so valuable, but Kentucky farmers have been losing market share also. I would imagine if a cooperative of Va farmers got together and co-marketed their products regionally, they may do fairly well. But there's a learning curve to adopting a new crop. MB

In Virginia, we still have a tobacco economy, although the heyday is long past. From the perspective of a small Virginia farmer, can hemp replace tobacco as a primary crop?

[Jalfred_Prufrock](#)

This will depend on the economy of scale and the desired product produced. AH

Why isn't hemp more commonly grown in third world countries?

[sonicjesus](#)

Well, it (*Cannabis sativa*) is grown in these areas, but more for recreational/medicinal purposes, because this product has more value then either fiber or grain. Also, most of the poorest regions on Earth are near the equator. The short days near zero latitude cause most varieties of hemp to flower earlier than desired, if fiber is the main product. Basically, there are no "tropical" varieties of hemp for fiber production. The grain can be produced, of course, but most impovrished countries typically lack this infrastructure for modern grain production. It can be done, but it is not (yet!) so efficient. Anyone need a huge, unfunded project for the rest of their lives? I hope so !

I'm not very familiar with the growing and processing of hemp. How is the plant grown different from the plant grown for medical/recreational cannabis, if at all? What regulations must you follow in order to grow hemp in non-legalized states? Also, how do you see this industry expanding with the possibility of nation-wide legalization/regulation of cannabis? Thank you for your time!

[hankuti](#)

First of all, it's grown outside, only! You'd be in for many more acres and much less profit per acre. But you aren't trying to maximize THC production, so that helps. If your state is participating in the 2014 Farm Bill allowance for hemp-growing, the state dept of agriculture will have a whole process to follow to get approval for your crop. You need to start pretty early to get everything approved. -MB

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[hankuti](#)

Hemp for food is grown at approx 100 plants per square meter, for fibre only approx 300 plants per square meter and for flowers only about 1 plant per 2-4 meter square. Hemp for food and fibre is grown outside and for flowers (where allowed by law) can be grown in or outside.

Under the Farm Bill you are only allowed to grow in states that have regulated hemp and have permitting/registration application.

The Industrial Hemp Farming Act in the USA congress would remove hemp from a Sch 1.
www.votehemp.com

AH

Do you think the quality of hemp-related products are comparable to the quality of their non-hemp competition? Could they become a viable replacement, or is the intention to create a more environmentally friendly alternative?

[whydoctor](#)

I think for most products, quality would not be a hindrance, if price and availability were in line with the intended use.

Hemp oil, though, is fairly unstable compared to other vegetable oils. It is very healthy, but needs to be kept in the refrigerator. Still, hemp oil used to be used in many industrial products including paint (a big market). But those markets are different now (ie, oil based paint has been replaced by water based). But possibly there would be new uses in industrial lubricants - also a very big market (dominated by motor oil and hydraulic fluids). Biobased is a plus in many of those markets. MB

Do you think the quality of hemp-related products are comparable to the quality of their non-hemp competition? Could they become a viable replacement, or is the intention to create a more environmentally friendly alternative?

[whydoctor](#)

It is more about hemp being a great alternative and/or addition to a product to increase quality parameters.

AH

What red tape stands in the way of growing hemp? It seems like the obvious go to, for renewable resources, for so many potential uses.

[EarthwormPUP](#)

Melody here - if you hate red tape, this is not the crop for you. Even in Canada and Europe, hemp products must be tested for tetrahydrocannabinol (THC) and contain less than 0.2 or 0.3 percent. Varieties and growing conditions determine THC amounts, but it's the paperwork that's more of an issue in most cases.

In the U.S., to grow hemp you need to be in one of 20 states with state agriculture programs that oversee hemp growing. Generally, the ag dept will take proposals that have to have some sort of research component to them. Even getting viable seeds (from Canada or Europe) is not a simple matter. One issue has been clearing all the hurdles each planting season in time to get the seeds in the ground on time. MB

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[EarthwormPUP](#)

The red tape: US Govt. to redefine hemp.

AH

I know "industrial hemp" typically is very low in THC. Is there any reason high-THC medical/recreational cannabis can't also be grown for fiber, i.e., the flowers are for smoking, while the stalks are used for industrial purposes?

