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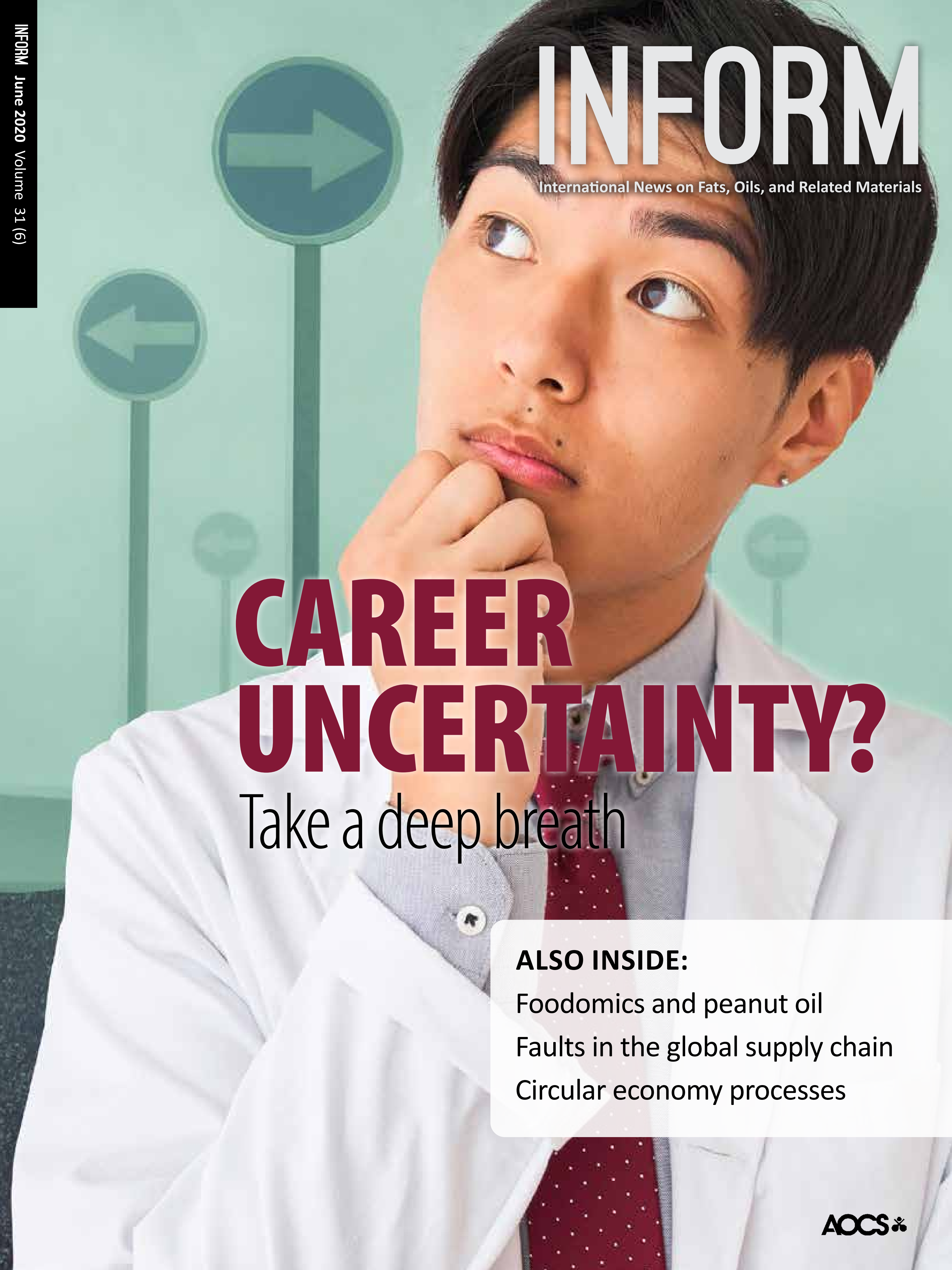

INFORM

International News on Fats, Oils, and Related Materials

CAREER UNCERTAINTY?

Take a deep breath

ALSO INSIDE:

Foodomics and peanut oil

Faults in the global supply chain

Circular economy processes

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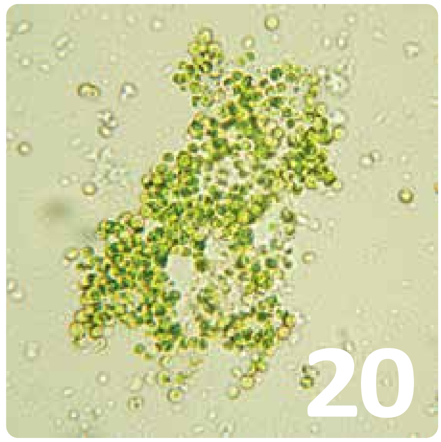

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Managing your career in times of change

Rebecca Guenard

The scars of coronavirus will be visible on the world economy for years to come. Social distancing protocols, implemented to contain the outbreak, altered daily life around the globe for the first half of 2020. Businesses shuttered, and companies enacted work-from-home orders. Billions of people are experiencing an unprecedented strain on their careers. Thankfully, a pandemic is not a regular career concern, but change should be expected.

- **Most of us have spent an uncertain couple of months working from home. Here we offer expert advice on how to keep your career goals while maintaining flexibility in times of uncertainty.**
- **Identify your feelings and take care of yourself.**
- **Stay professional, stay connected, and stay in the present.**

Numerous sources have pointed out that expecting career certainty is the best way to be derailed by change. Yet, it is impractical (and anxiety-inducing) to set career and life goals on a foundational belief that they may someday fall apart. Studies in career development find that individuals with a thoroughly cultivated vocational vision perceive greater satisfaction in their work life. But, as the current health crisis shows, we cannot always predict what challenges our careers will face. While a clear, stable picture of one's goals, interests, and talents are a career asset, flexibility takes precedence.

"The people who are going to succeed are the people who have the most flexibility. In this current circumstance, that means the adaptability to work remotely," says Judith Katz, executive vice president at Kaleel Jamison Consulting Group (https://kjcg.com/). She has worked with companies like American Airlines, Ecolab, and Merck to adjust their culture and help employees adapt to change. She suggests the following five tips for dealing with the career disruptions caused by coronavirus, though their practice should not be limited to this particularly unusual time. Apply these strategies during your company's merger, an acquisition, a denied promotion, or any uncertain time in your career.

RECOGNIZE YOUR TRAUMA

"We cannot avoid the reality of the trauma this is going to create for people," says Katz, referring to the economic effects of coronavirus. For some, that trauma might be caused by a job loss. She says, we cannot be naïve about that possibility as we await the full economic outcome of the pandemic. However, other types of loss take a psychological toll that should be acknowledged.

"The loss of normalcy; the loss of connection. This is hitting us, and we're grieving. Collectively. We are not used to this kind of collective grief in the air," said David Kessler, a grief expert, in a recent article for the *Harvard Business Review* (https://hbr.org/2020/03/). He says that to take power over the grief, we have to acknowledge it.

On the days when you are feeling anxious about managing your composure in a state of uncertainty, it is OK to say that out loud. Let your co-workers know when you are struggling. Ask your team how they are feeling on a scale of 0–10

to avoid the compulsory response, "*I am fine*." Sharing beyond the number should be voluntary, but people should encourage one another to share more information in particularly difficult times.

Only when we accept our emotions can we figure out how to work through them, says Kessler. "When you name it, you feel it and it moves through you," he says. "Emotions need motion. It's important we acknowledge what we go through." Finally, he says to remind yourself that, as with any career change, this is survivable. There will be times in your transition when you doubt that is true. Express those doubts as you feel them, and eventually you will make it through to the other side.

FOCUS ON THE PRESENT

Katz says, though we do not want to be naive about the future, we do not want to put too much energy there, either. For some people, making plans is comforting, but the practice can also be detrimental. Spending a lot of time working out different *what-if* scenarios will raise your anxiety if there are too many unknowns, says Katz. "Focus on the present and what you can do on a day-to-day basis."

In the case of the current health crisis, we do not know how products and services will be changed by statewide or country-wide stay-at-home orders. We do not know how long it will take the economy to recover. We cannot predict what the decision makers in our organization will do in this stressful time. Katz says, some people get frozen while others go into overdrive. They may even go against their better interest because they are afraid, she says. "The challenge for many industries is that they do not know how the shutdown is going to impact their capabilities and profits when it is over," says Katz.

In times of change

Recognize your trauma
Accepting our emotions helps us work through them.

Focus on the present
What is your #1 priority (or top 3) for today?

Do your best work
Be professional, avoid indifference and cynicism.

Take stock of your resources (Be a resource)
Build your network, volunteer.

Practice self-care
Do something life-affirming.

Kessler recommends regular check-ins with the present moment to avoid preforming mental calculus trying to solve all possible career outcomes. "This will be familiar advice to anyone who has meditated or practiced mindfulness, but people are always surprised at how prosaic this can be," he said.

If you find yourself worrying about the future, try shifting your focus to your present space. According to Kessler, naming five things in the room will bring you back to the present. Remind yourself that in the present moment you are safe. Hopefully none of the worst things that your imagination can conjure have happened. But, even if they have, apply your energy to what is within your control. "Instead of focusing on all the unknowns," Katz says, "ask yourself: What is the most important thing to do right now?"

For example, you have all that data you compiled last year. Is this a good time to learn about data visualization? Set a date to present your data story to your group. Maybe you wish your team could be better organized, but you have been too busy with day-to-day work to research project management tools. Is this a good time to investigate if platforms like Basecamp or HubSpot could be a team asset? If you have, unfortunately, lost your job, this is definitely a good time to secure your finances and update your resume.

Whatever your career situation, stay active in the present. Do the tasks that are most important for your present situation and avoid concentrating on things that are out of your control.

DO YOUR BEST WORK

"Do the best job that you can in your current position and, in the back of your mind, know that it could all change," says Katz. A time of uncertainty does not mean that you lower your standards. Maintain professionalism, even when there is turbulence in your career. All the uncertainty can take its toll on your emotions. You may not be able to summon your usual energy or creativity. You may feel frustrated or angry. Resist operating in such a state of mind. Give yourself a break. Go for walks to clear your head or take an afternoon off, if needed.

Change is uncomfortable. It takes time to get good at something. A change can make us resentful that time was wasted and now more time will be required to get good at something new. But change is inevitable, so remember your work ethic and try to maintain it through the transition.

Katz says, this is not the time to become indifferent. Stay engaged and contribute with the same level of excellence. You might not have any control over the change that is happening around you, but you do have control over your reaction to it. When normalcy is restored, your organization will appreciate having a steadfast employee they could rely on through a challenge.

TAKE STOCK OF YOUR RESOURCES (BE A RESOURCE)

"What do you have control over? Think about the things you do have control over and focus on those things," says Katz. "Otherwise it is too much anxiety." One thing we can all do, she says, is maintain our networks.

Further reading

Whole-life career management: a counseling intervention framework, Hirschi, A., *The Career Development Quarterly 68*: 2–17, 2020.

Dare to Lead: Brave Work, Tough Conversations, Whole Hearts, Brown, Brené, Random House, New York, 2018.

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Staying connected to people professionally is an essential part of managing a career. Social distancing required that we all stay apart, but, Katz says, the coronavirus protocols actually gave us time to strengthen our connections. Our colleagues and acquaintances were all experiencing the same uncertainty. A shared experience presents an opportunity to form a bond. Reach out to others in your industry who are experiencing (or have experienced) the same uncertainty as you.

Video conferencing became the new workplace norm during stay-at-home mandates. We got used to coffee breaks, happy hours, and even religious ceremonies over video chat apps. As we begin working onsite again, do not lose this virtual meeting habit. Use it to stay connected with other professionals in your network. Pick five people in your network and schedule a 15-minute Zoom coffee break on a routine basis.

Many of us look forward to conferences to provide a respite from work and social time with like-minded people. Their cancellation this year does not need to be a total loss. If you were looking forward to attending a particular conference session, reach out to the moderator on LinkedIn and express your interest. If you were scheduled to chair a session, invite all your speakers to a virtual coffee hour to meet and discuss your common interest.

Katz says that if her business dried up today, she knows exactly who she would contact. She has built strong connections over a long career by making the intention to get involved. She emphasizes that the best way to build networks is to give of your time and talent. "I always say to people in different organizations that volunteering and doing what you can to be known is critical," says Katz. "Make yourself of value; a valued resource becomes even more important in these times."

Foster professional connections throughout your career. In times of change, a reassuring voice from someone with experience can ease your anxiety and, in turn, as you navigate change through your career, you can be that voice for someone else down the line.

PRACTICE SELF-CARE

"Make sure that you are taking care of yourself and doing things that are life-affirming," says Katz. Exercise, read a book, sew a quilt, take-up salsa dancing. Find something that brings meaning to your life besides your work, she says.

During the coronavirus, outbreak gyms had to be closed. As a response, many online workout services extended their free trial periods. Peloton's app provides workouts for people who have purchased their stationary bike, but they also have instructor lead workouts with no bike required. For a limited time, they offered 90 days of classes for free (https://www.onepeloton.com/). Workouts include walking, stretching, strength training, and even outdoor activities. Similarly, the yoga instruction app, Down Dog, extended its free trial period during the outbreak (https://www.downdogapp.com/). These free trial periods are not unique to the pandemic. Check out exercise studios in your local area. At any point when you are experiencing uncertainty in your career, a cost-free exercise routine can offer a necessary stress release.

If changes in your career have caused a lack of mental stimulation, there are many opportunities to sharpen your skills. Coursera, an online learning site established by Stanford professors, offers several free classes (https://www.coursera.org/). Webinars are also organized in an instructional manner, and you can find a range of subjects by searching YouTube. Check nearby universities for their distance learning or extended education programs. Let a change in your career be an opportunity to reflect on your interests. Pursuing them could have multiple benefits, for your emotions and your career.

Regardless of how you choose to spend your self-care time, make sure to include an emotional assessment. Research by sociologist, Brené Brown, shows that being courageous requires vulnerability (https://brenebrown.com/). If you are bravely facing career changes, there will be times when fear and uncertainty creep into your psyche. That is expected, according to Brown. In those times, practice the things that bring you comfort and share your feelings with people you trust.

The oil seed industry has experienced profound change in the past five years (https://philhoward.net). The big six agrochemical and seed firms consolidated into four companies that now control an estimated 60% of global proprietary seed sales. Dozens of acquisitions and joint ventures have been executed around the world since 2015. Now that we have collectively experienced career upheaval, we can better empathize with the human effect imposed by these corporate transactions. And, on the other side of this global pandemic, there will be yet more change. We hope these expert tips will help you manage it all successfully.

"Make sure that you are doing your best, adding value, and staying connected," says Katz, in summary. "And take care of yourself. If you are not taking care of yourself, then your career will not matter."

Rebecca Guenard is the associate editor of Inform *at AOCS. She can be contacted at rebecca.guenard@aocs.org.*

Foodomics: a good way to study the effects of extraction methods on the composition and nutrition of peanut oil

Yong-Jiang Xu, Yuanfa Liu, and Fan Jiang

- **Processing technology has a significant effect on the composition and nutritional quality of vegetable oil, but the exact mechanism is not very well known yet.**
- **The processing method used can affect the trace components in peanut oil which, in turn, may affect animal metabolism.**
- **Foodomics can be used to uncover the strong associations between specific metabolic alterations and peanut oil trace components, offering new insight into the impact oil processing has on nutritional health.**

Yong-Jiang Xu was scheduled to present, "Metabolomics reveals the toxicological effects of polar compounds from frying palm," at the cancelled 2020 AOCS Annual Meeting & Expo.

Peanut (*Arachis hypogaea* L.) is one of the most popular oil crops around the world due to its high oil content and health effects. In China, peanut oil ranks third in terms of consumption. Many studies have suggested that consuming peanuts or peanut oil is associated with a lower risk of cardiovascular disease (CVD), slower progression of atherosclerosis, and reduced risk of colorectal cancer [1].

Many factors affect the quality of peanut oil, such as peanut varieties, climate, maturity, storage conditions, and processing methods. Among them, the processing technique is one of the important factors.

