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From Editors Desk

Dear Readers,

It is my great pleasure and honor to bring forth the **Fourth issue** of the Journal of Lipid Science & Technology (JLST) for the year 2021 to you. This issue of the Journal of Lipid Science and Technology of Oil Technologist Association of India (OTAI) comprises papers collected and reviewed by eminent scholars & researchers. The work reflects the research work of the scientists who have not only come up with innovative and groundbreaking ideas, but have also articulated them in an uncomplicated fashion.

The interesting fact about information availability today is that it is allpervasive-

whether you like it or not, you receive a whole lot of information, even in the passive mode. If one were to actively look for information through search engines, one will, of course, receive a mind boggling number of results. Digital platforms, such as WhatsApp, Facebook, Twitter and You Tube, also contribute to the vast body of information that is available to us. It is but natural to get lost in this vast

ocean of data and facts. Trying to judge the authenticity of some of this freely shared information is also no easy task. Therefore, as professionals working in the field of lipids and their derivatives, it is our responsibility to provide access to accurate and authentic information to the reader's of our journal and masses in general.

The recent scare about coconut oil, after a Harvard professor deemed it 'pure poison', helped me decide the theme for this editorial. Fats and oils are no longer just about the kind of fatty acids present in them, but also about the balance of the essential fatty acids, the bio-active components present in them, how the oil is being processed, how we use the oil for cooking and the method of storage. Further oils and fats are used in preparation of several oil based derivatives, in home and personal care.As professionals, we have also had to deal with the problem of conflicting information that reaches the consumer and obviously confuses them. One such instance is that of ghee and how it has turned from good to the ugly and is now very much back in favor. While gaps in our knowledge about fats and oils may always remain, today, we know for sure that hydrogenated fats and partially hydrogenated fats (also called trans fats) are the ugly fats and much worse than saturated fats. These man-made, industrially produced fats should be avoided at all costs. It is important to make a distinction between these synthetic

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* As per Nielsen Retail Index data for MAT March 2021.
All India (Urban +Rural) market in Washing Powder Category.

trans fats and the naturally occurring trans fats found in many animal products such as milk, and cheese that are not harmful if consumed within the prescribed amounts.

The Editor-in-Chief wishes to thank all the contributors. I am also thankful to reviewers who have taken great pains to meticulously review the contributions. Hope this volume will serve the purpose of research &development for students and the members of OTAI. I would be happy to receive any feedback regarding the JLST. Please feel free to email me your inputs and comments.

Prof. Rakesh Kumar Trivedi
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INDEX TO ADVERTISEMENTS / ANNOUNCEMENTS

Annual Subscription : Rs 2000 (India)/ US $ 100 (Overseas).

Antibacterial Activity of Four Edible oils against a group of Food-Borne Pathogenic bacteria: A comparative study

Abhinav Pathak*, Nimisha Dutta and Manjeet Kaur

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ABSTRACT

Plant derived edible oils (EOs) have been known to show antimicrobial activity against specific pathogens and therefore could be considered as alternative antimicrobial agents in controlling pathogens. The present study was done to investigate the antibacterial activity of Soybean seed oil, Mustard seed oil, Coconut oil and Cotton seed oil against targeted food borne pathogens. Antibacterial activities of edible oils were determined using agar well diffusion assay. Among the four edible oils chosen for the study, Mustard seed oil showed highest antibacterial activity whereas, cotton seed oil showed least antibacterial activity against targeted food-borne pathogenic strains.In general all the edible oils showed antimicrobial activity. These edible oils thuscan be used in context of drugs, food and cosmetics due to their antimicrobial properties and also can also be used for preservation purposes. The results obtained from present study may help customers to have more choices in the consumption of edible oils in Indian market.

KEYWORDS: Edible oils (E0s), Antibacterial activity, Gram-positive bacteria, Gram-negative bacteria.

INTRODUCTION

In recent years, food security has become a hot topic for public health globally. Food-borne pathogens often points to the pathogenic micro-organism introduced into the food system and circulation. These microorganisms can release toxic substances, which can directly or indirectly cause illness or toxicity. Common pathogens that cause food poisoning are *Escherichia coli*, *Salmonella spp.*, *Vibrio cholera*, *Pseudomonas spp*., and *Staphylococcus aureus*. In recent years, an increasing number of microorganisms have been identified that can cause illness or toxicity in humans. These pathogens are not only detrimental to human health, but also an important basis for foodborne outbreak of diseases (Ayaz*et al.*, 2015).

Antimicrobial agents used for destroying or preventing the growth of pathogenic or foodborne pathogens can occur by synthetic or natural means. The use of synthetic antimicrobial compounds as food preservatives has raised consumer concerns, as they present many toxicological complications and may not be safe for human consumption (Singh *et al.,* 2019). Natural resources can give a wide range of structurally diverse and complex compounds. Herbal extracts, edible oils and essential oils have antibacterial, anti-fungal and antiviral properties and have been tested worldwide as potential sources of new antimicrobial compounds, food preservation agents, and other treatments for infectious diseases (Astani*et al.,* 2010; Safaei-Ghomi and Ahd, 2010).

Edible oils have been a major contributor to the diet of many people in many countries, serving as a good source of protein, lipid and fatty acids in human nutrition including the repair of aging tissue, the formation of new cells, as a source of energy and as an anti-bacterial and antioxidant (Atasie*et al.,* 2009).

Coconut (*Cocos nucifera*) for example is useful in the development of medicines against many diseases. The high potency of coconut oil as a drug was confirmed by Kabara in the 1970s, who reported coconut oil's antiviral, antibacterial and antifungal activity (Kabara, 1978). Antimicrobial activity of coconut oil was also studied by

Hierholzer and Kabara (1982) focusing on the virucidal effects of monolaurin RNA and DNA viruses. Manohar *et al*. (2013) stated that coconut oil, when used as flavouring agent in food, showed a wide range of antimicrobial activities.

Yellow mustard oil, another example, contains mainly allyl isothiocyanate (AITC) compound (Techathuvanan*et al.*, 2014) which successfully inhibit a variety of pathogenic microorganisms even when used in low concentrations. The antibacterial activity of mustard oil is maybe due to the potential of its components to disrupt bacterial cell membranes, resulting in cell rupture (Turgis*et al.,* 2009).

Cotton seed oil exhibits antimicrobial activity because of phytochemicals. Many naturally occurring compounds found in medicinal plants, edible oils, herbs and spices have antibacterial activity that acts as a source of antimicrobial agents against fungi and bacteria (Deans and Ritchie, 1987; Janssen et al., 1985; Kim *et al.,* 1995).

Soybeans (Glycine max) is a commercial agricultural crop that is widely used to produce a wide variety of products such as soybean oil, tofu, soy flour, soy milk, roasted soy beans and many other products. The antibacterial activity of the active ingredients isolated from soybeans is extensively studied; soy isoflavones contain antimicrobial and antioxidant activity. Numerous research papers have published that isoflavones extracted from soybeans have the potential to inhibit the growth of many bacteria (Ponnusha*et al.,* 2011, Hong *et al*., 2006, Villalobos *et al*., 2015). Dastidar*et al*.(2004) studied the antimicrobial properties of isoflavones through the tests performed on 12 known gram-positive and gram negative bacteria. Lu extracted isoflavones from soybean whey and tested antimicrobial activity through filter paper. The results showed that soy isoflavones show antimicrobial activity.

Aluyor and Ori-Jesu (2008) noted that the shelf life of edible oils used in food and its application in the industry depended heavily on their oxidative stability and anti-bacterial activity. *E.coli*, *Pseudomonas spp.*, *S. aureus*, *Vibrio cholera* and *Salmonella spp*. are the most common bacteria that are found in the human body and environment and these are opportunistic pathogens that cause severe and life-threatening infections in patients with immune deficiency (Hammer *et al*., 1999; Islam *et al*., 2014). Thus, the control of these bacteria in the food industry is needed.

The present study is designed to study the antimicrobial activity of edible oils against a variety of Gram-positive and Gram-negative bacteria namely *E.coli*, *Pseudomonas spp.*, *S. aureus*, *Vibrio cholera* and *Salmonella spp* using aagar well diffusion method to test their zone of inhibitions.

METHODS AND MATERIALS:

Edible oils:

For the present study, edible oils were procured in sealed container from different vendors in Delhi city, India. Edible oil used in the study were: Soybean seed oil (*Glycine max*), Coconut oil (*Cocos nucifera*), Mustard seed oil(*Brassicajuncea*)and Cotton seed oil (*Gossypiumhirsutum*) respectively.