[BarnabyWoods](#)

First, these high THC strains are not uniform or stable enough to be grown by seed on a large scale for fiber production. Yes, you can pull fiber off of a drug Cannabis plant. But, fiber varieties have already been bred to be very uniform, and non-branching, grown from seed. By contrast most drug varieties show a lot of branching, and they are typically propagated by clones, not seed. Branching and non-uniformity of a drug Cannabis crop makes industrial applications very difficult and inefficient.

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[BarnabyWoods](#)

The use of stalks off the MMJ production is typically regulated under the MMJ regulations.

AH

I apologize in advance for all of the questions but I am extremely ignorant on the subject, but also very genuinely interested. Assuming that large scale hemp production is made legal, the market demand is strong, and the business economics of production, processing and distribution of profitable end products becomes viable, could you share your thoughts on how you envision the effective supply

chain would form? Would hemp be harvested, handled and processed like cotton or wheat, or are there inherent differences in the hemp production process which might make it more difficult? Any idea how hemp will be transported based on where you see distribution channels forming? Can it be stored? Would it be harvested seasonally and aggregated in elevators by cooperatives like corn? I'm curious to know if the industry already perceives this market as shovel ready and simply waiting on the stroke of a legislative pen, or if you think the appropriate market strategy will require further research (possibly years) before it can/will be effectively implemented.

[TheJobbys](#)

Good questions. Let me take them in order, one at a time:

The supply chain in Western countries is well under way. As the cultivation area continues to expand in Europe and North America, then these things will continue to work themselves out. Nearly 100,000 acres of hemp in Canada over the past two years, which is still not much, when compared to other grains. A lot has been achieved over the last 20 years, but there is still a lot more work to be done.

Yes, hempseed fits into the existing grain infrastructure. There are some considerations for cleaning and storage. Please visit www.finola.fi for more basic info.

Transport is the same as with other grains; truck, sea and rail.

Yes, good quality hempseed grain will keep for several years if it is stored properly; cool, dark, dry, away from birds and rodents, etc.

Yes, hemp sown and harvest seasonally. It is an annual crop.

This project has been shovel ready for decades. We're just waiting for more policy wonks to do their job. Natural attrition has also helped to precipitate the changes we are all beginning to enjoy these days. Looking forward to the 2016 presidential vote in the US, and hoping for real change, in this regard!

What kind of commercial uses do you see coming out of hemp at this day and age? Does it have the ability to take the place of trees for paper or anything like that?

[imthescubakid](#)

In my opinion, the real value is in the seed (grain). As more is grown, prices will come down, and more people will use it. Then there is animal feed to consider. Normally, "new" oilseeds are used as animal feed first; soya, for example. This is another paradox for hemp; currently too expensive for animals. No, hemp will not replace trees as a source of fiber. Almost all of the world's paper is made from tree pulp by the Kraft process. A totally different industrial process is required for hemp pulp. Can be done, yes, but agriculture cannot economically compete on an industrial scale with forestry for pulp.

What proactive steps are you suggesting for hemp growers to use to deactivate the pollen that will spread throughout the region by anemophily? What powers do cannabis growers have to recoup losses due to cross pollination?

[Alphakronik](#)

There are no reasonable steps to be taken with an open pollinated crop that may be cultivated on a very large scale. Best to kept the medical production in a carefully filtered environment, to avoid pollination that way, and also to avoid other contaminants that might spoil a high value herbal product that is intended for medical/recreational use.

How should we expect the cost of medical, recreational, and industrial hemp/cannabis materials/products to fluctuate over the coming decade?

[Master420Kief](#)

Availability should increase as prices decrease. Expect a hefty tax windfall from the medical/recreational, and better nutrition for the masses from hempseed foods.

I have owned hemp clothes in the past and found them superior to cotton, how long before we start seeing more clothing on the American marketplace?

[ImmodestPolitician](#)

The production on hemp as a textile can be specialized. We are seeing more hemp fashions and textile based product entering into the USA market. AH

You mentioned Tennessee in your list of places regarding hemp regulation. As a southerner, I'd really like to hear more about what's happening there and any other possibilities for introducing hemp to the south.

[OmniYummie](#)

Melody here - yes, farmers in the south are definitely willing to give hemp a try. Again, Kentucky seems to be taking the lead. Check out the website for Atalo Holdings - <http://ataloholdings.com/> This company is run by Andy Graves, a seventh-generation farmer - his grandparents used to grow hemp.