Foodomics is a discipline that combines food science and nutrition science [2]. It uses a high-throughput approach that uses various fields of study (such as proteomics, genomics, transcriptome, and metabolomics) to understand and improve human nutritional health.

In the article, "Foodomics revealed the effects of extract methods on the composition and nutrition of peanut oil," published in the *Journal of Agricultural and Food Chemistry* [3], we established that foodomics can be a very effective tool to study how different processing methods affect the composition and nutritional function of peanut oil. It can also shed light on the correlation between metabolite differences and variables, which can help us find out how these variables impact human metabolism.

EFFECT OF PROCESSING METHOD ON THE QUALITY OF PEANUT OIL

The main processing methods for peanut oil include cold-pressing, hot pressing, and aqueous enzymatic oil extraction. Cold-pressing avoids the production of harmful components that are generated at high temperatures, such as trans fatty acids and polar substances. However, yields are relatively low, and cold-pressed oils have a lighter flavor. In comparison, hot-pressing produces high yields of refined oil that has a good flavor but is darker, and the comprehensive utilization rate of the oil cake is lower than it is with cold pressing because the albumin in the cake degenerates at high temperatures. Aqueous enzymatic reaction conditions are mild and environmentally friendly, but the oil yield is low, and the flavor is poor.

Liquid chromatography–mass spectrometry (LC-MS) analysis of peanut oils processed using these three methods showed that the levels of most substances, such as *p*-coumaric acid, isorhamnetin, ursolic acid, salicylic acid, cinnamic acid, leonurine, and catechin, were higher in enzyme-assisted aqueous extract oil (EAO) and cold-pressed oil (CPO) than they were in hot-pressed oil (HPO). Moreover, the highest content of formononetin was observed in CPO, while the highest levels of wogonin and methyl 4-hydroxybenzoate and lowest of isovanillin were detected in EAO.

EFFECTS ON ANIMAL METABOLISM

The trace components of peanut oil can affect animal metabolism and even improve metabolic disease induced by a high-fat diet (HFD). The liver and serum of experimental rats administered with peanut oil produced by different processing methods were used as samples for analysis. The procedures used to study the nutritional effects of peanut oil by foodomics is shown in Figure 1.

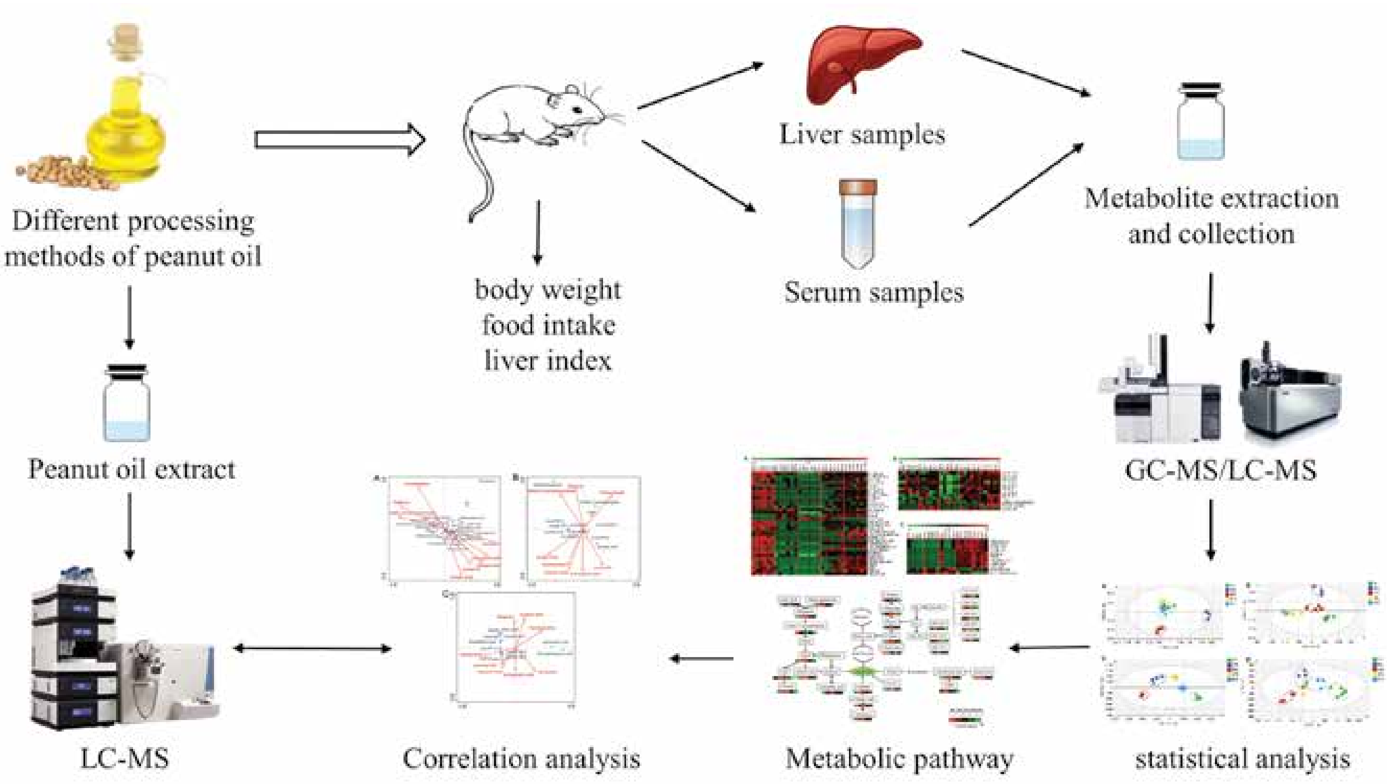

FIG. 1. The process of studying the nutritional effect of peanut oil by foodomics

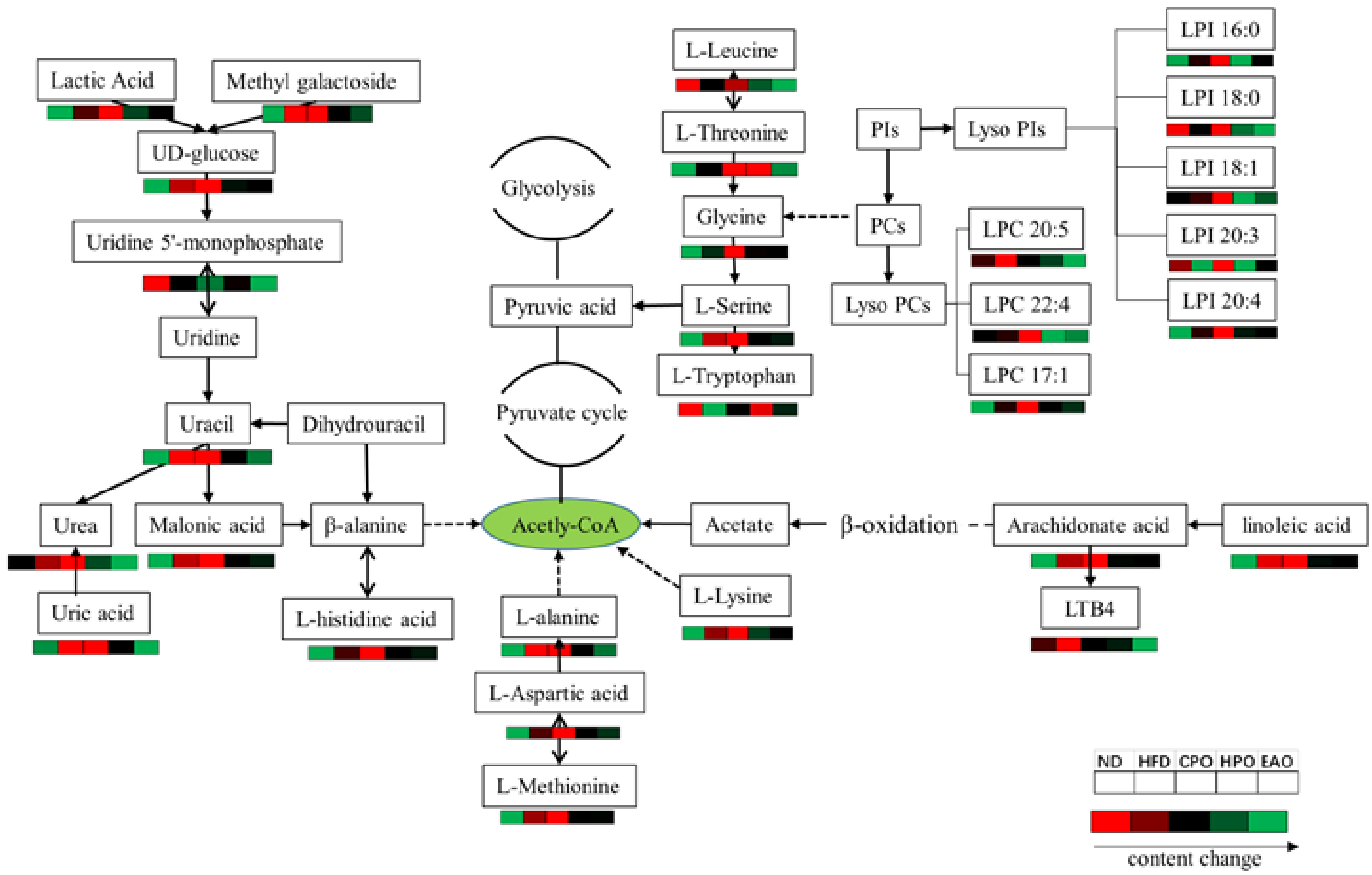

FIG. 2. Major metabolic pathways in SD rats. The color scale indicated the content changes of different substances in the five experimental groups; red indicated the low content, and aluminum indicated the high content.

More than 50 biomarkers were identified by high-resolution and tandem mass-spectrometry based on variable importance for projection (VIP) values (>1.0) and statistical significance levels ($p < 0.05$), including amino acids, lipids, carbohydrates, and nucleoside compounds. The results suggested that peanut oils of different processing methods mainly affect lipid metabolism, carbohydrate metabolism, amino acid metabolism, and nucleoside metabolism in Sprague Dawley® (SD) rats. The metabolic pathways of different metabolites *in vivo* and the variation trend in different groups are shown in Figure 2.

In the liver, significantly altered metabolites include fatty acids and lysophospholipids. Compared with the control group, fatty acids such as linoleic acid, arachidonic acid, and stearic acid were lower in the CPO group, while oleic acid was higher. Consumption of HPO and EAO increased the content of lys-

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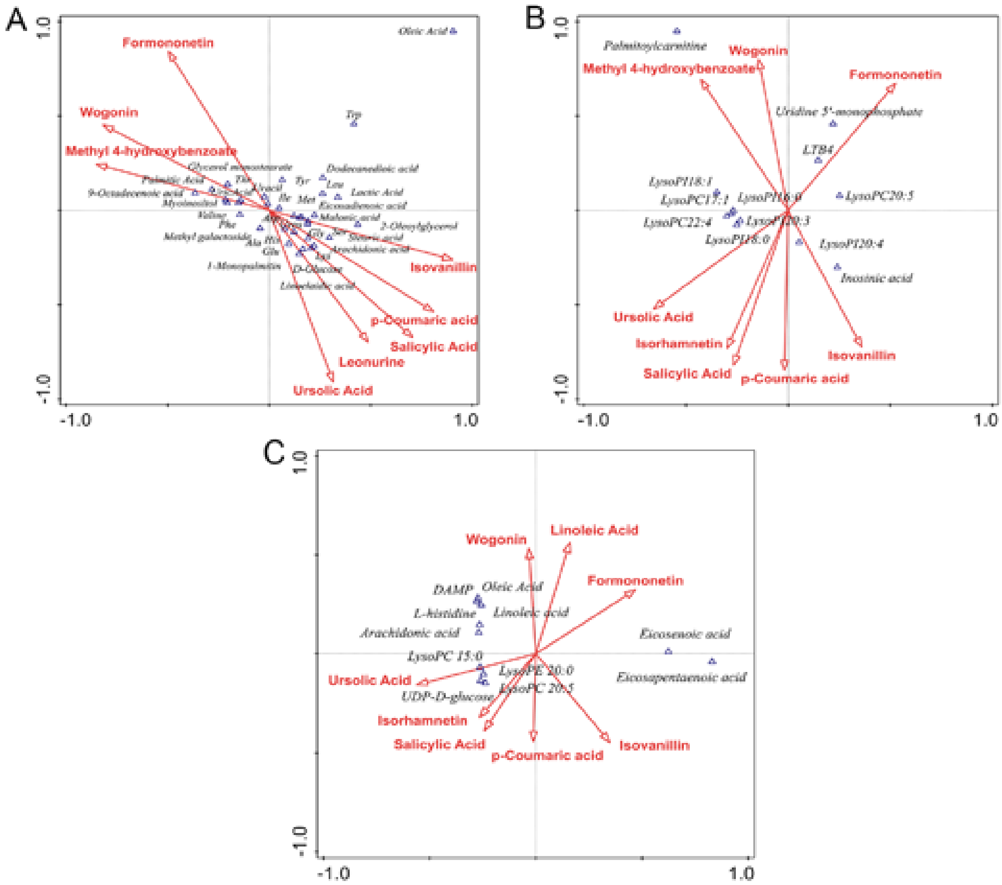

FIG. 3. Canonical correspondence analysis(CCA) of trace substances in peanut oil and biomarkers of SD rat liver and serum samples. (A) Correlation analysis between trace substances and biomarkers of liver samples by GC-MS. (B) Correlation analysis between trace substances and biomarkers of liver samples by LC-MS. (C) Correlation analysis between trace substances and biomarkers of serum samples by GC-MS and LC-MS. The length and angle of arrows shows the contribution of a particular environmental variable to the CCA axes.

ophospholipid in the liver, but CPO reduced its content. The amino acid (including histidine, glutamic acid, lysine, and serine) contents of the normal diet group (ND), HPO, and EAO groups were higher, while the HFD and CPO groups were lower.

At the same time, different processing methods of peanut oil had little effect on serum metabolites. Consumption of HPO and EAO increased the content of L-histidine, arachidonic acid, linoleic acid, oleic acid, and 2'-Deoxyadenosine-5'-monophosphate (dAMP). In contrast, eicosapentaenoic acid (EPA) showed an decreasing tendency in the HPO and EAO groups.

TRACE COMPONENTS IN PEANUT OIL AND ANIMAL METABOLISM

Multiple samples canonical-correlation analysis (CCA) was used to investigate the association of trace component and endogenous metabolites. As Figure 3A shows, the compounds with the highest overall contribution rate were isovanillin, formononetin, and p-Coumaric acid.

Several studies have demonstrated that p-coumaric acid (PCA) has various pharmacological properties, such as strong antioxidant, anti-inflammatory, anti-diabetic, and immunomodulatory activities [4]; formononetin is a natural isoflavone that has been found to lower serum cholesterol levels and improve abnormal lipid metabolism in liver.

The results of our analysis showed that there was a significant negative correlation between myoinositol and methyl galactoside with p-coumaric acid level, suggesting that due to the anti-inflammatory activity of p-coumaric, intake of p-coumaric may affect the body's carbohydrate metabolism (Fig. 3A). Previous studies have revealed that inositol will help glucose to enter adipose tissue through an insulin-dependent signaling cascade, which can be used to treat obesity [5]. Hence, this suggested that hot-pressing and hydroenzyme can reverse the decrease in carbohydrate compounds (except myoinositol) induced by the high-fat diet.

Additionally, oleic acid and tryptophan were positively correlated with isovanillin and formononetin, and our analysis proved that isovanillin, formononetin, and p-coumaric acid had the greatest effect on liver metabolites detected by GC-MS.