Culture Maintenance:

Different pathogenic bacterial strains used in this study include*Escherichia coli* (*MTCC-443*), *Pseudomonas sp.* (*MTCC-424*), *Staphylococcus aureus* (*MTCC-737*), *Vibrio cholera* (*MTCC-3906*), *Klebsiella spp.* (*MTCC-109*), and *Salmonella spp.* (*MTCC-733*) were used to determine the antimicrobial activity of these edible oils respectively. Reference culture of these pathogenic bacterial strains was procured from CSIR-IMTECH, Chandigarh. Bacterial isolates were subcultured at least twice from the stock on Nutrient agar (Himedia Laboratories Ltd., India) to prepare a fresh culture before using them in the assay.

Preparation of inoculum:

Working stock of subcultured bacteria were

inoculated in Nutrient broth and incubated at 37°C for 18 hrs to compare to a turbidity of 0.5 Mac-Farland standards.Overnight (18hrs) broth culture of test pathogens was swabbed uniformly on the surface of Muller-Hinton agar, MHA (Himedia Laboratories Ltd) plates using sterilized cotton swabs. One plate of MHA was kept as media control. Commercially available Chloramphenicol disc (10µg) was used as Positive control. For pathogen control, 5 MHA plates were swabbed with the 5 different pathogens.For treatment control, 5MHA plates were swabbed with 5pathogens; single well was cut in each plate and about 20 µl of 10 mg/ml of four oil samples were placed separately. Plates were incubated at 37°C for 24hrs. Zone of inhibition formed around the wells was observed and measured in millimeters and results were recorded.

Statistical analysis:

Each experiment was carried out in triplicate and mean standard deviation (SD) was calculated for every type of bacterium. Microsoft Excel 2010 software was used for calculation.

RESULTS AND DISCUSSION:

Antimicrobial activity of edible oils against different food borne pathogens including both Gram-positive and Gram-negative bacteria is summarized in Table-1. Previously, many studies highlighted the antimicrobial activity of plant derived non-edible oils but current study is based on antimicrobial activity of edibleoils, which are usually consumed as edible oils. All bacterial strains showed susceptibility to each edibleoil as illustrated in Table-1.

Table 1: ANTIMICROBIAL ACTIVITY OF EDIBLE OILS AGAINST PATHOGENIC MICROORGANISUMS

	Zone of inhibition (measured in millimetre)				
	Escherichia coli	***Pseudomonas spp.***	***Staphylococcus aureus***	***Vibrio cholerae***	***Salmonella spp.***
Chloramphenicol		23.16±0.21	24.38±0.14	19.62±0.17	22.27±0.85
Mustard seed oil	17.36±0.42	19.27±0.42	21.34±1.11	18.68±0.00	19.16±1.36
Coconut oil	15.45±00	18.36±0.25	19.74±0.59	18.06±0.34	18.53±1.10
Soybean seed oil	13.59±0.52	11.82±0.47	15.03±1.15	12.03±0.54	11.43±0.28
Cotton seed oil	8.37±0.23	7.51±0.22	9.14±0.36	8.23±0.26	7.18±0.50

The diameter of the zone of inhibition varied depending on the edible oil and bacterial species used as represented in (Fig 1). In present study, Mustard seed oil reveals higher antibacterial activity as compared to other three edible oils showing zone of inhibition for *E.coli* (17.36±0.42 mm), *Pseudomonas spp.* (19.27±0.42 mm), *Staphylococcus aureus* (21.34±1.11 mm), *Vibrio cholera* (18.68±0.00 mm) and *Salmonella spp*. (19.16±1.36 mm) respectively. This finding is in agreement with the finding of Tegos*et al*., (2002). For Coconut oil, present results showed higher antibacterial activity as compared to soybean seed oil and cotton seed oil respectively, bactericidal activity of coconut oil had been attributed to the carboxylic acid-monolaurin metabolized to lauric acid in the body, reported by (DebMandal*et al*., 2011). Like-wise Soybean seed oil, also showed moderate antibacterial activity in present study, it might be due to the presence of Soy isoflavones that contain antimicrobial and antioxidant activity stated by Ponnusha*et al.,* (2011). Out of the four edible oils, cotton oil showed least antimicrobial activity towards food borne pathogenic bacteria.

Several reports reveals that bioactive components present in essential oils penetrate the phospholipid bilayer of the cell membrane by which structural integrity of cell membrane is disrupted, which can detrimentally influence the cell metabolism casing cell death (Bajapai *et al.*, 2013). In present study *Staphylococus aureus*, shows higher sensitivity

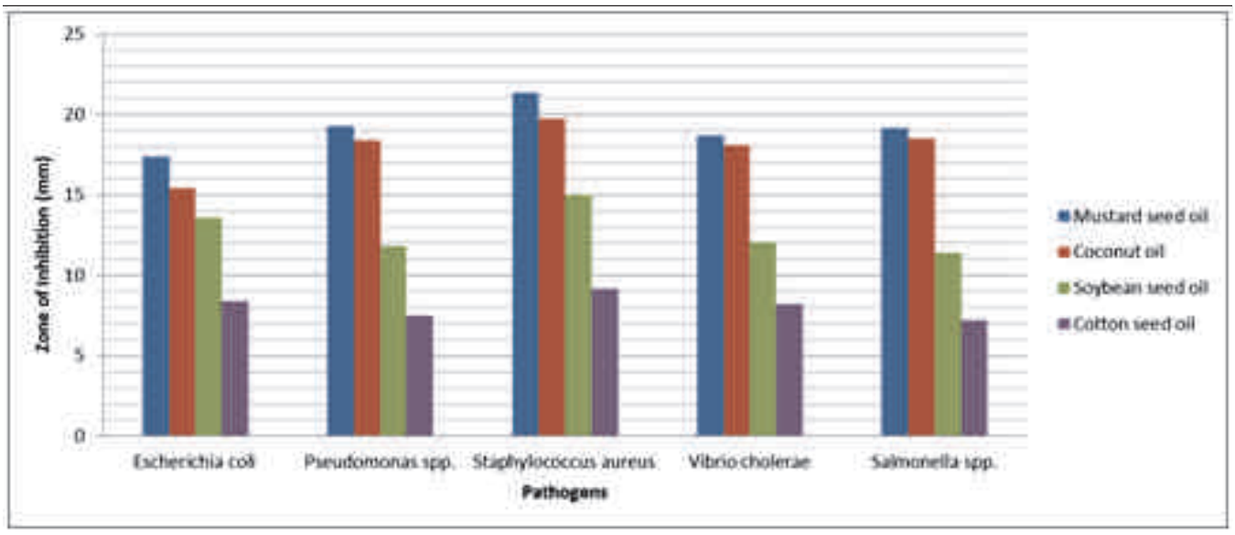

Fig 1: Sensitivity of food borne pathogens towards four different edible oils

towards all edible oils as compared to other pathogenic strains. Similar studies carried out by Huang *et al.,* 2014, showed that Gram-positive bacteria are more susceptible to Eos as compared to Gram-negative bacteria. This can be attributed to the fact that Gram-negative bacteria have an outer membrane which is rigid, rich in lipopolysaccharide (LPS) and more complex, thereby limiting the diffusion of hydrophobic compounds through it, while this extra complex membrane is absent in Gram-positive bacteria which instead are surrounded by a thick peptidoglycan wall not dense enough to resist small antimicrobial molecules, facilitating the access to the cell membrane (Hyldgaard*et al.,* 2012).

CONCLUSIONS:

Edibleoils possess important volatile compounds with diverse bioactivities including antimicrobial potential.Several types of edible oils and their individual components are used as natural antimicrobial compounds to reduce the impact of microbial activities in food products. We conclude from this study that edible oils are potential sources of biocontrol products that should be further studied due to their potential to protect food commodities. In this study potential of edible oils was found to control food borne pathogenic bacteria. Although, there are countless potential uses of edible oils and more research is needed to meet the needs of a food industry shifting toward the use of green technology.

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Quantitative Analysis of Phospholipids in Lecithin by Evaporative Light Scattering Detection

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KEYWORDS: HPLC-ELSD, Lecithin, Limit of detection, phosphotidylcholine, Phosphotidylethanolamine, Lyso-phosphotidylcholine

ABSTRACT

A method was validated using high performance liquid chromatography with evaporating light-scattering detector (HPLC-ELSD) for the determination and quantification of phospholipids in lecithin using a normal phase column. The method was validated for specificity, linearity, accuracy, precision limit of detection and limit of quantification. The method was specific for the determination of phosphotidylcholine, Phosphotidylethanolamine, and Lyso-phosphotidylcholine in lecithin and related products. A lower detection limit was estabilished with this method for the phospholipids with 1mg/ml. The calibration curves were linear over the range tested (R2 > 0.99) and accuracy and precision were acceptable with relative standard deviation < 5.0%. The analytical procedure was successfully applied to evaluate the phospholipids in commercially available lecithin.