Interestingly, the states in the SE US might be the last to legalize recreational/medicinal cannabis, but they may be the first to scale up hemp. MB

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[OmniYummie](#)

Depending on what state you are in you may find a HIA state Chapter. www.thehia.org

AH

I read somewhere that Henry Ford built a car almost entirely out of hemp and it was much stronger/lighter than steel. Do you think this (or something similar) could be a practical use of hemp in the future?

[le_django](#)

Sure - Lightweighting cars is a huge market opportunity for new materials. And it is a high-value market, so a good one for hemp. And automakers really like to use biobased materials where they can. So it's a matter of developing the materials to meet the tough specifications of auto parts makers. One area of development that will be important for hemp composites will be developing the binders/resins

(and they can be biobased also). MB

How do you think the legalization of cannabis in the future will effect the economy in the south?

[MuseDrones](#)

The Washington Post recently did a story about adoption of hemp in the U.S. south - you'd probably find it interesting! <https://www.washingtonpost.com/news/business/wp/2015/10/15/the-south-says-no-to-marijuana-but-yes-to-hemp/?postshare=4131444928524655> -MB

Hi there! Do you know if it's legal to harvest flower parts from hemp in Canada?

[The_Red_Rocket](#)

Yes, it is legal to harvest hemp flowers in Canada, but only for the seed (grain). The vegetative material is then cleaned away as waste, or left in the field as combine residue. We recently calculated the value of CBD that was left on Canadian fields in 2015, and came up with about 0.8 trillion dollars (Canadian dollars). This estimation was based on the price of a single CBD capsule. Law enforcement likes to inflate their confiscation values in the same way. More realistically, using current bulk prices, Canadian farmers actually left only about 40 billion worth of CBD in the field last year. I guess it is not supposed to make sense (see chaos theory).

Has hemp oil suitable for plastic? Is it possible to injection mold hemp plastic?

[shilabula](#)

Industrial hemp polymers are not in the marketplace today, and I'm not sure what has been tried on the lab scale. Castor oil is used in plastics and has been for 70 or 80 years. But it is very different from hemp. Here's info I cribbed from C&EN on castor oil plastics: "thanks to its useful handles for chemical reactions, castor oil continued to be used in myriad personal care, automotive, and industrial applications. Now the oil is getting a second life as a raw material for polyurethanes and specialty nylons desired by auto manufacturers and other companies looking to boost the renewable content of their wares." "

Like other vegetable oils, castor oil, known chemically as ricinolein, is a triglyceride—a glycerin molecule in which the three hydroxyl groups are esterified with a long-chain fatty acid. But in other ways castor oil is unique, according to Tom Pensak, a business director at the specialty chemical maker Vertellus Specialties who has worked with castor oil for more than 10 years.

For starters, castor oil is chemically consistent from season to season and from growing region to growing region, Pensak says. In addition, the main fatty acid is ricinoleic acid, an 18-carbon compound notable for the hydroxyl group on its number 12 carbon. On top of the hydroxyl group, castor oil offers chemists an ester linkage and a single double bond per fatty acid chain."

Hemp oil has very different properties - very good for human health, not so sure about plastics. -MB

Has hemp oil suitable for plastic? Is it possible to injection mold hemp plastic?

[shilabula](#)

Most hemp plastics are using hemp fibres not so much oil.

AH

What are your thoughts on how future legalization will affect the tobacco industry?

[dephchild](#)

Hemp works well after a tobacco. I see a benefit to the tobacco farmer.

AH

Are there ecological risks associated with growing hemp? What can we expect for the inevitable genetically modified(GM) hemp? Have biotech companies joined the conversation yet?

[EasySmeasy](#)

Melody - I keep an eye out for biotech crops and have not heard about anyone developing biotech hemp (that doesn't mean no one would). But right now the high value product is the grain for food use - and the biggest demand is for organic-labeled grain which would exclude GMO varieties. FYI, you can check the USDA for an updated list of approved GM crops. Always worth a look. -MB

Have you seen any updates on the research for the hemp based capacitor batteries?

<https://www.asme.org/engineering-topics/articles/energy/hemp-carbon-makes-supercapacitors-superfast>

[ImmodestPolitician](#)

Alas, I have no updates - our last report on the topic also dates from 2013. But contact the researchers - they may have unpublished results. -MB

Greetings! I'm thinking about pursuing a graduate degree in Chemistry/related field and I would love to work in a Hemp-related industry, but I'm weary of the time it would take to complete such a degree and the job prospects afterwards.