In the LC-MS analysis of liver samples (Fig. 3B), ursolic acid and wogonin had the largest overall contribution rate. The highest content of wogonin (5,7-dihydroxy-8-methoxyflavone) was found in the EAO group. Wogonin has been reported to have anti-inflammatory, anti-viral, and anti-fibrosis properties that promote apoptosis of cancer cells [6]. It can be seen that the production of peanut oil by aqueous enzymatic oil extraction increases the content of wogonin, thus affecting the positive or negative correlation of metabolites in the liver. Figure 3B also shows that palmitoylcarnitine, uridine 5'-monophosphate, and LTB4 are positively correlated with formononetin, wogonin, and methyl 4-hydroxybenzoate, among which palmitoylcarnitine is especially significantly correlated. In addition, most lysophospholipids (except LysoPI 20:4 and LysoPC 20:5) were positively associated with the expression of methyl 4-hydroxybenzoate and ursolic acid.

The analysis of serum samples showed that the contribution rate of ursolic acid was 28.5% and that of formononetin was 28.6%. Eicosenoic acid and eicosapentaenoic acid were positively correlated with formononetin and isovanillin. The levels of oleic acid, linoleic acid, arachidonic acid, histidine, and 2'-Deoxyadenosine-5'-monophosphate (dAMP) showed a different trend. These metabolites had a positive relationship with wogonin, linoleic acid, and ursolic acid. LysoPE (20:0), LysoPC (20:5), and LysoPC (15:0) correlated with ursolic acid, isorhamnetin, and salicylic acid (positive correlation), as well as wogoin, linoleic acid, and formononetin (negative correlation). The correlation trend of glucose was consistent with that of lysophospholipids.

In conclusion, the results of this study imply that the processing method can affect the trace components of peanut oil, and the different nutritional effects of those trace components lead to differences in metabolites in the liver and serum of rats. Therefore, we can speculate that the trace components in peanut oil may affect animal metabolism. In general, hot-pressed and hydroenzymatic peanut oil can effectively alleviate the organism injury and liver degeneration induced by a high-fat diet, while cold pressed peanut oil has no obvious effect. However, the specific metabolic pathways and influencing mechanisms of the trace components in peanut oil within the body need further study.

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Toward circular economy by electrodialysis with ultrafiltration membrane: from slaughterhouse blood to natural meat preservative

Laurent Bazinet, Rémi Przybylski, Pascal Dhulster, and Naïma Nedjar

- **The valorization of underestimated and underused bio-food industry co-products by producing products with high added value is key to moving toward a sustainable economy.**
- **Electrodialysis with ultrafiltration membrane (EDUF) technology is a major breakthrough in purification of bioactive peptides, due to its unique size/charge separation and because it is a reliable and cost-effective separation technique.**
- **The excellent microbial growth inhibition and antioxidant capacities of the EDUF peptide fraction showed that it is a promising food preservative that could potentially substitute for synthetic additives that are widely used to protect meat during its storage or distribution.**
- **In keeping with the concept of circular economy, the blood waste from slaughterhouses can thus be recycled into raw materials of the meat industry for production of bioproducts with improved functions.**

The circular economy is an economy that operates in a loop, thus avoiding waste. Its objective is to produce goods while strongly limiting the consumption of raw materials and non-renewable energy sources. How can this be applied to the meat industry?

BLOOD AS A SOURCE OF BIOACTIVE PEPTIDES

Blood from slaughterhouses is an inevitable part of meat production and causes environmental problems due to the low valorization of the very large volumes recovered. Indeed, in 2019, more than 120 million liters of bovine and porcine blood were produced in Canada. Its current use is limited to the animal feed chain (a controversial concept in the context of preventing animal diseases); the rest (about 70%) goes to landfills.

This article is based on a presentation from the cancelled 2020 AOCS Annual Meeting.

The blood is divided into two parts: plasma (60%) and cruor (40%). The cruor, a co-product, represents 70 to 75% of the total blood proteins but it is currently underutilized. This fraction contains more than 90% hemoglobin, a protein widely described as a rich source, after its hydrolysis, of hematopoietic, antimicrobial, antioxidant, antihypertensive peptides [1,2]. One of these antimicrobial peptides, the α137–141 peptide, has recently been reported as a natural promising candidate for the substitution of synthetic additives used to protect meat during its storage and distribution [3].

However, the main challenges in the production of such a bioactive peptide or bioactive fractions are its isolation from the complex feed hydrolysate and its recovery at a concentration that is effectively bioactive. Many approaches proposed the use of pressure-driven processes to extract peptide fraction from complex hydrolysate containing more than 100 peptides, however these processes are not able to separate compounds with similar molecular weights.

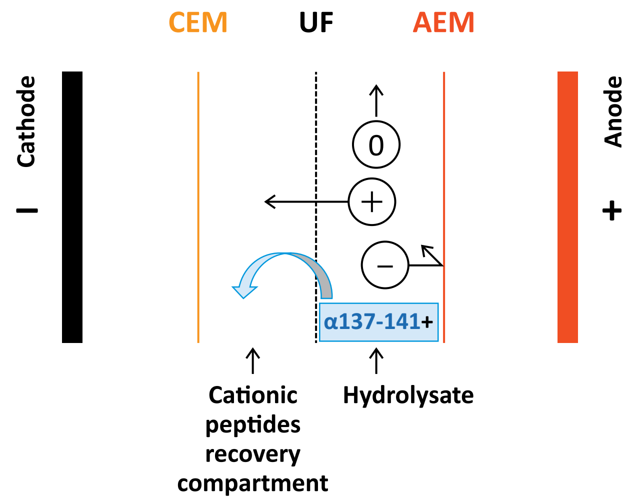

FIG. 1. Schematic representation of electrodialysis with ultrafiltration membrane (EDUF) configuration for cationic peptide recovery. CEM: cation-exchange membrane, AEM: anion-exchange membrane, UF: ultrafiltration membrane

EDUF: A NEW GREEN PEPTIDE-SEPARATION TECHNOLOGY

Electrodialysis with ultrafiltration membrane (EDUF) separates peptides according to their charge (by application of an electrical field) and their molecular weight (due to the molecular weight cut-off of the ultrafiltration membrane) [4]. The process uses a conventional electrodialysis cell in which some ion exchange membranes are replaced by ultrafiltration ones; compounds of molecular weights lower than the membrane cut-off can be separated (Fig. 1).

No pressure is applied in the electrodialysis cell; only the charged molecules migrate under the effect of the electric field, while the neutral molecules stay in the feed solution and do not reach or pass the filtration membrane [5].

The applications are potentially numerous, as already demonstrated by the very different hydrolysate sources on which the technology was tested (snow crab by-product, flaxseed, soybean, salmon, herring milt, whey protein, etc.) and the bioactive peptides recovered (anticancer, antihypertensive, glucoregulatory, anti-inflammatory, antimicrobial, and so on) [5]. Amongst the advantages of this unique technology, we can mention: 1) preservation of the commercial value of the non-bioactive fractions for more conventional low-value uses, since no solvent is used, 2) high selectivity of the process due to the unique simultaneous size/charge separation, 3) reduced membrane fouling since no pressure is applied and only charged molecules migrate under the effect of the electric field, 4) can be easily integrated in an existing industrial production line (after the pressure-driven raw separation process step) or be established in a small industrial unit close to the source of raw material [5].

We used this hybrid technology to recover, from the hydrolysate cruor, a peptide fraction containing the antimicrobial peptide α137-141 in sufficient concentration to be applied as a meat preservative (Fig. 1) [6]. α137-141 peptide was positively charged and also had a small molecular weight (653 Da). These characteristic features facilitated its migration through the ultrafiltration membrane, considering the highest α137-141 purities at low feed peptide concentrations. However, for its potential application, it is important to separate this peptide at high purity and concentration. The α137-141 concentration was increased about 4-fold at a feed peptide concentration of 8% with an enrichment factor superior to 24-fold. This feed peptide concentration also demonstrated the lowest relative energy consumption (4.68 ± 0.24 $Wh.g^{-1}$) [6].

ANTIMICROBIAL AND ANTIOXIDANT ACTIVITIES OF EDUF PEPTIDE FRACTION

The total microbial population evolved more slowly into the meat with the presence of additives for all 14 days of the experiment (Fig. 2). However, no significant difference was observed between the microbial growth into the meat treated by the standard α137-141 peptide and the EDUF fraction regardless of the storage day [6].

The same evolutions were observed for the yeasts and molds, coliform bacteria, and lactic acid bacteria (Fig. 3).

Meat without additives

Meat with additives: peptide fraction

FIG. 2. Peptide fraction from EDUF as antibacterial and antioxidant agents in meat

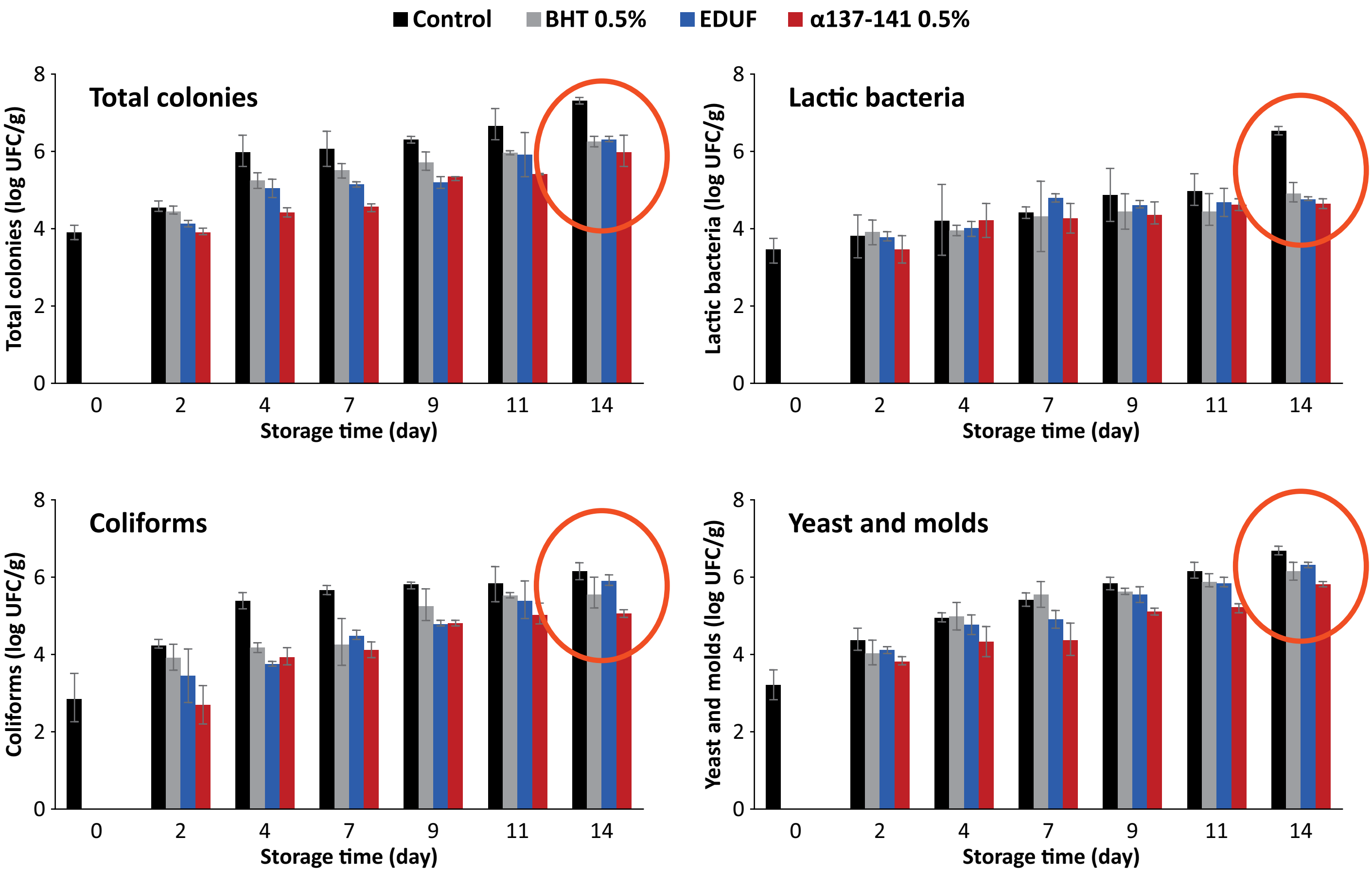

FIG. 3. Survival rates of total viable bacteria, coliform, lactic acid bacteria, and yeasts and molds contained in meat treated by peptide fraction from EDUF, the standard α137-141 peptide, the synthetic butylated hydroxytoluene (BHT), and without treatment

Indeed, no-difference was observed between the two treated groups, but high effects of additives were observed on all counted microbial populations, with a significant effect always seen during day 14 of the experiment [6]. In addition, based on a previous study [3] in which pure α137-141 was compared to the synthetic butylated hydroxytoluene (BHT) in terms of antimicrobial activity, the fact that the α137-141 and the EDUF peptide fraction had similar antimicrobial activities suggests that the EDUF peptide fraction would have an antimicrobial effect close to that of synthetic butylated hydroxytoluene (BHT) (Fig. 3).

Figure 4 shows the evolution of lipid oxidation into the meat under three conditions (without treatment, with the recovered EDUF peptide fractions using 8% feed peptide concentration, and with standard α137-141). For all meat samples, the thiobarbituric acid-reactive substances (TBARS) values increased throughout the 14 days of experiment. For all days, the control (i.e., without additive) had the highest values than all tested conditions, particularly at the end of storage (day 14) [6]. Consequently, the reduction of lipid oxidation into the meat was about 50% for the EDUF fraction and about 60% for the standard α137-141 peptide. This difference could be explained by the presence of other peptides in the EDUF fraction, which reduced its antioxidant activity in comparison with α137-141 peptide alone [6].

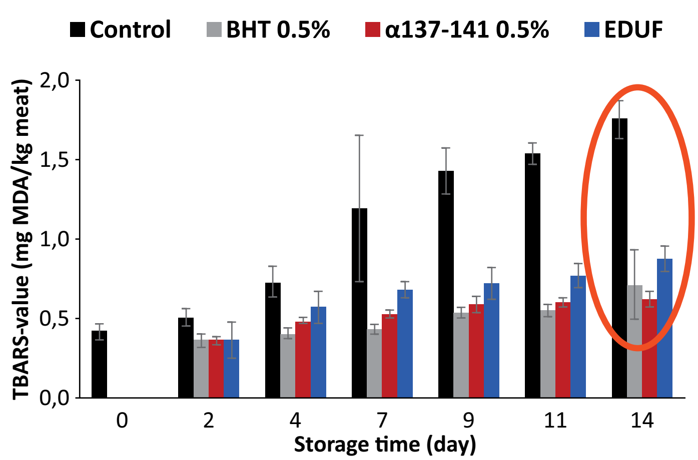

FIG. 4. Comparison of lipid oxidation of the meat treated by peptide fractions from EDUF, the standard α137-141 peptide, and the synthetic butylated hydroxytoluene (BHT) against meat without additive during storage under refrigeration. The lipid oxidation was quantified by the measurement of the thiobarbituric acid-reactive substances (TBARS)

EDUF IN THE CIRCULAR ECONOMY OF MEAT AND FUTURE DEVELOPMENTS

The production of an antimicrobial/antioxidant peptide fraction from a waste in an energy-efficient and sustainable way using EDUF fits perfectly with the concept of circular economy.

Indeed, under the concept of circular economy, the blood of the slaughterhouse is, after centrifugation, the source of hemoglobin. This protein, once hydrolyzed, allows the bioproduction of antimicrobial and antioxidant peptides (ecological bioproducts) that can be separated by EDUF and then used on meats or meat products to increase their preservation and safety: Blood waste from slaughterhouses is thus recycled into raw materials of the bio-food or meat industry for production of bioproducts with improved functions.

This type of food waste bioconversion could reduce the environmental impact of industrial activities by minimizing synthetic additives production. Moreover, this way of waste transformation improves food production sustainability by harnessing by-products. This work has the potential to reduce waste in an efficient, economical, and ecological manner in the short term, and to maximize the value of resources in the medium term by demonstrating, among other things, the beneficial effects on food safety of these bioactive peptides coming from blood or other natural resources.