INTRODUCTION

Phospholipids are molecules with two fatty acids and a modified phosphate group attached to a glycerol backbone. All naturally occurring glycerophospholipids possess α-structure and L-configuration, in which hydrophilic head group and hydrophobic acyl chains are linked to the alcohol. Variation in the head group leads to different glycerophospholipids, such as phosphatidylcholine (PC), phosphatidylethanolamine (PE), phosphatidylserine (PS), phosphatidic acid (PA), phosphatidylinositol (PI), phosphatidylglycerol (PG) [1, 2]. In plant and animal tissue phospholipids commonly serve as structural components in membranes in addition to playing a role in enzyme activation. For this reason, they are widely based in the food and cosmetic industries, as well as industrial manufacturing [3, 4]. In general, lecithins is a byproduct of the vegetable oil refining process from oilseeds, such as soybean, corn, rapeseed, sunflower and cotton seeds. However, raw lecithins are complex mixtures of lipids, namely, phosphatidylcholine, phosphatidylethanolamine, and lysophosphatidylcholine, etc as main components. In addition to PL functional properties, the food industry also has great interest in associated nutritional properties and health benefits of polar lipids [5].

From the analytical point of view, separation of phospholipids have been studied and performed with different methods including thin layer chromatography (TLC) and high performance liquid chromatography (HPLC) [6,7]. The previous quantification and separation of phospholipids have been performed with thin layer chromatography (TLC). This method has several disadvantages, such as quantitative separation of individual phospholipid moieties is very difficult and not always accurate. In the case HPLC, quantification of phospholipids utilizing an UV detector could not be performed due to the poor response of phospholipids. In the case of refractive

index detector, the refractive index of the solvent was influencing the analysis. In order to overcome the issues of these detectors, later evaporating light-scattering detector (ELSD) was introduced as an universal detector. ELSD was first described by Charlesworth [8]. The principle is based on the detection of nonvolatile molecules carried by a volatile mobile phase. The column effluents are nebulized to an aerosol, followed by volatile compound vaporization and formation of small solute droplets. The laser light scattered by these droplets is detected by a photodiode. ELSD has become popular to detect and monitor the separation of poor UV-absorbers, such as phospholipids [9-11], PEGs [12, 13] and triglycerides [14, 15]. This detection technique was chosen in these studies for several reasons. First, this equipment is well established in the quality control of liposome suspensions [16, 17]. Second, contrary to UV and refractive index (RI) detection, solvent selection and gradient elution are not limiting factors [18, 19].

Considering the review literature and research articles, the present investigation is aimed for the determination and quantification of phospholipids by normal-phased HPLC with ELSD detector. The suitability of the method for the determination of phospholipids in lecithin is evaluated by testing its specificity, linearity, precision, sensitivity, and accuracy. For this reason, we have chosen the phosphatidylcholine, phosphatidylethanolamine, and lysophosphatidylcholine (fig.1) as an example to establish a method for their quantification individually and as mixture. This method can be applied for the quantification of phospholipids present in the industrial grade lecithins.

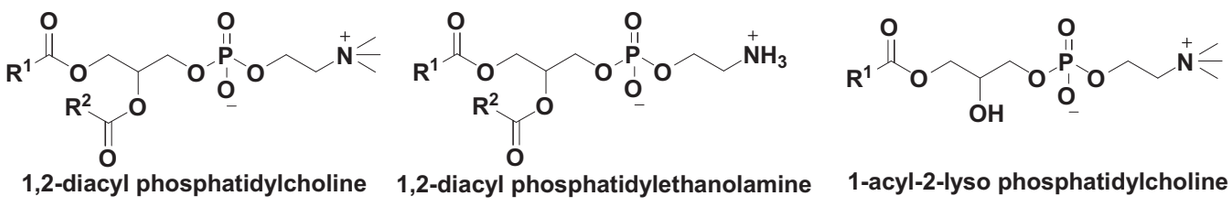

Fig.1: Chemical structure of phospholipids

MATERIALS AND METHODS

Materials

Phosphotidylcholine (PC), Phosphotidylethanolamine (PE) and Lysophosphotidylcholine (LPC) standard are purchased from Sigma Aldrich (St.Louis, MO, USA). Hexane (HPLC grade), Isopropyl alcohol (HPLC grade), triethylamine (TEA) and Glacial Acetic Acid (GAA) from Finar Limited (Ahmedabad, India). Ultra-pure water was prepared using a Milli-Q Synthesis system (Millipore, Billerica, MA)

Instrumentation and chromatographic conditions

Phospholipid separation was performed on Agilent UHPLC Infinity II 1290 system with four solvent lines, Evaporating light scattering detector which was coupled with control panel CDS software. As a nebulizing gas, Nitrogen was used at a flow rate of 2 SLM (Standard litter per minute), a nebulizing temperature of 50°C and evaporator temperature 80°C was set. The separation is done with flow rate of 1ml/min, with injection volume of 10 µl. Column temperature was set at 40°C

Separation was performed on Agilent Pursuit XRs 10-Si 250mmx4.6mm column. The elution program was gradient with eluent a) hexane: isopropyl alcohol: triethylamine: glacial acetic acid (814:170:0.8:15) (v/v) and eluent b) Isopropyl alcohol: Milli-Q: triethlyamine: glacial acetic acid (844:140:0.8:15) (v/v), for gradient composition refer the Table 1 given below. Diluent/Solvent mixture use for standard and sample preparation was hexane: isopropyl alcohol: Milli-Q (23:23:4).

Table 1: Gradient composition table

Time (Min)	Mobile Phase A (% Composition)	Mobile Phase B (% Composition)	Flow Rate (ml/min)
0.0	95	5	1
1.0	95	5	1
6.0	80	20	1
9.5	60	40	1
16.0	0	100	1
18.5	0	100	1
19.0	95	5	1
21.5	95	5	1
22.5	95	5	2
27.5	95	5	2
30.0	95	5	1

Standard Preparation

Stock solution of individual phospholipids standard Phophotidylcholine (PC), Phosphotidylethanolamine (PE), Lyso-phosphotidylcholine (LPC-I & II) is prepared by accurately weighing about 0.5 g of each into a 5 ml volumetric flask and make up the final volume with diluent. Mix stock solution of 1 mg/ml, 2 mg/ml, 3 mg/ml, 4 mg/ml and 5 mg/ml is further prepared from above individual stock solution in diluent.

Sample extraction and preparation

1gm of soya lecithin sample taken in 15 ml centrifuge tube. 5mL of solvent mixture was added and vortex for 10min. Again 5mL of solvent mixture was added, mixed well and sonicate for 15 min. After sonication, sample is filtered using 0.2µ nylon filter.

RESULT AND DISCUSSION

Specificity/Selectivity

Specificity is the ability to assess the analyte in the presence of components which may be expected to be present. Typically these might include impurities, degradants, matrix, etc. For specificity, we analyze diluent, blank samples, reference standard (Fig.2) and spiked sample. The retention time of the analyte in spiked sample and standard sample are same. The diluent, blank sample did not give any response at the relevant RT of the analyte (PE, PC, LPC-I and LPC-II).

Calibration/Linearity

To evaluate linearity, five different concentration of mix standard was analyzed. Linearity should be evaluated by visual inspection of a plot of signals as a function of analyte concentration. Linearity was determined by analyzing reference material at minimum 5 different concentrations 1 mg/ml, 2 mg/ml, 3 mg/ml, 4 mg/ml and 5 mg/ml. five level of concentration were used for the calibration of each compound. The regression coefficient (R2) for analytical standard solution should be $\geq$0.99. The correlation coefficient (R2) of PE, PC, LPC-I and LPC-II is found 0.99771, 0.99177, 0.99430 and 0.99821 (Fig. 3).