What are your opinions on the future prospects of the fields in which you are currently involved and represent?

Thanks.

[geetarzkool](#)

I'm just a journalist, but I know that employment for chemists has been tough since the Great Recession. That said, food chemistry is a field that seems to have good hiring and biobased industries are likely to grow. ACS Members can avail themselves of a ton of career resources, by the way (shameless plug). -MB

Hi, thanks for doing this! My father is organizing a group of farmers, reporters, and assemblymen to pass [Wisconsin House Bill 215](#) to get Industrial Hemp legalized in wisconsin. I'll direct him to this AMA, but I'm curious what sort of methods you've learned have been most effective at grass roots movements with Hemp. Thanks!

[Tarsupin](#)

Melody here - I'm sounding like a broken record, but I'd suggest connecting with the movement in Kentucky. They had both senators working on National legislation, and they worked in advance to create a state program (ten years before the Farm Bill gave hemp the green light)

What universities will be leading the agricultural research to improve the hemp crop for specific uses (protein-content, fiber quality, etc)? Are there universities filing paperwork for approval of these projects? I am interested in studying hemp breeding at the graduate level but not sure how to approach an advisor since the farm bill is relatively recent.

[hxc2step](#)

This varies by state. But generally whatever university runs your local ag extension service is the one working with the state ag dept to run the programs. Check with your state ag dept. -MB

How would industrial hemp cultivation fit within the proposed 4/1000 regenerative agriculture plan adopted by France, the UK, Germany &c (but not the USA) at COP21? If it could, would the cost to the soil/biome be worth the potential carbon sequestration effects?

[nochvedmy](#)

Melody here, speculating somewhat. Since hemp would likely be grown on already cultivated land, it would depend what crop it is replacing. Or if it is used in rotation, etc. A great study for a grad student to take on - the comparative lifecycle benefits of hemp. If one grew fibers for use in durable goods, though, it would make for a nice carbon sink. From what I understand, it is not more costly to the soil than other crops, though it would take up nitrogen which must be replaced.

What's the best way to get involved in the industry? Either industrial, medicinal, recreational (should we anticipate widespread legalization?)

[WuTang4Children](#)

One way to get involved is by joining the Hemp Industries Association and reaching out to your state chapter, calling your congress persons and talking with local ag. dept.

AH

What's the best way to get involved in the industry? Either industrial, medicinal, recreational (should we anticipate widespread legalization?)

[WuTang4Children](#)

[shameless plug] I'd suggest joining ACS! The org is home to many scientists that are in or want to be in the industrial cannabis industries. -MB

As a fellow chemist I am fascinated by the potential new employment opportunities. Currently in my neck of the woods cannabis is frowned upon severely. What do you think needs to change for it to become accepted? My thought is that a reliable spot test, similar to a breathalyzer in function, needs to

be created.

[OverlyAverageJoe](#)

What do you think needs to change for it to become accepted?

Drug Cannabis (marijuana) is still in Schedule 1 in the US. This is the most restrictive drug category. Pure THC, the main psychoactive component, is Schedule 3. I think a rescheduling of drug Cannabis from Schedule 1 to 3 would help hemp a lot. Hemp would then follow as an after thought, and the Earth will continue to spin, as it always has...

Hi there! What's your opinion of the recent Dow/DuPont deal? Do you see this affecting your research in one way or another?

[mcgillycuddy412](#)

As you can imagine, we at C&EN are monitoring the developments with Dow/DuPont with great interest. In particular, I am interested to see how the deal will affect DuPont's industrial biosciences businesses. DuPont isn't (yet?) a purveyor of hemp products but they are in many markets that hemp could be used in. -MB

The colonial royal charter from the town I am from in New Hampshire listed two requirements for all town residents: they were to reserve all mast trees for the royal navy, and each resident was required to produce 1 pound of "good merchantable hemp" per year. No other plant in North America has been the subject of such strict and variable governmental control. Can you speak about the challenges you face in re-writing modern regulations banning hemp? For those interested in growing hemp for personal use, do you see there being any legal options on the horizon?