The next steps of this work, which are already under way, are: 1) the scale-up of the EDUF technology to an industrial scale, 2) the development of the production of antimicrobial/antioxidant peptides from blood hydrolysis of other sources such as pork, chicken, etc.), 3) the study of other natural by-products as sources of bioactive molecules (antihypertensive, anti-inflammatory, and so on) after EDUF separation, and 4) to produce larger quantities of EDUF fractions to demonstrate their bioactivities *in-vivo*.

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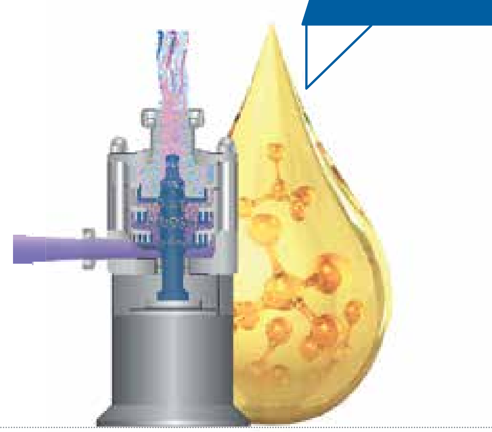

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Improving oil production in plants and microalgae by engineering performance-enhanced diacylglycerol acyltransferase 1

Yang Xu, Stacy D. Singer, and Guanqun Chen

- Certain plants and microalgae accumulate storage lipids, mainly in the form of triacylglycerol (TAG).
- Due to the widespread use and value of such oils, much research has been dedicated toward increasing lipid contents in source organisms.
- One promising approach to achieve such lipid gains is through the engineering of acyl-CoA:diacylglycerol acyltransferase (DGAT) enzymes with enhanced performance.
- This article reviews recent efforts to engineer performance-enhanced DGAT1, as well as their implications in boosting oil production in oleaginous organisms, and considers the potential value of improving additional membrane-bound acyl-CoA-dependent enzymes in the future.

Triacylglycerol (TAG) represents the major form of reduced carbon and storage energy in most oleaginous plants and microalgae, and has important implications for food, nutrition, and oleochemical industries. The global demand for plant-derived TAG has been consistently rising over the past few decades, and is expected to continue increasing due to our ballooning population and growing reliance on TAG-derived chemicals. To meet this demand, interest in manipulating plant and microalgal oil production using biotechnological approaches has gained momentum in recent years (for a review, see Xu, *et al.*, 2018).

In plants and microalgae, TAG is assembled via acyl-CoA-dependent and acyl-CoA-independent pathways which involve catalysis by a series of acyltransferases (for a review, see Xu, *et al.*, 2018). Acyl-CoA:diacylglycerol acyltransferase (DGAT) catalyzes the final step of acyl-CoA-dependent

This article is based on an invited presentation from the cancelled 2020 AOCS Annual Meeting.

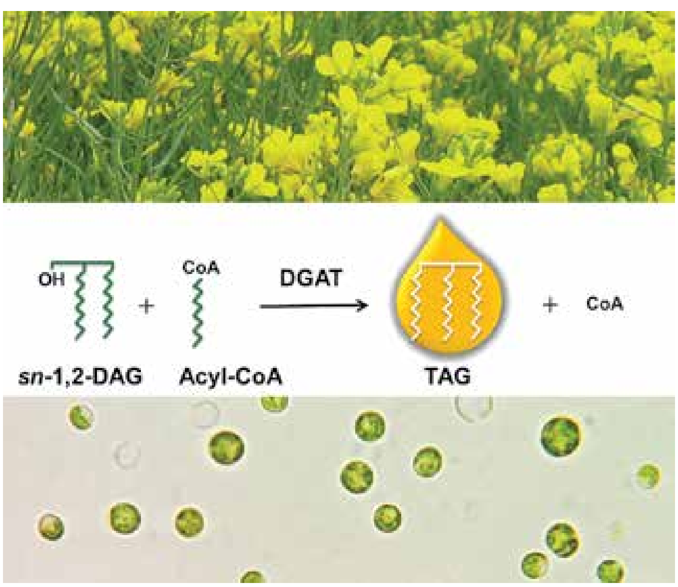

FIG. 1. Diacylglycerol acyltransferase (DGAT) catalyzes the final step of triacylglycerol (TAG) assembly in the Kennedy pathway (acyl-CoA-dependent pathway). A canola field (photo by Chris Kazala, University of Alberta) and cells of the green microalgal *Chromochloris zofingiensis* (photo by Yang Xu, University of Alberta) are also shown. Other abbreviations: CoA, Coenzyme A; DAG, diacylglycerol.

(Kennedy pathway) TAG biosynthesis by transferring an acyl group from acyl-CoA to the *sn*-3 position of *sn*-1,2-diacylglycerol to form TAG (Fig. 1).

There are two major forms of membrane-bound DGAT (DGAT1 and DGAT2) that predominantly contribute to TAG accumulation in plants and microalgae. In plants, DGAT1 is considered to be a major determinant of TAG accumulation in oil crops, such as rapeseed (*Brassica napus*) and safflower (*Carthamus tinctorius*), whereas DGAT2 appears to be more important for the formation of TAG containing unusual fatty acids. The relative contribution of DGAT1 and DGAT2 to TAG biosynthesis in microalgae, however, remains largely unexplored, although more copies of DGAT2 are present in many microalgal species than DGAT1. DGAT is generally believed to play an important role in governing the flux of carbon into TAG, and, therefore, has been used as a popular target of gene manipulation for boosting oil production. For example, it is now well-known that the over-expression of *DGAT* cDNAs can boost oil production and tailor the fatty acid composition of oils in oilseeds, vegetative tissues, and microalgae. In addition to using wild-type DGAT amino acid sequences, efforts to create DGAT variants with improved catalytic properties have also been undertaken, which may open up a new avenue for engineering TAG production.

Because DGAT has an integral membrane protein with multiple transmembrane domains, its engineering is hampered by the absence of a three-dimensional structure and limited information on the catalytic mechanisms of the enzyme. Indeed, the very first three-dimensional structure of human DGAT1 was not revealed until very recently (Wang, *et al.*, 2020). Therefore, initial attempts to engineer DGAT performance largely relied on natural variation and sequence-based prediction (for a review, see Xu, *et al.*, 2018). Natural variation in DGAT1 was identified in a high-oil maize line, in which a phenylalanine insertion at position 469 of DGAT1 was credited for the increased enzyme activity and oil content of the seeds.

Amino acid residue variation in isoforms of plant DGAT also provides potential mutation sites for higher enzyme performance. For example, a polymorphism in the second codon of *B. napus* DGAT1 was found to substantively affect the accumulation and activity of the recombinant enzyme in yeast. Similarly, introducing the amino acid residue substitutions, which were derived from the sequence variations in eight peanut (*Arachis hypogaea* L.) DGAT2 isoforms, to one peanut DGAT2 isoform increased enzyme activity. DGAT performance has also been engineered by mutating possible regulatory sites based on sequence-based prediction. In this case, substitution of a serine residue with an alanine residue in *Tropaeolum majus* DGAT1 enhanced enzymatic activity, and the over-expression of the *TmDGAT1* variant in the model plant *Arabidopsis thaliana* led to higher seed oil content gains than the wild-type enzyme. This amino acid site has also been identified in *B. napus* DGAT1, and is located in a putative SnRK1 consensus site, which is phosphorylated and inhibited by this kinase.

The pace of DGAT engineering has been enhanced in recent years through the use of directed evolution, which is an especially powerful tool for proteins lacking structural information. By using a yeast-based high-throughput system, dozens of improved DGAT1 variants have been identified from randomly mutagenized libraries of *B. napus* DGAT1 and *Corylus americana* DGAT1, which were generated using error-prone PCR and DNA shuffling, respectively (Chen, *et al*., 2017; Roesler, *et al*., 2016). The resulting DGAT1 variants exhibited improved catalytic and kinetic properties, and their over-expression resulted in enhanced oil production in tobacco leaves and soybean seeds, respectively (Xu, *et al*., 2017; Chen, *et al*., 2017; Roesler, *et al*., 2016). More importantly, these identified beneficial amino acid substitutions (Fig. 2) also have the potential to be used to improve DGAT1s from other crops such as *Camelina sativa* and soybean (*Glycine max*) (Xu, *et al*., 2017; Roesler, *et al*., 2016).

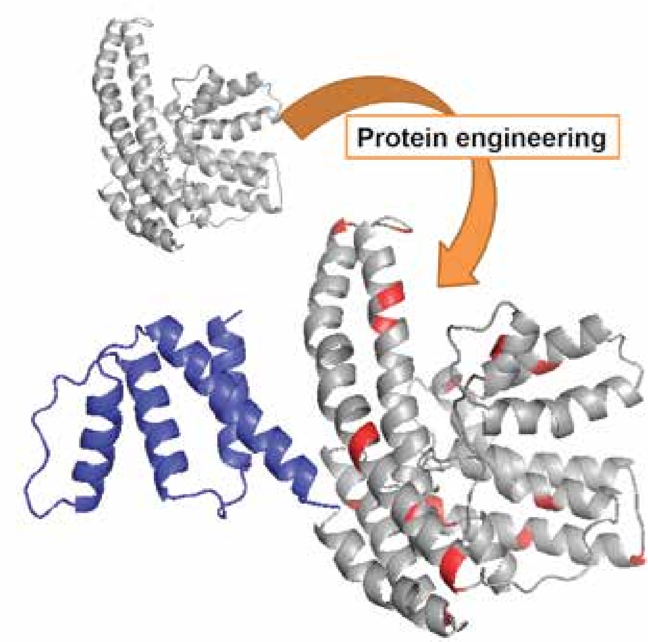

FIG. 2. Illustration of the improvement of diacylglycerol acyltransferase 1 (DGAT1) using protein engineering strategies. The predicted three-dimensional structure of DGAT1 (shown in grey) from the green microalga *Chromochloris zofingiensis* was used as a representative to show beneficial amino acid reside substitution sites (shown in red) identified from plant DGAT1. *C. zofingiensis* DGAT1 was also engineered for enhanced performance by fusion with an *Arabidopsis thaliana* acyl-CoA binding protein (shown in blue).

Another approach to engineer DGAT involves protein fusion. Recently, the fusion of an acyl-CoA binding protein (ACBP) to the N-terminus of an algal DGAT1 (Fig. 2) was found to yield a kinetically improved enzyme variant with augmented protein production levels in both yeast cells and tobacco leaves compared to wild-type enzyme, and also boosted oil production in both systems (Xu, *et al*., 2020). This type of N-terminal

Further reading

Chen, G., Y. Xu, and R.M.P Siloto, *et al*., High-performance variants of plant diacylglycerol acyltransferase 1 generated by directed evolution provide insights into structure function, *Plant J. 92*: 167–177, 2017, doi: 10.1111/tpj.13652.

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fusion could possibly lead to improved protein stability and/or translation efficiency, which would explain the increases in both DGAT1 and oil accumulation seen in this study. Moreover, fusion with ACBP could also improve the kinetic properties of DGAT1 by enhancing its substrate affinity. Since ACBP is involved in the binding and transportation of acyl-CoA, and provides substrate for DGAT and other acyl-CoA-dependent acyltransferases, the fusion of ACBP and DGAT1 could facilitate substrate feeding of DGAT through the capture and channeling of cytosolic or membrane lipid bilayer-localized acyl-CoAs to DGAT by proximity. This fusion strategy could also hold promise for the engineering of other membrane-bound acyl-CoA-dependent enzymes.

In summary, since the importance of DGAT in oil biosynthesis has been recognized, manipulating DGAT activity has been in the spotlight as one of the most important approaches to improve plant and microalgal oil production. To date, the over-expression of cDNA encoding wild-type DGAT, or performance-improved DGAT variants has been successfully applied in the engineering of oilseed crops and microalgae for higher oil content and tailored fatty acid profiles. To further our progress in this area, it will be essential that we advance our understanding of the *in planta* molecular catalytic mechanisms of the enzyme, as well as the regulatory and interactive networks involving DGAT in TAG biosynthesis. As a first step in this direction, the recently resolved three-dimensional structure of human DGAT1 (Wang, *et al*., 2020) may provide new perspectives for improving plant DGAT performance using rational design.

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Characteristics and processing challenges of camel milk cream

Islem Mtibaa, Giorgia Purcaro, Hamadi Attia, Mohamed Ali Ayadi, and Sabine Danthine

In some tropical and sub-tropical arid as well as semi-arid regions of Africa and Asia, camel milk is regarded as an essential source of nutrients in the human diet. Indeed, camel milk is popular for its nutritional and therapeutic properties thanks to its high content of essential fatty acids (C18:2, C18:3) and bioactive substances (immunoglobulins, lactoferrin, lysozymes, among others).

- **This article compares the chemical composition, physical, and nutritional properties of camel milk fat to that of cows.**
- **The microstructure of camel fat globules and specific fatty acid composition constitute an obstacle in butter technology.**
- **Despite the high nutritional value of camel cream, limited information exists about the manufacture of butter from it.**

This article is based on a poster presentation from the cancelled 2020 AOCS Annual Meeting.

Camel milk fat is dispersed in milk in the form of small droplets called fat globules. These camel fat globules present two main particularities when compared to those of cow milk. First, camel milk has a higher proportion of smaller globules and a lower mean fat globule diameter (2.6 micrometer vs 3.6 micrometer, for camel and cow, respectively). Second, the membrane surrounding camel milk fat globules—known as the milk fat globule membrane (MFGM)—is thicker than that of cow milk fat globules. In addition, studies of camel MFGMs showed that it is poor in proteins but rich in neutral lipids and in phospholipids. These particular properties lead to difficulties in milk skimming by centrifugation and a slow rate of spontaneous creaming during storage. Moreover, some authors have attributed the low spontaneous creaming of camel milk cream to the absence of agglutinin. In cow milk, this whey protein adsorbs itself at the surface of cold fat globules and facilitates their clustering.

The rheological properties of camel milk are also affected by the globule size, distribution, and by the properties of the globule membrane. In fact, camel milk cream is more viscous than cow cream due to the higher thickness of the globule membrane and to the relatively higher amount of phospholipids.

At ambient temperatures (20°C–25°C), camel cream appears to be stickier and more greasy than cow cream. These characteristics can be explained by an important solid to liquid ratio in camel milk fat.

Analysis of the fatty acids (FA) composition shows great differences between camel and bovine milk fats (Table 1). The FA profile of camel milk fat varies as a function of geographic location as well as environmental and physiological factors (e.g., diet, stage of lactation, and genetic

differences). Several authors indicated that camel milk fat contains a lower amount of short-chain FA (C4-C12) and less saturated FA as compared to bovine milk (2.47% vs 12.01%, respectively).

The cause of this low amount of short-chain FA is not adequately explained: Some authors suggest that it is due to the rapid metabolizing of these fatty acids by camel tissues before being excreted in the milk; some other authors correlate it with the nature of camel feeding.

The most abundant saturated fatty acids identified in camel milk fat are C14:0, C16:0, and C18:0. The comparative amounts of these saturated FA in camel and cow milk fat is still discussed by authors. Furthermore, several researchers have found a higher proportion of unsaturated fatty acids in camel milk fat as compared to cow milk fat, especially with respect to C16:1 and C18:1. Some authors found a higher percentage of C18:3ω3 and traces of arachidonic acid, which is interesting from a nutritional point of view.

Camel milk fat has a very different triacylglycerols (TAG) composition than cow milk fat. Some studies revealed a lower percentage of CN22-CN34 TAGs, due to the low level of short-chain fatty acids. The most predominant TAGs found in camel milk fat are CN46, CN48, CN50, and CN52, with a maximum level for CN48.

The differences in fatty acid and TAG composition imply differences in the melting profile and crystallization behavior. Camel milk fat has a broad melting range, and thermograms show that it presents more melting peaks than cow fat, which is consistent with the differences in their TAG compositions (Fig. 1, page 26). Melting of the camel milk fat starts around –26°C and is completed at about 43°C. The final melting temperature and the thermal enthalpy are higher in camel milk fat.