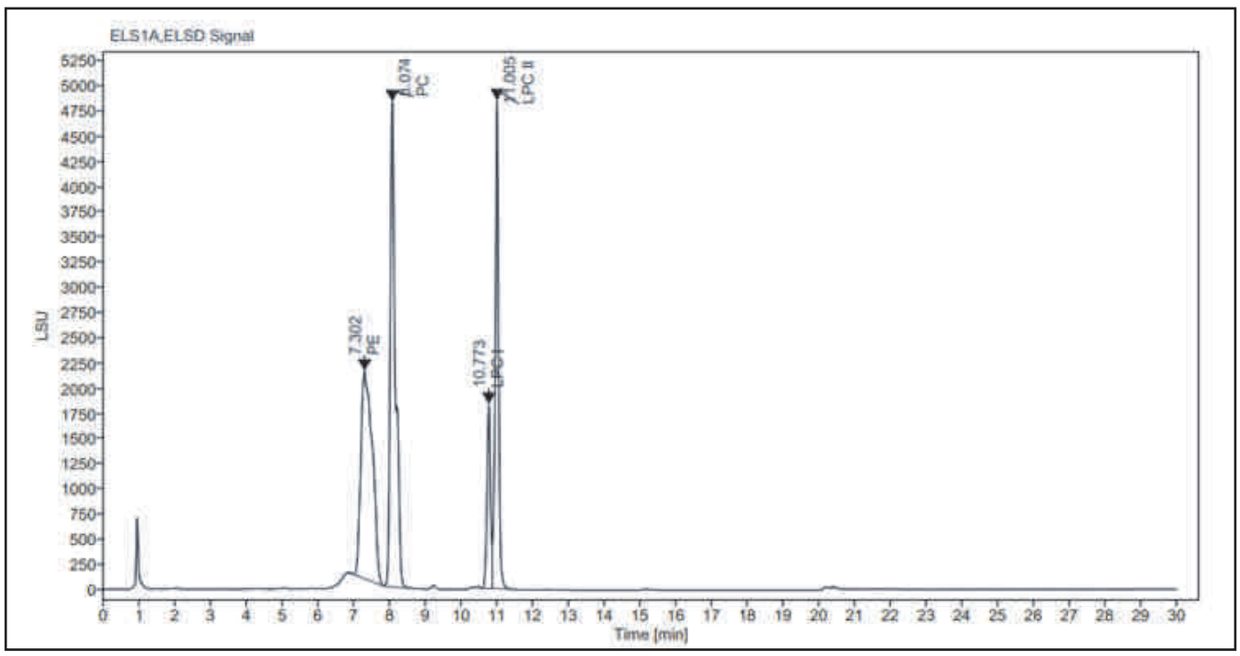

Fig. 2: Chromatogram of mix phospholipid standard

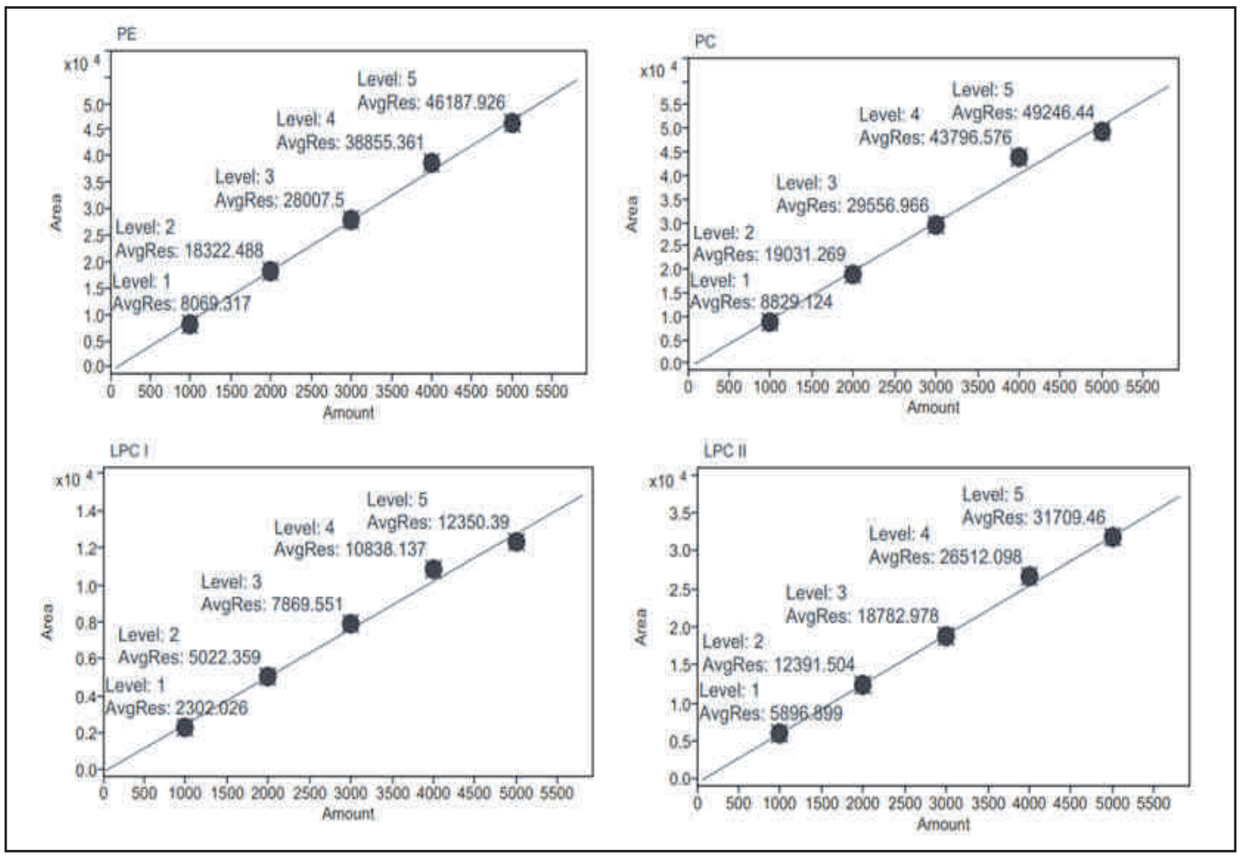

Fig. 3: Correlation coefficient and concentration range of Phosphotidylethanolamine, Phosphotidylcholine, Lysophosphotidylcholine calibrations.

Recovery and Repeatability

Recovery (Accuracy) and Repeatability (Precision) is done investigate the effect of matrix on recovery analyze blank sample and spiked at the minimum three different concentrations level of analyte and six replicates at each concentrations level. Recovery and repeatability is reported as percent accuracy and percentage of relative standard deviation (%RSD). The result of this study for recovery ranges from 86% to 102% and %RSD for repeatability ranges from 2.24% to 4.91% as shown in Table 2., which was satisfactory in consideration of the future application of the proposed method.

Table 2:- Recovery and repeatability of phospholipids

Phospholipid Compounds	Recovery (%)	Repeatability (%RSD)
Phosphotidylethanolamine (PE)	86.95	3.64
Phosphotidylcholine (PC)	97.22	4.91
Lysophosphotidylcholine-I (LPC-I)	88.18	4.85
Lysophosphotidylcholine-II (LPC-II)	102.84	2.24

Limit of detection (LOD) and Limit of quantification (LOQ)

Limit of detection (LOD) is the smallest amount or concentration of analyte in the test sample that can be reliably distinguished, with stated significance, from the background or blank level whereas limit of quantification (LOQ) is the lowest amount or concentration of analyte in the sample which can be quantitatively determined with an acceptable level of precision and accuracy. To define the limit of detection and limit of quantification, six replicates of spiked concentration at LOD and LOQ concentrations level are injected. The LOD and LOQ for the different phospholipids is found 1 mg/ml and 2 mg/ml as shown in Table 3.

Table 3: Limit of detection (LOD) and limit of quantification (LOD)

Phospholipid Compounds	LOD (mg/ml)	LOQ (mg/ml)
Phosphotidylethanolamine (PE)	0.1	0.2
Phosphotidylcholine (PC)	0.1	0.2
Lysophosphotidylcholine-I (LPC-I)	0.1	0.2
Lysophosphotidylcholine-II (LPC-II)	0.1	0.2

The optimized method was applied to the determination of phospholipids in five samples of soybean lecithin. As can be observed PC content in samples 15.24-16.81%, PE content in the sample is 11.81-13.02 and LPC content 1.62-1.94 % is low compared to both PC and PE content in the samples results are obtained. The proposed method is appropriate for the quality control of soybean lecithin.

CONCLUSIONS

In this study, a simple HPLC-ELSD method was validated for the determination and quantification of phospholipids in lecithin by using normal phase. The ability of this analytical method to provided detection and quantification limits are 1 mg/ml and 2 mg/ml respectively. Recoveries over 85% were obtained and the calibration curves were linear at the tested ranges (R2 > 0.99). The method to be efficient for a precise and accurate quantification of the phospholipids from lecithin and is applicable to routine analysis, which would provide further information regarding the properties and functions of lecithin.