[ridemybikein](#)

Another good question. Many of us in the hemp industry have been working on the re-introduction of this crop for at least 20 years. We've seen a lot of change during that time, but not yet enough. In too many places, hemp is still regulated as if it might suddenly change into marijuana one day. This bit of illogic would be big news in botany, and the evolutionary sciences, if it were actually true. The educational process on this topic is never ending. As to your last question; yes, these options are beginning to open up- soon coming to a state near you!

What positions will arise in the field for material engineers?

[Chubbyswaqq](#)

I would say it would be in composites and building materials. Getting new materials to meet technical specifications for the auto and building industries is no small task and materials engineers would be needed. -MB

Hey I'm about to take a chemical thermo exam, how often do you guys really utilize fugacity and chemical equilibria

[yoilovetrees](#)

Great question. Yes! Most of us in the hemp industry rely on fugacity and chemical equilibrate, at least

several times a day. However, it seems that these concepts are neither necessary nor sufficient for success. Some actually ignore these concepts entirely. I'm tending towards chaos theory if I want to get a true picture of the situation, concerning hemp and just about anything related to it!

Here in Colorado, many farmers have had to destroy fields because the THC% was over 0.5%. We're still talking fields that tested under 1%. Is it better to try and breed for less than 0.5% or change the rules to 1% max THC?

[tikkamasalachicken](#)

I know that Jace at Finola is advocating for better, more consistent instructions and standards for THC monitoring. You'll find more info here: http://finola.fi/news_info.html Perhaps he'll be able to return for this question. -MB

How does hemp production fit in with crop cycling? Is it a net consumer or producer of soil nitrogen? In what other ways does it impact soil qualities?

[Laws91](#)

In Canada, as I understand, it is generally grown in rotation with crops like canola and wheat or forage crops. It does use nitrogen.

What about hemp for paper and textiles? Do you see these businesses taking hold in the US?

[sewnlurk](#)

As niche or specialty products, perhaps. Unfortunately, both paper and textile industries in the US have been on the downturn for decades. It'll take more than hemp fiber to bring them back. -MB

Hello, and thank you for taking the time to answer all these questions. As a recent grad with a BS in biology, I have a strong interest in genetics and work in a lab at my university while figuring out my grad school situation. Only within the past 5 years has the entire genome of cannabis been sequenced. Where do you see cannabis genetics going in the future? Do you see a Monsanto type situation developing where a single company patents cannabis genes that signal for expression of a certain trait? Lastly, do you see cannabis genomics as a soon-to-be 'hot' field to be in?

[fortzen1305](#)

Plant genetics and synthetic biology are growing fields right now. No need to specialize in a particular crop while you are still a student (other than out of interest). As you probably know, plants like Arabidopsis and tobacco are common model plants used in the lab. I'd suggest checking out the group at <http://synbiobeta.com/> to indulge your enthusiasm!-MB

Do you find it quite curious that this AUA is posted a few days after the meeting in Paris? In which apparently the world reached a treaty for "global warming" or something like that?

Does this directly effect/affect you or your work in general?

[Kbearforlife](#)

As a reporter, I cover many topics that the climate agreement will touch on - food & agriculture, renewable energy, advanced biofuels, and technologies relating to natural gas. If countries stick to and increase their commitments the effects will be large on these industries but at this point it's hard to tell how it'll play out. I'm pretty excited to find out, though! - MB

Hi there,

How do you see hemp's reintroduction into the North American marketplace as a biomass energy fuel source?

I'm in Canada, and as you mention in the opening post, hemp has been legal since 1998, but the regulatory requirements makes it prohibitive to actually grow regionally in scale (most farmers can't be bothered with the hassel).

[Ehcadroj](#)

Pretty much any other use for hemp would be more valuable than burning it for energy. But I've read that switchgrass can be made into fuel pellets (like for pellet stoves). Not sure if it contains a lot of silica/ash compared to other biomass. -MB

How close can hempseed oil compare to petroleum in things like plastics and lubricants? Could synthetic oil be made from it?

[sonicjesus](#)

You'd need some pretty fancy catalysts to make an industrial synthetic oil from hemp oil. The reason rape seed is used for industrial purposes is that it is high in stable oleic fatty acids while hemp is quite low in oleic. High oleic soybean oil (GMO and hybrid) are moving into this market now. -MB

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We'll be online live to answer questions starting today at 11AM ET. so check back!