TABLE 1. Fatty acid composition (w/w %) of camel and cow milk fat

Fatty acids	camel	cow
C4:0	0.60	2.60
C6:0	0.22	1.65
C8:0	0.21	1.12
C10:0	0.25	2.75
C12:0	1.19	3.89
C14:0	13.11	13.05
C14:1	0.70	1.70
C15:0	0.10	1.50
C16:0	31.45	38.59
C16:1	11.62	2.30
C18:0	16.12	8.65
C18:1	20.70	20.52
C18 :2	1.19	1.92
C18 :3	1.33	1.34
C20:0	0.49	0.49
C4-C12	2.47	12.01
unsaturated fatty acids	35.54	27.78

Source: Attia *et al.* 2000

These characteristics are consistent with the relatively higher proportion of long-chain fatty acids that represent an important fraction of high melting point TAG and a lower percentage of triacylglycerol that melt in the medium range.

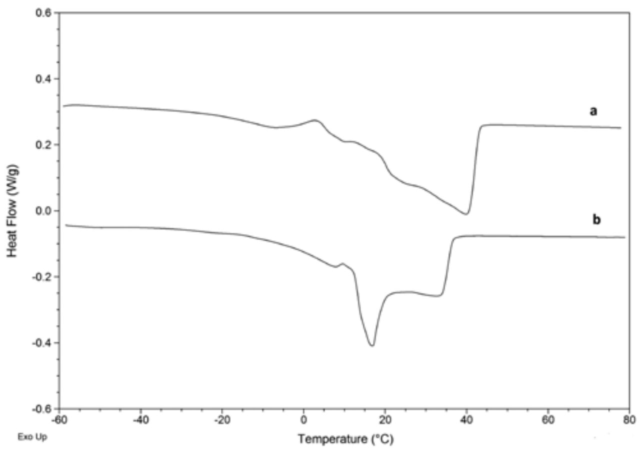

FIG. 1 Melting curves of camel milk fat (a) and cow milk fat (b)

From a technological point of view, these specific characteristics of camel milk fat lead to some butter-making difficulties. These difficulties are attributed to the higher proportion of small fat globules and the fat globules membrane thickness.

It is thus difficult to produce butter from camel milk fat using the same technology as for butter from bovine milk. Few studies have dealt with the possibility of making butter from camel milk. It was found that it is necessary to use a churning temperature close to 25°C to facilitate the phase inversion. This churning temperature is higher than that usually found for cow cream (10–15°C); this can be explained by the higher level of high melting point TAG in camel milk fat, as just described.

FIG. 2 Washed camel butter

Sensory analysis showed that camel milk butter is white, which is probably attributed to the low betacarotene content of camel milk (Fig. 2). Its flavor is also less intense compared to that of butter made from cow milk. This can be explained by the lower proportion of short-chain fatty acids, which play an important role in butter's flavor.

Although camel milk fat can be considered to be more nutritional than cow milk fat, studies on the butter-making process from camel cream are still scarce. Hence, more detailed studies regarding butter-making technology are needed to enhance the utilization of camel milk fat.

As cream ripening is one of the most crucial steps of butter manufacturing, we are currently investigating the effects of ripening conditions on camel cream crystallization related to the churning process.

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Use of high-pressure processing (HPP) as an alternative method to standard raw milk processing

Anastasios Koidis and Theano Stoikidou

- High-pressure processing (HPP) can successfully decrease the concentration of spoilage bacteria and enzymes, as well as the concentration of pathogens in milk.
- The fat and milk casein particle sizes after HPP in raw milk are similar to those in raw milk, resulting in products with organoleptic quality comparable to fresh milk.
- HPP could be an alternative method for the dairy industry to produce microbiologically safe milk with fresh-like characteristics.

This article is based on the paper: "The effect of high-pressure processing on the safety, shelf life, and quality of raw milk," Stratakos, A.C., E.S. Inguglia, M. Linton, J. Tollerton, L. Murphy, N. Corcionivoschi, A. Koidis, and B.K. Tiwari, *Innovative Food Science and Emerging Technologies 52*: 325–333, 2019.

Milk is an integral part of the human diet and has a high nutritional value; it is a great source of proteins, lipids, minerals, and vitamins. Although the demand for fresh milk with high nutrient content and high organoleptic quality has steadily increased, raw milk has been perceived to be a cause of highly contagious bacterial diseases. Numerous studies have focused on developing methods to limit the health risks of raw milk consumption. The prevalent method is thermal pasteurization, introduced around the 1920s. In principle, pasteurization uses mild heat (72°C for 15 seconds) to inactivate pathogens in raw milk and limit spoilage by bacteria and enzymes. As a result, the shelf life of fresh milk is extended.

Even with advances in the processing equipment over the years, the main problem associated with pasteurization is that the heating process compromises milk's organoleptic and physicochemical properties. This is a particularly inevitable effect of some of the new heating technologies that have been introduced, such as Ultra High Temperature (UHT) or High Temperature Short Time (HTST) pasteurization, which use even higher temperatures (e.g., 100°C for 1 second). Such high-tem-

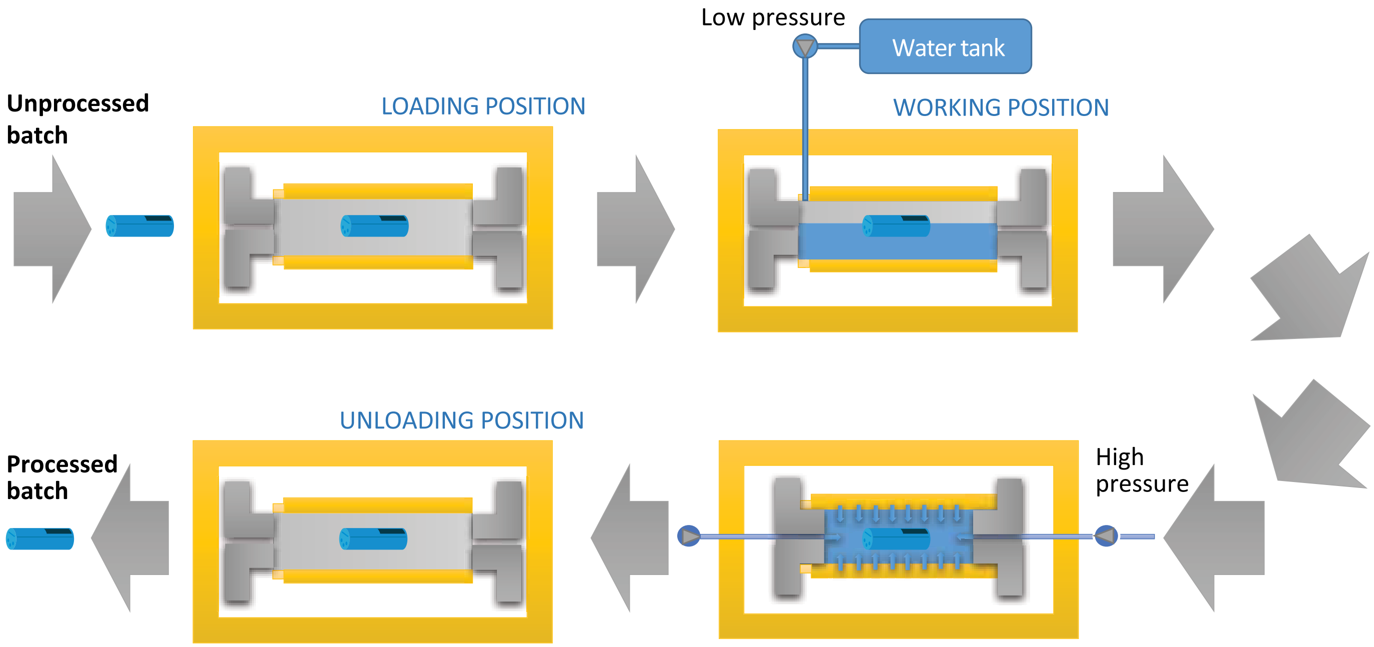

FIG. 1. The products are subjected to a high level of isostatic pressure (300–800 MPa) for approximately 3–6 minutes at + 4°C to 10°C or ambient temperature. The pressure vessel has a holding capacity of approximately 350 liters and a production capacity of 1,500 kg per hour. Adapted from https://www.toripiha.fi/en/high-pressure-processing and https://tinyurl.com/vbl3wza.

perature processes increase shelf life and convenience (storage at room temperature) at the expense of milk's flavor and other organoleptic characteristics (Jo, *et al.*, 2018) An interesting alterative is high-pressure processing (HPP), a cold pasteurization method that in theory has the potential to fully retain the original flavor, aroma, and micronutrients of fresh milk while extending its shelf-life.

WHAT IS HPP AND HOW DOES IT WORK?

High-pressure processing (HPP) is a volumetric preservation method by which liquid or solid foods are subjected to extreme pressures, usually between 300 and 800 MPa (sometimes as high as 1000 MPa), with or without packaging. During processing, the food is placed inside a pressure vessel and submerged in a pressure-transmitting medium, such as water (Fig. 1).

IS HPP EFFECTIVE?

Effect on the inactivation of milk pathogens: Different pressure levels (400–600 MPa) and exposure times (1–5 min) have been tested and reported in the literature against artificially inoculated pathogenic *E. coli, Salmonella*, *and L. monocytogenes***.** Generally, the inactivation of milk pathogens can be more pronounced by increasing the pressure level and the exposure time, but even at a low-pressure level (400 MPa) and exposure time (1 min), the application of HPP can result in a significant reduction ($P < 0.05$) in the levels of milk microorganisms. The lowest HPP condition set capable of reducing the levels of pathogenic bacteria, such as as *E. coli, Salmonella* and *L. monocytogenes*, by >5 log is the 600 MPa for 3 min set (Stratakos, *et al.*, 2019*).* Similar results were observed after applying pressure to UHT whole milk *(*Guan, *et al.,* 2005*).*

Effect on microbiological shelf life: According to our study, HPP (600 MPa for 3 min) significantly reduced total viable bacteria count (TVC*), Enterobacteriaceae*, lactic acid bacteria, and *Pseudomonas spp*., thereby prolonging the microbiological shelf life of milk by 1 week compared to pasteurized milk.

HPP AND ORGANOLEPTIC QUALITY

Effect on casein and fat particles: The size of the milk particles affects milk's microstructure and physicochemical and organoleptic properties, such as colloidal stability, texture, and color. Hence, the effect of HPP on the particle size is an important aspect.

HPP can influence milk constituents, such as proteins and fats, whereas vitamins, amino acids, simple sugars, and flavor and other compounds tend to remain unaffected. Particle size distribution curves of raw, pasteurized, and HPP milk showed that the casein and fat particle sizes were more similar in raw and HPP milk compared to the sizes in pasteurized milk.

Color evaluation: The scattering of light particles by fat globules and casein micelles is the reason why milk has a white color. Generally, the Hunter Luminance value (L* value) is used as a measure of the whiteness of a liquid *(*Harte, *et al.,* 2003*).* As already discussed, different treatments can cause changes in the size of fat particles and micelle disintegration, resulting in different light scatter and therefore differences in color. According to our study, pasteurized milk presented the highest L* values; significant changes could be detected after HPP with L* closer to raw milk L* values.

Significant differences were observed in the color parameter -a* (greenness) of raw milk compared to HPP and thermal treated milk. For the +b* value (yellowness), HPP caused a significant increase compared to raw milk and to pasteurized milk samples. Similar studies reported that milk subjected to HPP or thermal treatment followed by high pressure loses its white color and turns yellowish *(*Harte, *et al.,* 2003*).*

Based on our findings, treating raw milk with HPP can extend its shelf-life, as it reduces the levels of TVC*, Enterobacteriaceae,* lactic acid bacteria, *and Pseudomonas spp.* Applying HPP can also reduce the concentration of pathogens, such as *E. coli, Salmonella*, *and L. monocytogenes*, by 10^5-fold and achieve that "cold pasteurization" status. The organoleptic characteristics, such as color and mouthfeel sensation, can be maintained because the fat and casein particle sizes are similar to unprocessed milk.

Therefore, although HPP cannot operate in such large volumes to fully replace conventional pasteurization, it was proven to be a viable alternative method for fresh milk treatment, as it arguably makes microbiologically safe milk that elevates at the same time its keepability and its organoleptic and nutritional profile.

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A global supply chain, what could go wrong?

Olio is an Inform *column that highlights research, issues, trends, and technologies of interest to the oils and fats community.*

Rebecca Guenard

On the last day of 2019, Chinese Health officials informed the World Health Organization about a mysterious illness spreading among its citizens. In the following weeks, Chinese scientists identified the source of the illness as the novel coronavirus and succumbed to the reality of its deadliness and exponential transmission. Even before the virus left China's shores, the outbreak affected the rest of the world. The incurable virus could only be stopped if everyone limited its spread by staying home. The Chinese government shut down parts of the country, and the cogs of the global supply chain came to a halt.

Economists envisioned globalization as an ideal, international division of labor where low-paying jobs went to those most in need, elevating factory workers to higher-paying positions, and optimizing financial returns for all. In the past decade, some have acknowledged globalization's flaws, but the coronavirus pandemic exposed the catastrophic potential that has always existed in a global supply.

For as long as there have been humans, there has been trade. Since the days of the Silk Road, in the first century B.C., global trade has been the norm. The popularity of globalization has fluctuated over the years but became a tour de force after the fall of Communism in parts of Europe and the Soviet Union. In 1995, the World Trade Organization (WTO) was established to reduce tariffs and barriers to trade. At the same time, the development of the internet lowered trade barriers even further. According to a report by the World Economic Forum (https://www.weforum.org): "The internet also allowed for a further global integration of value chains. You could do R&D in one country, sourcing in others, production in yet another, and distribution all over the world."

China functioned as an agriculturally based economy until 2001, when they became a WTO member. The country quickly established itself as an inexpensive production source, stoking the global economy fires into a blaze. Trade became the source of over half of the world's GDP. The upside of globalization has been worldwide economic growth, with cheaper products and a larger middle-class population. Corporate profits ballooned from reduced labor costs, subsidies, and tax breaks from China.

However, in the past five years, global trade has waned in popularity, observable in its shrinking contribution to global GDP. This trend can be attributed to a few different causes. First, workers in the United States and many European countries did not experience the higher (or even equivalent) wage jobs that economists predicted. According to the MIT economist David Autor, in the United States alone, 2 to 2.4 million of those jobs were displaced by globalization. Meanwhile, Chinese labor costs have slowly increased. Next, climate change has been exacerbated by globalization. Pollution from China's factories combined with the freight emissions from transporting products around the world have increased the amount of greenhouse gases in the environment over the past decade. Now, the current health crisis highlights another prominent issue: A single-source supply chain is not viable should anything go wrong.

Half of the world's surgical masks, for example, are made in China, which quickly halted export of the product in the wake of the coronavirus outbreak (https://www.nytimes.com). For a time, parent companies like Minnesota-based 3M and Canada's Medicom were restricted from shipping their product out of the country. A similar ban was issued by the Indian government , which prohibited the export of masks, ventilators, and textiles for masks and coveralls amid the pandemic (https://economictimes.indiatimes.com). Restricting exports

assured that their own citizens would have adequate supplies in case manufacturing plants were required to shut down for transmission prevention or worker illness.

Along with medical supplies, cleaning products have also been affected by supply chain interruptions (https://news.bloombergenvironment.com). In an article for *Bloomberg*, John Nothdurft, director of government affairs for ISSA–The Worldwide Cleaning Industry Association, said the raw materials needed for cleaning supplies "cannot solely be sourced." Even the textiles used to make the towelettes in wipe canisters are limited by the disconnected supply chain.

Bloomberg reports that according to US trade association officials, disinfectant ingredients stopped arriving from China in mid-March. China is recovering from the virus and getting its manufacturing back online, but the limited supply means cleaning product manufacturers are paying a premium for shipping, according to Robert F. Helminiak, vice president of the Society of Chemical Manufacturers and Affiliates. In addition, US manufacturers are hampered by tariffs imposed on imports from China. Helminiak says, if the Office of the US Trade Representative could lift the tariffs during the state of emergency, it would help the supply chain eventually catch-up.

As best as they can, companies are attempting to shift to a domestic supply. Isopropyl alcohol producer Dow Chemical converted a manufacturing plant in Stade, Germany, to make hand sanitizer. Alcohol distilleries are doing the same—although these types of transitions are not without barriers. Dow first had to receive regulatory waivers to sell hand sanitizer, and some distilleries had difficulty acquiring denaturing chemicals.