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Prediction and sensitivity analysis of the cetane number of different biodiesel fuels using an artificial neural network

The cetane number (CN) of biodiesel fuels was predicted using an artificial neural network (ANN). A data set with 156 measured biodiesel CN data points was first collected from the literature. Then, two input sets were introduced for training the ANN including the fatty acid methyl ester (FAME) composition and the functional group of FAMEs. In the composition-based method, the input set includes the mass fractions of the 14 FAME components from C10:00 to C24:00. In the functional group-based method, the input set contains three improved functional group parameters of $n(\text{-CH}_2\text{-})/n(\text{C})$, $n(\text{C=C})/n(\text{C})$, and the position index of C=C. For the composition-based method and the functional group-based method, the best mean absolute errors are, respectively, 1.70 and 1.72, and the best mean relative errors are, respectively, 3.13 and 3.24% for the test set. To deeply understand the correlations between the CN and the composition and molecular structure of the FAMEs in biodiesel, an analysis method for calculating the single-factor and double-factor sensitivity coefficients between the input set and the output set was first implemented by **Shuang Hao *et al*** for the fuel property prediction study. It was found that C18:01, C18:02, and C18:00, as well as $n(\text{-CH}_2\text{-})/n(\text{C})$ and $n(\text{C=C})/n(\text{C})$, provide the largest sensitivity coefficients [**Energy & Fuels 35**, 17711-17720, (2021)].

Comparison of key aroma-active compounds between roasted and cold-pressed sesame oils

Wen-ting Yin *et al* studied the comparision of the key aroma-active compounds that contributed to the different aroma profiles between roasted and cold-pressed sesame oils. Aroma compounds were extracted by headspace solid-phase micro-extraction (HS-SPME) and simultaneous distillation extraction (SDE) and were analysed using gas chromatography–olfactometry-mass spectrometry (GC-O-MS) and aroma extract dilution analysis (AEDA) [**Food Research International**,150, Part A, Article 110794, (2021)]. The numbers of aroma-active compounds with the flavour dilution (FD) factors between 1 and 2048 were 57 and 16 in the roasted and cold-pressed sesame oils, respectively. A total of 28 volatile compounds were identified as aroma-active compounds in sesame oils for the first time. Important aroma compounds (FD $\geq$ 8) were quantified by the external standard method, and their odour activity values (OAV) were calculated as the ratio of their concentrations to odour thresholds in oil. The numbers of key aroma-active compounds defined by OAVs $\geq$1 were 23 (OAVs = 1–385) and 8 (OAVs = 1–42), respectively, in the roasted and cold-pressed sesame oils. 2-Methoxy-4-vinylphenol (smoked, 1924 µg/kg, OAV = 385), 2-methoxyphenol (smoked, 1488 µg/kg, OAV = 114) and pyrazines (roasted and nutty, 578–22750 µg/kg, OAV = 1–67) were the most important aroma-active compounds in the roasted sesame oil, whereas hexanal (green and fruity, 3094 µg/kg, OAV = 42) was the most important aroma-active compound in the cold-pressed sesame oil, followed by (*E,E*)-2,4-decadienal (earthy, 4170 µg/kg, OAV = 31), dimethyl sulfone (sulphur-like, 406 µg/kg, OAV = 20) and octanal (green and fruity, 901 µg/kg, OAV = 16). This study provides valuable information for manufacturers to achieve precise flavour control of sesame oil products.

Electrochemical oxidation of glycerol to dihydroxyacetone in borate buffer: enhancing activity and selectivity by borate–polyol coordination chemistry

Selective electrochemical oxidation of glycerol, the major byproduct during the biodiesel production process, can not only make biodiesel production more environmentally benign and economically feasible but also generate value-added C_3 chemicals that are important for medicinal and cosmetics applications. However, severe C–C bond breakage often occurs, which would lead to low C_3 selectivity, especially on earth-abundant, low-cost transition metal electrocatalysts **Xin Huang *et al*** exploited the coordination ability of borate ions with polyol molecules and reported the enhanced and selective electrochemical oxidation of glycerol to 85% C_3 chemicals (67% for dihydroxyacetone in detected liquid products, with an average production rate of 90 mmol m^{-2} h^{-1}), using cobalt borate as the electrocatalyst in borate buffer electrolyte [**ACS Sustainable Chemistry & Engineering, 9**, 14470-14479, (2021)]. The improved electrochemical activity and selectivity at different borate buffer concentrations and solution pH values have been explicitly correlated with the coordination ability of borate with glycerol under different circumstances, as revealed by ^{11}B NMR spectroscopy studies. The strategy presented herein can be potentially extended to the selective upgrading of a broad scope of biomass-derived sugars and polyols, for producing value-added chemicals on low-cost non-noble metal electrocatalysts.

Recycling of used domestic waste oils: A benign emulsifier-free lubricating material for leather process

The leftover vegetable oils after frying of food at higher temperature is toxic to environment as diminutive of technologies for proper disposal and reuse of waste cooking oil. A highly water soluble and emulsifier-free phosphorylated fatliquor with the emulsion stability of more than 60 min from economically cheap deep fried oils on transesterification with highly biodegradable ecologically innocuous and water soluble Poly (ethylene glycol) with *p*-Toluene Sulphonic acid followed by phosphorylation produces highly water dispersible and stable material for leather applications. **M. Venkatesh *et al*** synthesised phosphorylated fatliquors and ascertained the lubrication of collagen fibres and fibre splitting of goat skin by SEM analysis [**Journal of Cleaner Production**, 329, Article 129654, (2021)].The transesterification has confirmed by FT-IR, fat composition oils, COD, BOD, total solid in spent liquor were analysed. Physical characteristics of leathers were analysed by tensile strength, tear strength, elongation and quality assessments by hand evaluation by experts. Acid, iodine, saponification values, particle size of phosphorylated fatliquors, surface wettability, thermal stability of leathers were analysed and the properties compared. The finding can assist an emulsifier-free lubricating process significantly as currently available leather chemicals.

Improve the physical and oxidative stability of O/W emulsions by moderate solidification of the oil phase by stearic acid

Physical instability and oxidation were two of the most evident problems existing in food emulsions.

In this research, a facile approach of solidifying the oil phase by stearic acid was adopted to overcome the above problems simultaneously, emphasising the effect of the oleogelation extent. Polarizing microscope, rheological analysis, and X-ray diffraction (XRD) were used to characterize the oleogelation of the oil phase, and droplet size, microscopic observation and peroxide value analysis were applied to evaluate the emulsion stability. Results showed that with moderate solidification of the oil phase (0.8%–1.0% w/v stearic acid in oil phase), the emulsions exhibited excellent physical stability under the stress of centrifugal force, high salt, and long-term storage. Moreover, the oxidative stability of the emulsions was improved simultaneously, that the increasing of peroxide value was slowed significantly. Excessive solidification (e. g. 3% w/v stearic acid) of the oil phase would weaken these advantages or even bring about opposite results, due to the destruction of the emulsion droplets by the excessive crystallization. **Yuehan Wu *et al*** suggested that moderate solidification of oil phase would be a feasible and effective approach to improve the stability of o/w emulsions, which would be significant for the industrial-scaled production [**LWT**, 151, Article 112120, (2021)].

Crystallinity and water vapor permeability of *n*-alkane, alcohol, aldehyde, and fatty acid constituents of natural waxes

Natural waxes are valuable industrial products consisting of complex chemical mixtures. To probe the structure–function role of select constituents, model *n*-alkanes, alcohols, aldehydes, and fatty acids of $C_{18–19}$, $C_{22–23}$, and $C_{26–27}$ carbon chain lengths were synthesized and analyzed via calorimetry and X-ray powder diffraction. Pure compounds and binary mixtures were crystallized by **Francisco M. A. Leyva-Gutierrez and Tong Wang** into monoclinic (*M*), triclinic (*T*), and orthorhombic (*O*) lattices or combinations thereof [**Industrial & Engineering Chemistry Research, 60**, 14651-14663, (2021)]. The C_{26} aldehyde formed an *O* lattice and exhibited one solid–solid phase transition similar to *n*-alkanes. The water vapor permeability (WVP) of model systems cast as films was determined. For pure compounds, WVP decreased in the following order: fatty acid > even *n*-alkane > odd *n*-alkane > alcohol > aldehyde. Increasing carbon chain length, which translates to increasing unit cell volume, decreased WVP. Binary mixtures generally exhibited a more complex relationship with WVP. These findings may be applicable to the agricultural postharvest, pharmaceutical, and paperboard coating industries.