As the world gets creative with circumventing breaks in medical and cleaning supply chains, leading nations are keeping an anxious eye on pharmaceuticals. Recently, US and European leaders have raised alarms about the increasing amount of active pharmaceutical ingredients (APIs) manufactured overseas. Last summer, hearings held by the US-China Economic and Security Review Commission, a US congressional body, revealed that disruption of irreplaceable APIs could increase mortality rates in the country. Antibiotics are of particular concern. For instance, the United States closed its last penicillin fermenter in 2004. And, according to the *Economist*, Joerg Wuttke, president of the European Union Chamber of Commerce in China, says that pharmaceuticals are a topic of concern when he visits officials across the EU (https://www.economist.com).

Pharmaceutical companies tend to maintain at least a six-month stockpile of drugs, but as the coronavirus spreads, much of that stockpile is being depleted. There is a dwindling supply of painkillers, necessary for intubation, and antibiotics to treat secondary infections.

Should another virus wave swell in the fall, there would not be enough time to build back the stockpile. Leaders would struggle to even plan for such a crisis, since the API supply chain is largely unknown (https://www.fiercepharma.com).

During US congressional hearings in October, Janet Woodcock, the US Food and Drug Administration (FDA) director of the Center for Drug Evaluation and Research, said: "The FDA doesn't know whether Chinese facilities are actually producing APIs, how much they are producing, or where the APIs they are producing are being distributed worldwide, including in the United States." This is because, although the FDA licenses API production to plants in China and India, there is no real-time data to determine their contribution to the supply chain. "We do not have information that would enable us to assess the resilience of the US manufacturing base, should it be tested by China's withdrawal from supplying the US market," said Woodcock.

These are just the impacts coronavirus has had on the health care supply chain. Labor shortages in China due to quarantine have reduced the availability of most consumer goods. As of late March, trucking capacity in China was down 60–80%, meaning fewer goods were getting to ports for shipping overseas (https://www.foodnavigator.com).
Food supplies in the United States are reportedly secure (https://www.nytimes.com), but ASEAN, the Association of Southeast Asian Nations, have indicated that lockdowns among their member states are causing food supply-chain disruptions (https://www.foodnavigator-asia.com) .

As coronavirus transmissions recede, experts are attempting to predict how the global economy will respond. "Putting everything where production is the most efficient, that is over," says Wuttke, who predicts that coronavirus will trigger Europe's leaders to diversify their industrial supply chains. In reality, China could actually become more deeply ensconced by buying up industries that cannot recover from coronavirus's economic fallout. Economists say automotive, electronics, and pharmaceutical industries, whose supply chains are particularly complex, will be most vulnerable. The WTO predicts that in the short-term, global trade will shrink by 13–32%, but economists believe it will eventually recover.

So far, world leaders have been too consumed with addressing the virus to announce any adjustments to their global economic policies. Coronavirus is not the first disaster to reveal faults in the global supply chain, but will it be the one that impacts manufacturing processes the most?

Olio is produced by Inform*'s associate editor, Rebecca Guenard. She can be contacted at rebecca.guenard@aocs.org.*

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COVID-19: mass shift to disinfectant production across the world

Regulatory Review is a regular column featuring updates on regulatory matters concerning oils- and fats-related industries.

The demand for hand sanitizers and disinfectants has risen sharply during the COVID-19 pandemic, and this demand looks set to continue into the near future. Around the world, governments have put in place emergency regulatory processes to ensure sufficient products are available. Some are summarized in this article, but it can be time consuming to track these measures. So, Chemical Watch has created a comprehensive, practical tool that quickly allows you to see active substances that are permitted for use in different settings and countries across the world. The version of the biocides derogation tool as of May 1, 2020, can be downloaded at https://mail.chemicalwatch.com/t/d-l-mdldjkl-jttkidjdld-j/.

United States

The US Environmental Protection Agency (EPA) announced that it is temporarily allowing manufacturers of disinfectants to source certain active substances from any supplier without checking with the agency first. This is limited to products on the EPA's List N: Disinfectants for Use Against SARS-CoV-2, and the following active substances:

- citric acid;
- ethanol;
- glycolic acid;
- hydrochloric acid;
- hypochlorous acid;
- hydrogen peroxide;
- L-lactic acid; and
- sodium hypochlorite.

Manufacturers can source these from alternative suppliers, inform the EPA, and immediately start production, provided that the resulting formulation is chemically similar to the current one. The agency says it will "assess the continued need for and scope of this temporary amendment on a regular basis."

US Congress also allocated $1.5 million under a recently adopted coronavirus stimulus package for the US EPA to expedite the registration of disinfecting ingredients. The Coronavirus Aid, Relief, and Economic Security (CARES) Act (HR 748) was signed into law on March 27. The American Chemistry Council's (ACC's) Center for Biocide Chemistries has published an updated list of products (https://www.americanchemistry.com/Novel-Coronavirus-Fighting-Products-List.pdf) that the US EPA has pre-approved "for use against emerging enveloped viral pathogens and can be used during the current novel coronavirus COVID-19 outbreak."

European Union

In Europe, Echa has been speeding up the evaluation of applications to become an approved supplier of disinfectant substances, and published recommended compositional requirements (https://tinyurl.com/ycdfoasq) for the following three active substances for use in disinfectants:

- sodium hypochlorite;
- hydrogen peroxide; and
- peracetic acid

The agency says it is acutely aware of the "need to ensure adequate supply of active substances for use in biocidal products for disinfection purposes." The most effective way to address these needs is for competent authorities to follow article 55(1) of the Biocidal Products Regulation (BPR) to permit the placing on the market under derogations, it says. Echa's document provides key compositional requirements for the substances.

UK

The UK has joined other European countries in exempting hand sanitizers from product authorization requirements, under the biocidal products Regulation's (BPR) Article 55 derogation.

Biocidal hand sanitizers containing propanol-1-ol, propan-2-ol or ethanol will not need product authorization, the Health and Safety Executive (HSE) has said. For the latter two, formulations have to follow specific WHO rules.

The HSE added that it will take a "sensible and proportionate" approach to enforcing BPR rules for substance suppliers, which normally have to be registered on the law's Article 95 list.

But the Chemical Industries Association (CIA) said wider derogations were needed for other substances used to make sanitizer products, for example hydrogen peroxide.

The Netherlands

The Dutch competent authority for biocides (Ctgb) has exempted some surface disinfectants from the approval requirements under the BPR. Companies will be free to sell, for use in healthcare settings, surface disinfectants containing:

- alcohols (at least 70%);
- sodium hypochlorite (at least 0.025% active chlorine); and
- sodium dichloroisocyanurate (at a use concentration of at least 1,000 ppm active chlorine).
- The exemption applies until September 20. The Ctgb issued a similar exemption for hand sanitizers last month.

Brazil

Brazil will allow companies to manufacture and market certain disinfectants without obtaining an authorization from the health regulatory agency, Anvisa. This exemption has

Push to meet hand sanitizer demand prompts guidelines from US FDA

The US Food and Drug Administration has released a trio of guidelines on the preparation and mixture of alcohol-based hand sanitizers to help ensure their safety, as demand soars during the coronavirus COVID-19 pandemic.

Manufacturers and less traditional suppliers like distilleries have sought to boost production of the hand sanitizers to meet the needs of healthcare facilities and consumers in protecting against the virus. This has prompted the FDA to set out temporary procedures to ensure the alcohol-based products are properly labelled and safe to use.

The guidelines address different elements of production:

- the manufacture of alcohol that can safely be used;
- the compounding, or mixture, of ingredients by pharmacists to make the products; and
- the proper preparation of hand sanitizers for public distribution or other internal use.

The FDA guidance permits the production of one specific formulation of hand sanitizer using either denatured ethyl alcohol or isopropyl alcohol as active ingredients, which follows a WHO formula.

The agency's guidance on compounding specifies the ingredients and product labels pharmacists and other licensed facilities should use when mixing ingredients for alcohol-based hand sanitizers.

And for manufacturers of alcohol, the FDA lays out purity requirements and calls for the use of sterile water and certain denaturants or bitterants to discourage accidental ingestion of the products, particularly by young children.

While the guidelines are temporary, the agency said comments may be submitted at any time for agency consideration.

The guidance comes as a final rule banning 28 active ingredients, including triclosan, and tea tree oil, from use in over-the-counter hand sanitizers that was set to take effect on April 13. Under the rule, finalized in April 2019, products containing any of the 28 ingredients must first be approved under a new drug application (NDA), or abbreviated new drug application (ANDA), before they can be marketed.

The rule also deferred final action on the use of isopropyl alcohol and ethyl alcohol in OTC hand sanitizers. The agency also deferred rulemaking on a third ingredient, benzalkonium chloride, because it is currently evaluating their use as active ingredients in hand sanitizers when the temporary guidance ends.

Deferring action gives more time to companies and other stakeholders to complete studies on the safety and effectiveness of isopropyl alcohol and ethyl alcohol in hand sanitizers.

immediate effect and will last for 180 days. It covers products containing:

- 70% ethyl alcohol (w/w);
- 80% glycerin ethyl alcohol;
- 75% glycerinated isopropyl alcohol;
- 0.5% chlorhexidine digluconate; or
- alcohol gel.

Kuwait

The State of Kuwait has adopted three EU standards specifying the test methods and registration requirements for hand disinfectants. Two of the standards (https://tinyurl.com/yb65vt74) define test methods to establish whether a handwash product is effective. The third (https://tinyurl.com/ydyrqqgg) covers surface disinfectants for use in food, industrial, domestic and institutional areas.

Kuwait is also fast-tracking the adoption and entry into force of the standards due to the urgency of the coronavirus COVID-19 pandemic.

Canada

Health Canada has updated its list of hard-surface disinfectants and hand sanitizers (https://tinyurl.com/ybqg29m7) that it is allowing to be sold under COVID-19 regulatory exemptions. The list now holds 208 products.

The Canadian government also issued an interim policy (https://tinyurl.com/y7fnxgww) to increase access to certain consumer products, citing "an unprecedented demand for household cleaning products regulated under the Canada Consumer Product Safety Act (CCPSA) and hand soaps and body soaps regulated as cosmetics under the Food and Drugs Act (FDA)."

Under the interim policy, household cleaning products may be sold even if they do not conform to all CCPSA labelling requirements, including if:

- the product is labelled only in one official language;
- the hazard symbol is missing on the label; and/or
- safety and cautionary information on the label does not conform to regulatory requirements.

Similarly, hand and body soaps regulated under the FDA may be sold even if:

- the label is only in one official language; and/or
- the ingredients are not listed on the label exactly as outlined in the regulations.

The interim policy does not change other requirements under the applicable regulations.

Argentina: coronavirus and soy, corn, and wheat exports

Latin America Update is a regular Inform *column that features information about fats, oils, and related materials in that region.*

Leslie Kleiner

As Coronavirus and its implications weigh on all of us, I was curious about the impact of associated restrictions on supply chain of soy, corn, and wheat for export and internal consumption. Below, I have adapted an article written by Pablo Adreani for the *La Nación* newspaper (published on April 4, 2020), to a Q&A format.

Q: What are the restrictions imposed due to coronavirus/Covid-19 in Argentina?

On March 20th, the Federal government introduced mandatory isolation restrictions (quarantine) to combat the coronavirus pandemic. Agribusiness products such as grains, flour, and finished food products are exempt from the quarantine rules. However, the restrictions are affecting the free circulation of trucks transporting these food products, because many municipalities restrict truck traffic through their highways. According to the logistics company Agroentregas SA, the quarantine led to a 43% decrease of trucks entering the Gran Rosario harbor, which is commonly used for the export of grains.

Q: Is the export situation similar for soybean, corn, and wheat?

As the soy and corn harvest grew, producers became focused on fulfilling previously established contracts for these two products (therefore complying with agreed upon volumes, price, and delivery time). Focusing on fulfilling all soy and corn contracts as established before the quarantine delayed resources for wheat production. Normally, wheat production would follow that of soy and corn. At this time, there is no wheat for new export, but local mills have wheat for the production of wheat flour.

Q: How is the wheat supply chain affecting both exports and the baking segment?

The wheat supply chain is honoring the contracts established in the previous months, both for milling and export. Argentina thrives by positioning the customer first, so it is important to comply with promised shipments and delivery of raw material. Some of this raw material is for milling, which supplies the baking segment, for example. The wheat production was exceptionally high (19.5 MMT), and the exports and milling account for 12 MMT and 4.8 MMT, respectively. This leaves a remaining 2.7 MMT of unsold wheat, which can be used either for exports or for internal supply. The internal supply chain would start with milling to provide flour to the baking segment. The overall feeling, however, is that there is a shortage of wheat. This is because the producer is selling the lowest amount of product possible while waiting for the pandemic to improve. Then, there will be more availability of wheat based on a second semester assessment.

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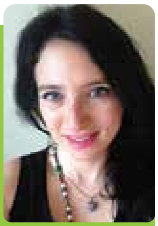
Latin America Update is produced by Leslie Kleiner, a senior research scientist and contributing editor of *Inform*.



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PROFESSIONAL

What's a typical day like for you?
Responding to messages, checking with technicians for updates about ongoing experiments or working on protein extraction in the pilot plant, analyzing research data, doing a literature search for or writing sections of a manuscript, reviewing a manuscript or proposal, completing any mandatory online trainings, or attending seminars.

My favorite part of my job is…
Talking about being a scientist and/or my research to students and how our findings/discoveries find their way into people's lives

Flash back to when you were 10 years old. What did you want to be when you grew up?
An astronaut (inspired by the Apollo 11 crew); never mind that I suffer from motion sickness.

Why did you decide to do the work you are doing now?
I've been fascinated with science since childhood. In college, and with an eye on graduate school, I chose the thesis option in the food technology program. I found that I enjoyed planning and running experiments and analyzing the results.

Is there an achievement or contribution you are most proud of? Why?
Receiving distinguished alumni awards in the same year and month from both my alma maters (University of the Philippines at Los Baños and Iowa State University) and then being selected as an AOCS Fellow not long after was a truly heady experience.

What event, person, or life experience has had the most influence on the direction of your life?
I took a chance in 1997, when I accepted the offer to work as a postdoc at USDA ARS NCAUR in Peoria, Illinois. At the time, my husband and I thought this move was transitional until we found more permanent positions elsewhere or returned to the Philippines.

A year into my postdoc work, my supervisor left, and with no team leader, the fate of the project was in doubt. This took place quite suddenly; we had no back-up option for employment. After my Iowa State mentors and unit leader in Peoria vouched for me, the funding agency allowed me to complete the project as its leader.

My handling of the personnel change and subsequent successful completion of the work resulted in the renewal of my postdoc appointment; when I became a naturalized US citizen in 2001, I applied for and was hired as a research chemist, a permanent position. I have been working for ARS for 22 years now, and raised my family in Peoria. Needless to say, the plan to return home has been postponed indefinitely.

Fast facts

Name	Mila P. Hojilla–Evangelista
Joined AOCS	1990
Education	Ph.D. in food science from Iowa State University (Ames, Iowa, USA)
Job title	Research chemist
Employer	United States Department of Agriculture, Agricultural Research Service, National Center for Agricultural Utilization Research (USDA ARS NCAUR; Peoria, Illinois, USA)
AOCS involvement	**Current**—Associate editor, *JAOCS*; Protein and Co-Products Division poster session chairperson and student poster competition chairperson. **Previous**—Governing Board member-at-large; guest editor, *JAOCS* Special Issue on Alternative Proteins; Protein and Co-Products Division officer (secretary/treasurer, vice-chairperson, and chairperson) and technical session chairperson.

PERSONAL

How do you relax after a hard day of work?
By checking messages/posts from family and friends, reading books (fiction and nonfiction), and listening to music.

What skill would you like to master?
Playing a musical instrument (piano, guitar, or drums) or ballroom dancing.

PATENTS

Lyotropic composition of carbohydrates in fats, method for obtaining it, and application thereof in the preparation of chocolate and substitutes

Miguel, J.F.G., *et al.*, Natra Cacao, S.L. Unipersonal, US10537120, January 21, 2020

A lyotropic composition related to the food industry field, and particularly to the chocolate industry field is described. Specifically, a lyotropic composition comprising carbohydrates in fats is described. Also described is a method for producing the lyotropic composition. Moreover, different uses of said composition, particularly for the manufacture of chocolates and chocolate substitutes, including chocolate with honey and fruity chocolate are described.

Conditioning shampoo with ester mixtures of plant oils

Fuhr, D., *et al.*, Henkel AG & Co. KGaA, US10537508, January 21, 2020

Subject matter of the present disclosure is a conditioning shampoo containing (A) a mixture of the mono-, di- and tri-esters of a fatty acid mixture (F1) and glycerine, and (B) a mixture of the mono- and di-esters of a fatty acid mixture (F1) and a polyethylene glycol having a mean molecular mass of from 200–800 g/mol, wherein the fatty acid mixture (F1) is a mixture of fatty acids which has the same fatty acid composition as a plant-based oil, and, relative to the total weight of the shampoo, the total quantity of all the plant-based oils included in the shampoo, which are not the same as the tri-esters of the fatty acid mixture (F1) and glycerine is a value of maximum 0.25 wt.%, and the total quantity of all the silicone compounds included in the shampoo is a value of maximum 0.25 wt.%.

Rubber composition for tires and pneumatic tire

Matsuura, A., *et al.*, Sumitomo Rubber Industries, Ltd., US10538647, January 21, 2020

The present invention aims to provide rubber compositions for tires that contain a natural rubber achieving a balanced improvement in abrasion resistance, breaking performance, and processability to achieve a balanced improvement in abrasion resistance, breaking performance, and processability, and also provide pneumatic tires containing such rubber compositions for tires. Included is a rubber composition for tires comprising a modified natural rubber prepared by treating natural rubber latex with a proteolytic enzyme, and then treating the treated natural rubber latex with a lipolytic enzyme and/or a phospholipid-degrading enzyme. Also included is a rubber composition for tires, comprising a modified natural rubber prepared by centrifuging natural rubber latex to recover a latex fraction comprising latex particles having an average particle size of 0.25 micrometer or less.

Method for mixing of particles

Bach, P., *et al.*, Novozymes A/S, US10543464, January 28, 2020

Continuous mixing in a static mixer is possible and can be used to add one kind of particle (such as an enzyme granular product) in a small amount to a larger amount of a different kind of particle (such as a powder stream of detergent powder), even if the powder characteristics are substantially different, with substantially no damage to the enzyme particles and with a high degree of homogeneity.

Methods and apparatus for producing alkyl esters from a reaction mixture containing acidified soap stock, alcohol feedstock, and acid

McNeff, C.V., *et al.*, SarTec Corporation, US10544381, January 28, 2020

Embodiments herein relate to the production of alkyl esters from acidified soap stock. In an embodiment, a process for producing alkyl esters is provided. The process can include mixing acidified soap stock with an alcohol, water, carbon dioxide, and/or carbon monoxide, to form a reaction mixture, and contacting the reaction mixture with a catalyst under supercritical conditions for the alcohol, the catalyst including a metal oxide. Other embodiments are also included herein.

Cocoa butter substitute

Cruz, A.F., *et al.*, Team Foods Colombia S.A., US10548334, February 4, 2020

A trans-fat-free cocoa butter substitute and its production process which has a lower quantity of saturated fatty acids than cocoa butter, common cocoa butter substitutes, and lauric fats, for coating and molding applications in chocolate products with adequate texture, gloss, and melting profile characteristics, and a good speed of crystallization during a cooling process without tempering.

Patent information was compiled by Scott Bloomer, a registered US patent agent and Director, Technical Services at AOCS. Contact him at scott.bloomer@aocs.org.

2021 AOCS Awards Call for

Society Awards

NOMINATION DEADLINE ▶ AUGUST 1, 2020

A.R. Baldwin Distinguished Service

Recognizes long-term, distinguished service to AOCS in positions of significant responsibility. The Society's highest service award. Sponsored by Cargill.

$2,000 honorarium, $1,500 travel allowance and a plaque

AOCS Award of Merit

Recognizes an AOCS Member who has displayed leadership in administrative activities, meritorious service on AOCS committees or performed an outstanding activity or service.

Plaque and recognition during the AOCS Annual Meeting

AOCS Fellow

Recognizes achievements in science or extraordinary service to the Society.

Fellow membership status, a plaque and custom medal

Scientific Awards

NOMINATION DEADLINE ▶ AUGUST 1, 2020

Supelco AOCS Research

Recognizes outstanding original research in fats, oils, lipid chemistry or biochemistry. Sponsored by MilliporeSigma, a subsidary of Sigma-Aldrich Corp.

$10,000 honorarium, $1,500 travel allowance and a plaque

Stephen S. Chang

Recognizes a scientist, technologist or engineer who has made decisive accomplishments in research for the improvement or development of products related to lipids. Provided by the Stephen and Lucy Chang endowed fund.

$1,500 honorarium and a jade horse

AOCS Young Scientist Research

Recognizes a young scientist who has made a significant and substantial research contribution in one of the areas represented by the Divisions of AOCS. Sponsored by the International Food Science Centre A/S.

$1,000 honorarium, $1,500 travel allowance and a plaque

Alton E. Bailey

Recognizes outstanding research and/or exceptional service in the field of lipids and associated products.

$750 honorarium and a plaque

AOCS Corporate Achievement

Recognizes industry achievement for an outstanding process, product or contribution that has made the greatest impact on its industry segment.

Plaque and recognition during the AOCS Annual Meeting

Schroepfer Medal

Recognizes a scientist who has made significant and distinguished advances in the steroid field. Originated by colleagues of George Schroepfer.

Honorarium and a bronze medal

Division Awards

NOMINATION DEADLINE ▶ AUGUST 1, 2020

ANA Division Herbert J. Dutton

Recognizes an individual who has made significant contributions to the analysis of fats, oils and related products.

$1,000 honorarium, $1,000 travel allowance and a plaque

BIO Division Ching Hou Biotechnology

Recognizes a scientist, technologist or leader who has made contributions to the advancement of the Biotechnology Division's area of interest.

$1,000 honorarium and a plaque

EAT Division Timothy L. Mounts

Recognizes research related to the science and technology of edible oils or derivatives in food products, which may be basic or applied in nature.

$750 honorarium and a plaque

EAT Division Outstanding Achievement

Recognizes a scientist, technologist or leader who has made significant contributions to the Division's area of interest or to the advancement of edible oils.

$500 honorarium and a plaque

H&N Division Ralph Holman Lifetime Achievement

Recognizes an individual who has made significant contributions to the Division's area of interest, or whose work has resulted in major advances in health and nutrition.

$500 honorarium, $1,000 travel allowance, a signed orchid print and plaque

H&N Division New Investigator Research

Recognizes a young scientist who is making significant and substantial research contributions in one of the areas represented by the Health and Nutrition Division of AOCS.

$1,000 honorarium and a plaque

IOP Division ACI/NBB Glycerine Innovation

Recognizes outstanding achievement for research in new applications for glycerine with emphasis on commercial viability. Sponsored by the American Cleaning Institute (ACI) and the National Biodiesel Board (NBB).

$5,000 honorarium and a plaque

Nominations

PRO Division Distinguished Service

Recognizes and honors outstanding and meritorious service to the oilseed processing industry.

$1,000 travel allowance and a certificate

S&D Division Samuel Rosen Memorial

Recognizes a surfactant chemist for significant advancement or application of surfactant chemistry principles. Initiated by Milton Rosen and this Division.

$2,000 honorarium and a plaque

S&D Division Distinguished Service

Recognizes outstanding and commendable service to the surfactants, detergents and soaps industry.

Plaque

Student Awards

NOMINATION DEADLINE ▶ OCTOBER 1, 2020

Honored Student

Recognizes graduate students in any area of fats and lipids. To receive the award, a candidate must remain a registered graduate student and must not have received a graduate degree or have begun career employment before the Society's Annual Meeting.

$500 travel allowance for U.S. and Canada residents [$1,000 travel allowance for recipients residing outside of those countries], Complimentary AOCS Annual Meeting registration and lodging, and a certificate

Hans Kaunitz

Recognizes a student conducting research related to fats, oils and detergent technology.

$1,000 honorarium, $500 travel allowance and a certificate

Lipid Chemistry and Nutrition

Recognizes outstanding performance and achievement of a graduate student conducting research in lipid chemistry and nutrition. Sponsored by Seawit Co., Inc.

$1,000 honorarium, $550 travel allowance and a plaque

Lipid Processing and Biotechnology

Recognizes outstanding performance and achievement of a graduate student conducting research in lipid processing and biotechnology. Sponsored by Myande Group Co., Inc.

$1,000 honorarium, $550 travel allowance and a plaque

Ralph H. Potts Memorial Fellowship

Recognizes a graduate student conducting research related to fatty acids and their derivatives, such as long-chain alcohols, amines and other nitrogen compounds. Sponsored by Nouryon.

$2,000 honorarium, $500 travel allowance and a plaque

AOCS Division Student Awards

Recognizes over 20 students from any institution of higher learning, who are studying and doing research towards an advanced degree in fats, oils and related materials.

Awards range from $50 to $1,000 and a certificate

Each award has its own specific and unique nomination requirements. Please refer to the website for full details.

The award recipient must agree to attend the AOCS Annual Meeting & Expo and present an award lecture. The 2021 AOCS Annual Meeting will be held in Portland, Oregon, USA, from May 2–5, 2021.

AOCS

Nominations Now Open!

2021 Awards

Innovation. Recognition. Prestige.

Celebrate the individuals and companies making outstanding contributions to science, technology, industry and our Society.

Who will you nominate for outstanding contributions?

How to nominate

1 ▶ Read the full award description and nomination requirements at aocs.org/awards. (Self-nominations are welcome.)

2 ▶ Submit nomination materials online at bit.ly/submit-AOCS-awards.

3 ▶ Questions? Email awards@aocs.org.

aocs.org/awards

Expedite peer review with Rapid Communications

Preprint servers have gotten a lot of press lately for being the quickest way for researchers to circulate results about COVID19. The advantages preprinting offers other types of researchers was covered in the May issue of *Inform* (page 41).

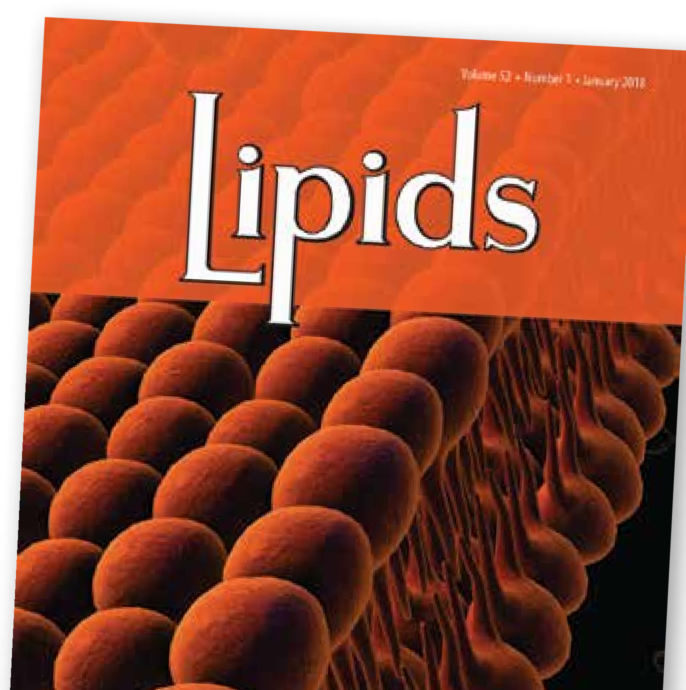
This AOCS Journals column looks at Rapid Communications, a fast-track publishing option that the journal *Lipids* has offered since 2015. Unlike preprinting—in which the full draft of a research paper is shared publicly before peer-review—the review standards for Rapid Communications are the same as those for other journal articles, but the articles are smaller in scope, and the review is expedited. In the case of Rapid Communications, the journal strives to have a first-decision letter within 21 days, and the expectation is that authors will turn around revisions within 14 days or less. Preliminary data are not acceptable, and fragmentation of related results into several reports is not acceptable.

Scientists often use this format when they have a discovery that will immediately advance or bring important information to a field of study, or when their findings are important to a current field of study and may lose relevance if published after a long time. In the time since the option was introduced, *Lipids* has published 20 Rapid Communication articles across a variety of areas.

Rapid Communications offer several distinct advantages, including:

- A quick turnaround time;
- the opportunity to share a distinct and complete body of work that presents an exciting set of data that moves the field forward;
- the ability to publish discrete and complete, albeit, smaller publications, for which researchers need a rapid decision;
- the ability to get a paper in press prior to a grant submission or a grant progress report; and
- the expedited review timeline may be helpful for authors being considered for jobs, promotions, or academic tenure.

If you would like information about submitting a Rapid Communication to *Lipids*, the author instructions are available at [https://aocs.onlinelibrary.wiley.com/hub/journal/15589307/forauthors.html]. To submit a paper to *Lipids*, visit [https://mc.manuscriptcentral.com/lipids].



EXTRACTS & DISTILLATES

The full version of all AOCS journal articles are available online to members at www.aocs.org/journal. This column builds on that member benefit by primarily highlighting articles from other journals.

ANA Analytical
BIO Biotechnology
EAT Edible Applications
LOQ Lipid Oxidation and Quality
H&N Health and Nutrition
IOP Industrial Oil Products
PRO Processing
PCP Protein and Co-Products
S&D Surfactants and Detergents

Review Articles

EAT Recent advances on the sustainable approaches for conversion and reutilization of food wastes to valuable bioproducts

Ng, H.S., *et al*, *Bioresour. Technol. 302*: 122889, 2020, https://doi.org/10.1016/j.biortech.2020.122889.

The increasing food wastage and accumulation generated per annum due to the growing human population worldwide is often associated with environmental pollution issues and scarcity of natural resources. Sustainable approaches that reuse food wastes as industrial substrates for production of valuable bioproducts meet the goals of a circular bioeconomy while diversifying applications and increasing market demands for the bioproducts. This review discusses current practices and recent advances in the reuse and bioconversion of agricultural and food processing wastes into valuable products.

EAT Algal biorefinery models with self-sustainable, closed-loop approach: trends and prospective for blue bioeconomy

Venkata Mohan, S., *et al.*, *Bioresour. Technol. 295*: 122128, 2020, https://doi.org/10.1016/j.biortech.2019.122128

Microalgae, due to their metabolic versatility, are a focus of attention in the biorefinery and bioeconomy context. Microalgae products have broad and promising application potential in the domains of renewable fuels/energy, nutraceutical, pharmaceuticals, and cosmetics. Biorefining of microalgal biomass in a circular loop with an aim to maximize resource recovery is being considered as one sustainable option that can be both economically and environmentally viable The expansive scope of microalgae cultivation with a self-sustainability approach is discussed in in the framework of a blue bioeconomy. Microalgae-based primary products, cultivation strategies, valorization of microalgae biomass for secondary products, and integrated biorefinery models for producing multi-based products are discussed. The need and prospect of self-sustainable models in closed loop format are also elaborated.

EAT Integrated biorefinery approach to valorize winery waste: a review from waste to energy perspectives

Ahmad, B., *et al.*, *Sci. Total Environ. 719*: 137315, 2020, https://doi.org/10.1016/j.scitotenv.2020.137315.

Wine production results in substantial quantities of solid organic and effluent waste. From an integrated biorefinery and circular economy perspective, winery waste could be exploited for multi-purpose, value-added products before using the biomass for energy. This review covers state-of-the-art biorefinery opportunities beyond traditional methods as a solution to overcome many current challenges, such as waste minimization in grape leaves, stems, seeds, pomace, wine lees, vinasse etc., and the biosynthesis of various high-value bioproducts, such as phenolic compounds, hydroxybenzoic acids, hydroxycinnamic acids, flavonoids, tartaric acids, lignocellulosic substrates, etc. A critical discussion of the valorization of winery waste (solid, liquid, or gaseous) and life cycle assessment were used to find a sustainable solution with value-added energy products in an integrated biorefinery approach, keeping the environment and circular economy in the background.