Enzymatic synthesis of capric acid-rich structured lipids and their effects on mice with high- fat diet-induced obesity

Julián Paul Martínez-Galán *et al* produced structured lipids (SLs) by enzymatic acidolysis using *Rhizopus oryzae* lipase covalently immobilized in a low-cost material. Grape seed oil was used to synthesize SLs containing the medium-chain fatty acid (C10:0) capric acid [**Food Research International**, 148, Article 110602, (2021)]. SL synthesis led to 38.8% medium-chain fatty acid incorporation with 5 reuses of the enzymatic derivative. The reaction conditions for the synthesis of MLM-TAGs (triacylglycerols with one long- and two medium-chain acyl residues) were at a molar ratio of fatty acid:oil of 3:1, performed at 40 °C and lipase immobilized load of 5% (w/w). The *in vivo* effects of SLs were studied

in Swiss mice fed premade diets: control (C) diet, high-fat diet (HFD) with 100% lipid content as lard, HFD with 50% lipid content as grape seed oil (HG) or HFD with 50% lipid content as capric acid-containing SLs produced from grape seed oil (HG-MCT). Mice from HG and HG-MCT groups had decreases in body weight gain and reductions in the weights of white adipose tissues. In addition, HG and HG-MCT mice had low plasma levels of glucose and total cholesterol, and improvements in the glucose tolerance. HG and HG-MCT diets have remarkable antioxidant properties, since low plasma levels of TBARS (thiobarbituric acid reactive substances, biomarkers of lipid peroxidation) were found in mice fed these diets. Interestingly, TBARS levels in HG-MCT mice were further decreased than values of HG mice. Mice fed HG and HG-MCT diets also showed preservation in the activity of the antioxidant enzyme paraoxonase 1. Both HG and HG-MCT diets promoted reduction of IL-6 and IL-10 production by splenocytes. The capric acid-containing SLs produced from grape seed oil emerges as a functional oil capable to mitigate obesity complications resulting from oxidative stress and inflammation.

Microwave pretreatment of camellia (Camellia oleifera Abel.) seeds: Effect on oil flavor

Microwave is a new pretreatment technology, and microwave processing time of camellia seeds is a factor affecting the flavor of camellia seed oil (CSO). **Junhua He *et al*** studied on the characteristic volatile compounds of CSO from microwaved seeds with different processing time was carried out by electronic nose (E-nose), headspace-solid phase microextraction-gas chromatography-mass spectrometry (HS-SPME-GC-MS) and headspace-gas chromatography-ion mobility spectrometry (HS-GC-IMS) [**Food Chemistry**, 364, Article 130388, (2021)]. The results of E-nose show that W1W, W2W and W5S were the main sensors to distinguish the flavor profile of CSOs. Through HS-SPME-GC-MS and odor activity value analysis, 80 volatile compounds were detected and 22 key aroma compounds were screened in CSOs. Compared with HS-SPME-GC-MS, 44 volatile compounds were detected by HS-GC-IMS, including 9 identical compounds and 35 different compounds. In general, the volatile compounds of 0, 2 and 3 min CSOs were mainly alcohols and esters, while the 4, 5 and 6 min CSOs were mainly heterocycles and aldehydes.

Sustainable ammonia production from steam reforming of biomass-derived glycerol in a heat-integrated intensified process: Modeling and feasibility study

Currently, ammonia, as a clean and sustainable energy carrier, is intensively synthesized from its elements during the Haber-Bosch technology. This process requires a large amount of energy and emits numerous amounts of carbon dioxide, because hydrogen is dominantly produced from fossil fuels through reforming processes. Biomass-derived glycerol steam reforming is an attractive alternative to traditional reforming for reducing the dependence on hydrocarbon resources and mitigating climate change. This research by **Mohammad Hasan Khademi and Mohammad Lotfi-Varnoosfaderan** aims to intensify a heat-integrated process for the co-production of ammonia and syngas from glycerol valorization [**Journal of Cleaner Production**, 324, Article 129241, (2021)]. In this process, glycerol reforming continuously provides hydrogen needed for

ammonia synthesis, and the liquid glycerol is simultaneously vaporized by heat generated from ammonia synthesis. Methane tri-reforming acts as a heat source to drive glycerol reforming; at the same time, the effluent gas produced through glycerol reforming is recycled to the tri-reforming side to reduce the greenhouse gas emissions. The role of different parameters on the process performance is identified by a one-dimensional heterogeneous model. Numerical results show that by adjusting the adequate operating conditions, glycerol and methane conversion >95%, nitrogen conversion >25%, glycerol dryness fraction = 1.0, and syngas with hydrogen to carbon monoxide ratio above 2.0, suitable for the Fischer-Tropsch and methanol synthesis processes, can be achieved. In addition, this heat-integrated intensified process is promising in terms of energy saving, environmental pollution mitigation, feasibility and effectiveness for industrial-scale application; however, experimental proof-of-concept is required to ensure the safe operability of this process.

Trends in blending vegetable fats and oils for cocoa butter alternative application: A review

Global demand for cocoa butter (CB) product is rising, but the production of CB does not meet the demand, and the availability of this fat is also limited. CB has specific melting properties, and the blooming effect causes defect in its physical properties. The blending of fat is one of the modification methods that offer new functional CB alternatives (CBAs) that can enhance the properties of CB and be applied as substitutes in the food industry. This review by **M. R. Norazlina *et al*** describes the current trends in blending the pure or modified vegetable fats and oils for CBAs production and summarises the characteristics of the blended substances [**Trends in Food Science & Technology**, 116, Pages 102-114, (2021)]. Typical and recent fats and oils used for CBAs production, including mango seed fat, bambangan kernel fat, shea butter, kokum butter, sunflower stearin and palm oil fractions such as palm oil mid fraction and palm stearin are highlighted. The potential application of the blended fat as CBAs and the changes in their physicochemical, thermal and morphological behaviour are discussed.The blended fats and oils produced from different sources greatly resemble the characteristics of commercial CB with improved thermal and bloom properties. Thus, the blending processes facilitated the application of various vegetable fats and oils as CBAs to improve the physical quality of the final product in the manufacture of chocolates and confectioneries.

Azolla pinnata methyl ester production and process optimization using a novel heterogeneous catalyst

Prabakaran S *et al* concentrated on utilizing a novel heterogeneous dolomite catalyst in transesterification of *Azolla pinnata* algae oil with methanol to convert *Azolla pinnata* methyl ester (AME) [**Renewable Energy**, 180, Pages 353-371, (2021)]. The thermophysical properties of the catalyst were characterized by XRF, XRD, FTIR, and BET analysis. The optimized AME yield of 88.7% was obtained for the methanol to oil molar ratio (30:1), catalyst weight% (4 wt%), and operating temperature of (70 °C) through central composite design (CCD) in response surface methodology (RSM) technique. Five different proportions of *Azolla pinnata* methyl ester (AME) viz., 10%, 20%, 30%, 40% and 100% by volume were blended with 90%, 80%, 70%, 60% and 0%

by volume of diesel. These AME test fuel blends were named AME10, AME20, AME30, AME40, and AME100. American Society for Testing and Materials (ASTM D6751) standards followed to testing the thermophysical properties of prepared biodiesel. AME fuel blends were tested in the single-cylinder variable compression ratio (VCR) engine with varied compression ratios (CR) of 16:1, 17:1, and 18:1 for different loadings at a constant speed of 1500 rpm. The performance, in-cylinder combustion, and exhaust emission results were concluded among five different diesel-AME blends at varied compression ratios. The obtained results for AME blends were compared with the diesel fuel under the same working conditions. At peak load condition, AME30 test fuel with CR18:1 gives a reduction of CO (14.0%), HC (12.06%) and smoke opacity (5.88%) and slight increment in NO_x (2.46%) emissions as well as reduced BTE (10.20%) and increased BSEC (17.33%) were obtained related to diesel fuel. Better diffusion phase combustion was recorded for AME blends due to their higher cetane value than neat diesel.

New insights into chemical compositions and health promoting effects of edible oils from new resources

Yueying Yao and Baojun Xu discussed the chemical compositions and health benefits of several kinds of oils which are extracted from new resources, including avocado seed oil, jackfruit seed oil, papaya seed oil, custard-apple seed oil, pomegranate seed oil, cherry seed oil, and pumpkin seed oil. In addition, the beneficial components found in these oils provide a future trend towards the utilization of seed oils as functional foods in the prevention and management of various chronic diseases [**Food Chemistry**, 364, Article 130363, (2021)]. Nevertheless, the development prospects of some seed oils, such as papaya seed oil or custard-apple seed oil, need to be further studied and reconsidered due to the unconfirmed edibility. Furthermore, some other hindrances need to be solved to make better use of these valuable food industry by-products.