IOP PRO An overview of potential oleaginous microorganisms and their role in biodiesel and omega-3 fatty acid-based industries

Patel, A., *et al.*, *Microorganisms 8*: 434, 2020, https://doi.org/10.3390/microorganisms8030434.

Microorganisms are known to be natural oil producers in their cellular compartments. Microorganisms that accumulate more than 20% w/w of lipids on a cell dry weight basis are considered as oleaginous microorganisms. These are capable of synthesizing the vast majority of fatty acids from short hydrocarbonated chain (C6) to long hydrocarbonated chain (C36), which may be saturated (SFA), monounsaturated (MUFA), or polyunsaturated fatty acids (PUFA), depending on the presence and number of double bonds in hydrocarbonated chains. Depending on the fatty acid profile, the oils obtained from oleaginous microorganisms are utilized as feedstock for either biodiesel production or as nutraceuticals. Mainly microalgae, bacteria, and yeasts are involved in the production of biodiesel, whereas thraustochytrids, fungi, and some of the microalgae are well known to be producers of very long-chain

PUFA (omega-3 fatty acids). This article reviews the type of oleaginous microorganisms and their expertise in the field of biodiesel or omega-3 fatty acids, advances in metabolic engineering tools for enhanced lipid accumulation, upstream and downstream processing of lipids, including purification of biodiesel and concentration of omega-3 fatty acids.

IOP PRO State-of-art review on conventional and advanced pyrolysis of macroalgae and microalgae for biochar, bio-oil, and bio-syngas production

Lee, X.J., *et al.*, *Energ. Convers. Manag. 210*, April 15, 2020, https://doi.org/10.1016/j.enconman.2020.112707.

Algal biomass, including macroalgae and microalgae, show great potential as pyrolysis feedstock in generating energy-dense and valuable pyrolytic products such as bio-oil, biochar, and bio-syngas. The chemical constituents of macroalgae and microalgae show great variations, especially their lipid, carbohydrate, and protein contents, which could affect the qualities of the pyrolytic products. From the established conventional pyrolysis, the products produced from both macroalgae and microalgae show moderate energy contents (<34 MJ/kg). This review identifies the issues associated with development of conventional pyrolysis, such as flash and intermediate pyrolysis. To enhance the production of biofuels from algal biomass, advanced or non-conventional pyrolysis techniques have been employed. Catalytic pyrolysis on algal biomass could reduce the nitrogenates and oxygenates in the biofuels. On top of that, co-pyrolysis with suitable feedstock shows great enhancement on the bio-oil yield. As for hydropyrolysis of algal biomass, their generated biofuels can produce up to 48 MJ/kg with high yield of bio-oil up to 50 wt%, comparable to conventional fuels. Microwave-assisted pyrolysis of algal biomass greatly shortens the processing time through advanced heating; however, favors the formation of bio-syngas by improving the yield up to 84 wt%, depending on the feedstock used. Therefore, formation of biofuel fraction suitable for energy generation highly depends on the selected pyrolysis technologies.

Original Articles

ANA Development of a reproducible method of analysis of iron, zinc, and phosphorus in vegetables digests by SEC-ICP-MS

Dell'Aquila, C., *et al.*, *Food Chem. 308*: 125652, 2020, https://doi.org/10.1016/j.foodchem.2019.125652.

Vegetables contain iron, zinc, and phosphorus as complexes with phytates limiting their availability from a vegetarian diet, meaning non-heme iron-deficiency anemia and zinc- deficiency immune malfunction are a risk. Although these elements have been analyzed previously in biological fluids and cereal using LC-ICP-MS, there is no method suitable for analyzing iron, zinc, and phosphorus simultaneously in vegetables because of their complex matrix. In this study, we analyzed iron, zinc, and phosphorus in cabbage, broccoli, pepper, spinach, kale, and rocket after a simulated gastrointestinal digestion using a newly optimized SEC-ICP-MS method. Ammonium nitrate, as the mobile phase, and a suitable rinsing regime allowed good reproducibility and maintenance of the equipment. The method showed good reproducibility and can be easily adapted to other vegetables, as required.

ANA Development of a cranberry standard for quantification of insoluble cranberry (*Vaccinium macrocarpon* Ait.) proanthocyanidins

Gullickson, E.R., *et al.*, *J. Agric. Food Chem. 68*: 2900–2905, 2020, https://doi.org/10.1021/acs.jafc.9b03696.

Cranberry proanthocyanidins (PACs) can be partitioned into soluble PACs, which are extracted with solvents, and insoluble PACs, which remain associated with fibers and proteins after extraction. Most research on cranberry products only quantifies soluble PACs because proper standards for quantifying insoluble PACs are lacking. In this study, we evaluated the ability of a cranberry PAC (c-PAC) standard, reflective of the structural heterogeneity of PACs found in cranberry fruit, to quantify insoluble PACs by the butanol–hydrochloric acid (BuOH–HCl) method. For the first time, a c-PAC standard enabled conversion of BuOH–HCl absorbance values (550 nm) to a weight (milligram) basis, allowing for quantification of insoluble PACs in cranberries. The use of the c-PAC reference standard for sequential analysis of soluble PACs by the method of 4-(dimethylamino) cinnamaldehyde and insoluble PACs by the method of BuOH–HCl provides analytical tools for the standardization of cranberry-based ingredients.

H&N Antioxidant activity of compounds isolated from *Elaeagnus umbellata* promotes human gingival fibroblast well-being

Iannuzzi, A.M., *et al.*, *J. Nat. Prod. 83*; 626–637, 2020, https://doi.org/10.1021/acs.jnatprod.9b01030.

Four new triterpenoid bidesmosidic saponins (1–4) and a sesquiterpenoid glucoside (5), together with nine known phenolic compounds (6–14), were isolated from the fruits of *Elaeagnus umbellata*. Their structures were elucidated using 1D and 2D NMR spectroscopy and mass spectrometry data. The antioxidant capability of the isolated compounds was evaluated in human gingival fibroblasts. Compound 6 decreased ROS production and promoted cell proliferation. It also counteracted the cell cycle blockade induced by a low concentration of H_2O_2 decreasing the expression of p21 and CDKN2A (p16INK4A). Compound 6 decreased the expression of inflammatory cytokines (IL-6 and IL-8) in response to inflammatory stimuli, supporting its possible use in periodontitis lesions.

H&N Advanced glycation end product inhibition by alkaloids from *Ocotea paranapiacabensis* for the prevention of skin aging

de Freitas, L., *et al.*, *J. Nat. Prod. 83*: 649–656, 2020, https://doi.org/10.1021/acs.jnatprod.9b01083.

A bioassay-guided study aiming at identifying inhibitors of the glycation process on the leaves of *Ocotea paranapiacabensis* afforded four benzylisoquinoline alkaloids (1–4), with 1 and 2 identified as new naturals products, while 3 and 4 were previously described in the literature, with 3 being identified as magnocurarine. Purification was performed by column chromatography and high-performance liquid chromatography. The structures of the isolated compounds were elucidated by spectroscopic methods including UV, NMR, and HRMS. The process of skin aging has been recently associated with advanced glycation end products (AGEs), and strategies inhibiting their formation have been addressed by pharmaceutical companies for the development of novel antiaging compounds. Alkaloids 1–4 were evaluated for their potential to inhibit AGE formation and showed inhibition of 62.9%, 83.3%, 26.1%, and 98.2% (150 μM), respectively. The antiaging potential of compounds 1 and 4 were evaluated with a reconstructed human skin model in vitro, and results showed a decrease in dermis contraction (8.7% and 4.2%, respectively, for 1 and 4) when compared to the glycated control (57.4%). Additionally, absorption, distribution, metabolism, and excretion (ADME) and toxicity properties were predicted using *in silico* methods, and the results were considered significantly promising for alkaloids 1 and 4 to continue the development of these alkaloids with skincare properties.

H&N PRO LOQ Impact of different roasting conditions on sensory properties and health-related compounds of oat products

Schlörmann, W., *et al.*, *Food Chem. 307*: 125548, 2020, https://doi.org/10.1016/j.foodchem.2019.125548.

Due to their high content of beta-glucan, the consumption of oat products can contribute to a healthy diet. Roasting may improve sensory properties but could also affect the nutritional value of oat products. Therefore, the aim of the present study was to analyze the impact of different roasting conditions (140–180°C, approx. 20 min) on sensory quality, health-related compounds (e.g., acrylamide, beta-glucan) and viscosities of oat kernels and flakes. Roasting resulted in oat flakes with improved sensory properties. Acrylamide formation increased with higher roasting temperatures in kernels, thin and thick flakes. Contents of fat, protein, starch, and beta-glucan were not affected by roasting, whereas dietary fiber fractions were marginally modulated. Viscosities were significantly reduced with increasing roasting temperatures. The results indicate that roasting up to 160°C is a processing technique with potential to generate oat products with improved sensory quality and favorable nutritional composition.

IOP PRO Alternative component containing diesel fuel from different waste sources

Tóth, O., *et al.*, *J. Environ. Manag. 265*, July 2020, https://doi.org/10.1016/j.jenvman.2020.110562.

Mixtures with high fatty acid content are produced during vegetable oil and animal fat purification and paper production. These waste fractions can be converted into alternative fuels through several steps. The co-hydrogenation of waste polypropylene thermal cracked fraction or waste fatty acid mixture with unrefined gas oils is a potential solution for their conversion into hydrocarbons. The co-processing of these three different fractions has not yet been investigated in these ratios. So, the aim of the research work was to produce high-quality diesel fuels and to study the occurring reactions and the interaction among these different compounds. The catalytic conversion of the mixture of unrefined gas oil, waste polypropylene cracked fraction (20 wt %), and waste fatty acid mixture (10, 20 and 30 wt %) was carried out on a commercial sulphided nickel-molybdenum-alumina catalyst. The effect of the feedstock compositions and the process parameters on the quantity and quality of the products was studied. The favorable process conditions to produce high-quality diesel fuel blending components were selected (e.g., 10 wt % fatty acid waste, 360°C temperature, 1.0 h^{-1} liquid hourly space velocity). The performance properties of this fuel were better than the conventional diesels', so their usage can be more environmentally friendly and lead to lower pollutant emission.

LOQ H&N Identification and quantitation of bioactive components from honeycomb (*Nidus Vespae*)

Haoan Zhao, H., *et al.*, *Food Chem. 314*: 126052, 2020, https://doi.org/10.1016/j.foodchem.2019.126052.

Honeycomb (*Nidus Vespae*), an agri-food waste in the bee product industry, is in soaring demand for high-value utilization. This study investigated the physicochemical properties, chemical composition, and nutritional value of honeycomb by determining physicochemical parameters, total phenolic and total flavonoid contents, antioxidant capacity *in vitro*, and bioactive components. By using ultra high-performance liquid chromatography–high resolution mass spectrometry (UHPLC–HRMS), a total of 76 bioactive components from hydro-ethanolic extracts of honeycomb (EHB) were tentatively identified. The principal ones were polyphenols and fatty acids, which were further quantified by LC–MS and GC–MS, respectively. Moreover, an antimicrobial activities test was conducted, verifying that EHB can inhibit both Gram-negative (G–) bacteria and Gram-positive (G+) bacteria, which is beneficial for high-value utilization of honeycomb.

LOQ EAT Benign recovery of carotenoids from *Physalis alkekengi* L. var. francheti through supercritical CO_2 extraction: yield, antioxidant activity, and economic evaluation

Huang, Z., *et al.*, *J. CO_2 Util. 36*: 9–17, 2020,
https://doi.org/10.1016/j.jcou.2019.10.015.

Benign recovery of carotenoids was carried out on the calyx of *Physalis alkekengi* var. *francheti* by means of supercritical CO_2 ($SCCO_2$) extraction. The influences of extraction pressure, temperature, and particle size on the time-dependent carotenoids yield were fully investigated and kinetically analyzed by using the hot-sphere model. The highest carotenoids yield recovered in 200 min was 15.96 mg/g raw sample, indicating that the calyx may be of great interest as a valuable raw resource for the extraction of carotenoids. The $SCCO_2$ extract exhibited good antioxidant capacity as verified by radical-scavenging activity test results. The manufacturing cost (COM) for $SCCO_2$ extraction of carotenoids from the calyx has been evaluated for scaling-up to the pilot plant at 40 MPa and 50°C and a particle size of 0.114 mm. The effects of extraction capacities, labor wages, CO_2 price, and calyx-purchasing cost on COM were analyzed. When using a capacity of 2 × 500 L and an extraction time of 60 min, the estimated specific COM can be US$ 687.96/t calyx or US$ 65.27/kg carotenoids, respectively. These calculation results turn to suggest that $SCCO_2$ extraction is economically feasible to produce carotenoids form the herbal calyces.

LOQ EAT Antioxidant and antimicrobial evaluation of rice bran (*Oryza sativa* L.) extracts in a mayonnaise-type emulsion

Martillanes, S., *et al.*, *Food Chem. 308*:125633, 2020,
https://doi.org/10.1016/j.foodchem.2019.125633.

The objective of this study was to evaluate the *in vitro* antimicrobial and antioxidant activities of different bran extracts and concentrations, and their influence on the parameters of a mayonnaise-type emulsion. To that end, first ethanol and then water were used to extract two rice bran extracts (RBE) from rice bran. Both these extracts were then added at two different concentrations (0.5 and 2%) to the emulsions that were subsequently analyzed after seven days under two different storage temperatures, 4°C and 20°C. The antioxidant and antimicrobial ability of the extracts were evaluated, along with a control and a synthetic antioxidant. Results indicate the positive effect of rice bran extracts as additives in the food matrix. Ethanolic rice bran extract (EE) at 2% decreased the oxidation as well as mold and yeast proliferation and preserved the emulsion structure, while the other treatments acted in a similar way although their effect was less pronounced.

LOQ Epigallocatechin (EGC) esters as potential sources of antioxidants

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Epigallocatechin (EGC) was acylated with selected fatty acids, namely propionic acid [C3:0], caprylic acid [C8:0], lauric acid [C12:0], stearic acid [C18:0]), and docosahexaenoic acid (DHA) [C22:6n-3] to increase its lipophilicity. Monoesters were identified as the predominant products (~40%) followed by diesters (~33%), triesters (~9%), and trace amounts of tetra- and pentaesters. 1H NMR, 13C NMR, and HPLC-DAD-MS were used to elucidate the acylation sites and structures of new EGC esters. According to the HPLC-MS analysis of the caprylate esters, EGC-4′-O-caprylate (27%), EGC-3′-O-caprylate or EGC-5′-O-caprylate (12%), and EGC-3′,5′-O-dicaprylate (16%) were the major compounds generated upon the acylation reaction of EGC. The acylation significantly increased the lipophilicity of EGC. In addition, EGC and its esters showed radical scavenging activities against DPPH radical and ABTS radical cation. Therefore, EGC esters could serve as potential sources of antioxidants for application in both hydrophilic and lipophilic media.

PRO EAT ANA Development of a method to evaluate the tenderness of fresh tea leaves based on rapid, *in-situ* Raman spectroscopy scanning for carotenoids

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The tenderness of the fresh tea leaves can affect the quality of tea products. It is important to develop a mechanized, accurate way to evaluate the quality of fresh leaves that avoids the uncertainty of a subjective evaluation. Herein, an *in-situ*, ultra-rapid Raman microscopy strategy to quantify carotenoids in tea leaves was established. The Raman microscopy of carotenoids distribution in leaves from new branches of 22 representative tea varieties showed that the average carotenoid signals increased from a low level in the bud to a high level in the fourth leaf, which represent different developmental stages. The concentration of carotenoids in the bud to fourth leaf, which were from 69.1 ng mg–1 to 199.5 ng mg–1, respectively. These results demonstrate that Raman imaging can serve as an *in-situ*, non-destructive and ultra-rapid technology for determining the tenderness of fresh tea leaves and be used in quality control for tea processing.