Effects of triolein dilution on the structural and mechanical properties of lauric acid-rich fat

Understanding fat structure and mechanical properties is crucial for the processing and mouthfeel of fat-rich foods. In this study, **Xiuhang Chai *et al*** systematically explored the impact of changes in the composition of fully hydrogenated palm kernel oil (FHPKO) on its crystallization behavior, nano/microstructure, and mechanical properties by blending with 1, 2, 3, 4, 5, 10, and 20% triolein (OOO) [**LWT**, 150, Article 112019, (2021)]. Changes in the triglycerides (TAGs) composition of FHPKO affected its crystal habit and therefore its functionality. The lower melting unsaturated OOO remarkably increased the onset of crystallization temperature and time of FHPKO, particularly with the addition of 10% and 20% OOO. The addition of OOO also slowed down the nucleation and crystal growth rate owing to the dilution of the high-melting point TAGs. X-ray diffraction analysis showed a similar lamellar longitudinal size for all fat blends. However, the crystal domain size increased with the addition of OOO, which was caused by an increase in the amount of liquid oil between the lamellae. In addition, large crystal particles were observed with an increase in OOO content, leading to a weak interaction between the clusters with a low fractal dimension, thus reducing the strength of the mechanical properties of the fat crystal network.

Microbial bioprocess for extracellular squalene production and formulation of nanoemulsions

Sustainable production of natural resources requires a clean manufacturing process with clean raw materials due to the risk of environmental contaminations. Microbial cell factories have enabled the production of natural products including hydrophobic chemicals. However, the microbial cells limit the production titer because of the limited intracellular storage capacity and no transport across the cell membrane. Herein, **Jaehyun Park *et al*** engineered *Corynebacterium glutamicum* to produce hydrophobic squalene as a model product[**ACS Sustainable Chemistry & Engineering, 42**, pages 14263-14276, (2021)]. Notably, squalene was secreted in the defined culture medium without in situ extractions. As a result, the secreted squalene was related to the glycolipid association with synthesized squalene in the cell envelope and a facilitated secretion occurred during cell division. Protein engineering and pathway engineering of *C. glutamicum* enhanced the total squalene (tSQ) production, where fed-batch fermentation resulted in 1406 ± 16 mg/L tSQ production (32% tSQ in the medium). Promoting extraction with dodecane overlay, bio-squalene nanoemulsions were formulated and the creaming effects were analyzed for cosmetic application. Combining metabolic pathway engineering and facilitated secretion in microbial cells will be a good strategy to produce sustainable hydrophobic chemicals.

Kinetic and nonideal vle modeling for transesterification reactions from ffa and methyl acetate at high temperature and pressure considering volatilization effects/influence

L. N. Brondani *et al* proposed a model considering the compounds' volatilization influence in simultaneous nonideal phase equilibrium, reaction kinetics, and chemical equilibrium for batch transesterification reactions from free fatty acids at high pressure and temperature [**Industrial & Engineering Chemistry Research, 60**, Pages14815-14829, (2021)]. Phase nonideality was modeled using the "φ – φ" method. Different kinetic and thermodynamic modeling approaches were applied and tested, and their parameters were estimated from the reaction data of oleic acid with methyl acetate catalyzed by niobium phosphate. Kinetic data at conditions of the liquid–vapor system were measured/obtained by varying the temperature, molar ratio, and initial reaction volume. The hypothesis of volatilization influence was evaluated and proved to be very relevant to ensure the model fitting, which its use proved necessary mainly for experiments with different initial ratios of the reaction volume/headspace or scale-up process. Auxiliary model hypotheses were evaluated. For the applied transesterification system, a study of volatilization influence was carried out and the simultaneous proposed model proved to fit data very well.

Transformation of residual fatty raw materials into third generation green diesel over a nickel catalyst supported on mineral palygorskite

The transformation of residual fatty raw materials (RFRMs) (waste cooking oils (WCO), fatty acid distillate (FAD), oil extracted from spent coffee grounds (SCGO) and oil from chicken fat (CHO)) into third generation green diesel was studied by **Sotiris Lycourghiotis *et al*** over a very active nickel catalyst supported on mineral palygorskite [**Renewable Energy**, 180, Pages 773-786, (2021)]. The transformation of biodiesel into green diesel was also studied. The physicochemical

characteristics of the RFRMs were correlated with their composition and the conditions and procedure of their preparation. The composition of the reaction liquid mixture in total green diesel follows the order: 98% (CHO), 83% (WCO), 68% (FAD) and 10% (SCGO). Biodiesel is transformed much faster into green diesel than RFRMs. The catalyst use does not affect its main physicochemical characteristics. The activity trend was rationalized in terms of the relative surface concentrations of the supported nickel phases and on the basis of some molecules present in the RFRMs which may bring about catalyst deactivation.

Designer lipids -synthesis and application – A review

Designer lipid is a novel, health-friendly lipid with potential application in food, nutraceutical and pharmaceutical industries, including obesity, cancer, heart disease, inflammation. These advantages arise due to modification of fat/oil by the chemical or enzymatic process to form designer lipid. The transformation of lipid results in the rearrangement of fatty acid within a triglyceride molecule or between two different triglycerides. Thus, the resulting designer lipid has superior and unique physicochemical properties than the naturally occurring triglycerides. Due to these excellent physicochemical properties, they are in great demand in the market. The primary aim of this review by **Harsh B. Jadhav and Uday Annapure** is to describe component fatty acids used for the synthesis of designer lipids, the process used in designing designer lipids, and reactors used to intensify the yield of designer lipids, application of designer lipid in the food and nutraceutical sector [**Trends in Food Science & Technology**, 116, Pages 884-902, (2021)]. Designer lipid is a chemically/enzymatically modified form of lipid to improve physicochemical and nutritional properties of traditional lipids coming from plant and animal source. Such fabricated lipids have attracted consumers' attention because of their unique properties and capability to manage various syndromes. Their demand by the consumer increased over the recent past. To fulfil the increase in demand, the intensified synthesis of these designer lipids is carried out using packed bed reactors, ultrasonic reactors, high-pressure reactors. With their claimed health benefits, designer lipids are widely used as a functional ingredient in the food and pharmaceutical industries. Currently, designer lipids are used as a plastic fat, human milk substitute, cocoa butter, used in infant formulation, low-calorie lipids, an anti-cancer, reduced cardiovascular risk etc. The application of designer lipid is governed by the positional distribution and type of fatty acid esterified on the glycerol backbone.

Simultaneous determination of α-tocopherol, β-tocopherol, γ-tocopherol, δ-tocopherol, sesamin, sesamolin, sesamol, and asarinin in sesame oil by normal-phase high performance liquid chromatography

Liumin Huang *et al* investigated simple and fast normal-phase high performance liquid chromatography method for simultaneous detection of α-tocopherol, β-tocopherol, γ-tocopherol, δ-tocopherol, sesamin, sesamolin, sesamol, and asarinin in sesame oil (SO) [**Journal of Food Composition and Analysis**, 104, Article 104132, (2021)]. Conditions were a silica gel column as the separation unit, *n*-hexane and tetrahydrofuran (93:7, v/v) as the mobile phase, isocratic elution, a flow rate of 0.8 mL/min,

column temperature of 30 °C, and florescence detector with excitation and emission wavelengths of 295 and 330 nm. SO samples were directly dissolved in *n*-hexane for HPLC analysis. Results showed that the method performed wide linear ranges and good linearity (0.27–100.0 μg/mL, R^2 > 0.9996), low limits of detection (0.09–0.16 μg/mL) and quantification (0.27–0.41 μg/mL), good precision and accuracy (biases of <2.83 % and relative standard deviations of <3.77 %), good separation performance [resolution factor (1.66–6.20), separation factor (1.11–3.94), retention factor (1.08–1.42), and height of theoretical plates (0.01–0.04 mm)], and satisfactory recoveries (87.3–109.8 % for SO and 96.5–106.9 % for lard). The method was successfully applied for the simultaneous determination of the eight analytes in eleven SO samples.

Applications of by-products from the olive oil processing: Revalorization strategies based on target molecules and green extraction technologies

During the last decades, olive oil consumption has experienced a continuous increase due to its unique organoleptic properties and its related beneficial properties. Consequently, waste and by-products derived from the olive production have also increased causing environmental problems and economic losses. However, the low-cost and huge availability of these by-products is an opportunity for their valorization and the obtaining of high added-value compounds such as tyrosol, hydroxytyrosol (HT), oleocanthal, oleuropein (OLE), ligstroside, squalene, fatty acids, etc. The development of innovative extraction and characterization technologies is a key factor for the olive sector. In addition, a deeper knowledge about the biological properties of the compounds present in the recovered products and their mechanism of action is crucial to allow their reintegration in the food chain and their potential uses in the food and pharmaceutical industries. This review by **Paz Otero *et al*** encompasses all these aspects showing the advances achieved to date in the olive oil by-products valorization focusing on their biological properties, including cardioprotective, antioxidant, anticancer, anti-inflammatory and antidiabetic effects [**Trends in Food Science & Technology**, 116, Pages 1084-1104, (2021)].The by-products derived from the *Olea europaea* L. processing industry are secondary but valuable products, from which different biologically active molecules can be recovered by green extraction technologies (PLE, SFE, *etc.*) and reused for food, pharmaceutical and cosmetic purposes following the circular economy policies. One of the main advantages on recovering valuable molecules from olive by-products is their incorporation to functional foods. A direct effect was proved between the use of olive by-products in human consumption and the heath claims. In this context, different food industries have used the phenolic fraction of olive by-products, holding mostly HT and OLE, as food additives and as preserving agents due to their antioxidant properties.

Mixture Temperature-Controlled combustion of different biodiesels and conventional fuels

Mixture Temperature-Controlled combustion is a novel concept featuring ultra-low pollutant emission. Since the resulting distributed combustion is highly homogeneous, NO_X emission can be kept below 10 ppm. The available renewable fuels worldwide vary a lot in their

characteristics. Three renewable hydrocarbon fuels: coconut oil, palm oil, and waste cooking oil-rapeseed oil methyl esters were tested by **Gyöngyvér Hidegh *et al*** along with three conventional fuels: standard jet fuel (JP-8), standard diesel oil, and natural gas [**Energy**, 234, Article 121219, (2021)]. The ultimate goal of the present study was the comparison of the flame structures, chemiluminescent, and pollutant emissions of various fuels, exploiting distributed combustion offered by the novel burner concept. As mixture preparation is highly sensitive to fuel vaporization, distillation curves of the five investigated liquid fuels were measured and evaluated. Density, surface tension, and viscosity were also measured to compare the estimated atomization characteristics. The tests were uniformly performed at 13.3 kW thermal power and an equivalence ratio of 0.8, varying atomizing pressure and air preheating temperature. It was found that jet fuel, diesel fuel, and coconut biodiesel bear the highest potential for distributed combustion in gas turbines, while incorrect burner setup may lead to unacceptably high emissions.

Development of empirical correlations for density and viscosity estimation of ternary biodiesel blends

M. A. Mujtaba *et al* investigated the density and viscosity of ternary biodiesel blends [**Renewable Energy**, 179, Pages 1447-1457, (2021)]. Fuel density and viscosity play an important role in the fuel injection system, flame propagation, and combustion process in compression ignition engine. The density and viscosity of biodiesel are higher than high-speed diesel which is an implication in the commercialization of biodiesel. In the present study, palm oil has been used for the production of biodiesel through the ultrasound-assisted transesterification process. Three different types of fuel additives including butanol, dimethyl carbonate, and plastic oil have been used for the preparation of nine ternary biodiesel blends. The density and viscosity of individual fuels and ternary biodiesel were measured experimentally in a temperature range of 281.51 K–348.15 K. For the prediction of density and viscosity of ternary biodiesel blends, four density and viscosity models were developed. The prediction accuracy of these developed models was assessed by a statistical tool absolute percentage error (APE). Newly proposed exponential regression models predicted well compared to experimental data for density and viscosity values with high regression coefficient 0.9995 and 0.9841 and lower mean absolute percentage of error 0.012 % and – 0.516 % at (348.15 K) temperature respectively. These correlations are significant for the automobile industry in developing fuel pipeline and transport equipment where additives would be present in diesel-biodiesel fuel blends.

Development of microencapsulated vegetable oil powder based cookies and study of its physicochemical properties and storage stability

Shubhangi Srivastava and Hari Niwas Mishra prepared cookies and formulated using microencapsulated oil powder (source of vegetable fat: sunflower and sesame oil) obtained by spray drying [**LWT**, 152, Article 112364, (2021)]. The optimized blend comprised of 30:70 (soya protein to milk protein isolate) as wall matrices, and 50:49 sunflower to sesame oil as core ingredients. Spray drying had a feed flow rate and drying air of 10 ± 2 mL/min and 73 m^3/h, with an inlet-outlet temperature of 160 °C and 60 °C. The oil powder

(OP) content was varied from 20 to 60% to study the effect on the % DPPH inhibition, peroxide value (PV), and free fatty acid (FFA) value. In cookies, the OP could be substituted up to a level of 40% without any significant effect on its sensory characteristics with a shelf life of 245 days. Moreover, the hardness of OP cookies was increased, while a decrease in moisture content and colour values was observed. The FFA value for 40% OP at zero days was 0.27% which increased to 0.74% at 245 days. The OP cookies had better antioxidant capacity (89% higher DPPH activity). The findings of FTIR and SEM further validated that the OP cookies had an enriched nutritional profile due to the presence of natural antioxidants.

Development of a barium-modified zeolite catalyst for biodiesel production from waste frying oil: Process optimization by design of experiment

Adeyinka S. Yusuff *et al* developed a barium-modified zeolite (Ba-ZEL) catalyst via co-precipitation technique followed by thermal treatment (calcination) at different temperatures (600, 700 and 800 °C) [**Renewable Energy**, 177, Pages 1253-1264, (2021)]. The thermal stability, elemental composition, surface functional groups, crystallographic structure, textural characteristics, basic strength and surface morphology of the Ba-ZEL catalyst were determined using TGA/DTA, EDX, FTIR, XRD, BET, CO_2-TPD and SEM techniques, respectively. The biodiesel production process conditions, such as catalyst loading, alcohol to oil ratio, temperature and time, were optimized using a central composite design approach. The Ba-ZEL composite calcined at 700 °C was selected as a representative catalyst due to its high activity for the waste frying oil (WFO) conversion, resulting in a maximum biodiesel yield of 93.17 ± 0.02% under optimum conditions (3.0 wt% catalyst loading, 12:1 methanol to WFO ratio, 65.38 °C reaction temperature and 2 h reaction time). The produced biodiesel, which was characterized by the FTIR and GC-FID analyses, contained sufficient ester groups and was in accordance with the specifications of EN 14214. Additionally, its physicochemical properties met ASTM D6751 specifications. Moreover, the Ba-ZEL700 catalyst was reused for five cycles upon regeneration using n-hexane washing followed by reactivation at 110 °C for 12 h.

Processing technologies, phytochemical constituents, and biological activities of grape seed oil (GSO): A review

The grape seed is one of the most valuable constituents of grape pomace, a by-product generated during winemaking. Using grape seed as a raw material to develop valuable products will contribute to the recycling and reuse of grape pomace, as well as to the sustainable development of the wine industry. The grape seed oil (GSO) is rich in bioactive compounds with various health-promoting properties and has great potential application in the pharmaceutical, cosmetic, and food industry. **Chenlu Yang *et al*** elaborated on the processing technologies of GSO in terms of requirements for raw materials, current extractive technologies, and oil stability [**Trends in Food Science & Technology**, 116, Pages 1074-1083, (2021)]. In the second part, they summarize the characteristics of GSO phytochemical compounds, such as fatty acids, phytosterols, vitamin E, and phenols. Finally, they focussed on recent studies related to the GSO biological activities, including antioxidant, anti-inflammatory, and metabolic disease alleviation. In addition, the latest

developments of GSO products and their derived foods are also illustrated concisely. For the product design of GSO, the key may be to fully exploit and utilize the inherent characteristics of grape seed to produce functional oil with high phenol content, which requires further improvements in the extraction and storage strategy of GSO, as well as increasing the lipid solubility of phenolic compounds. In terms of technology, designing more environmentally friendly, efficient, and low-cost processes and equipment for making GSO is also a trend. Concerning physiological activity, studies combining lipidomics, proteomics, metabolomics, and nutriomics may provide further insights into the mechanisms of the health benefits induced by GSO.

Direct conversion of Camellia japonica seed into biodiesel through non-catalytic transesterification

Biodiesel (BD) (that is alternative to petro-diesel) has been used as carbon neutral fuel as a strategic measure for CO_2 mitigation. BD has been produced *via* acid-/base-catalyzed transesterification of edible oils. Rectifying a conventional / commercialized platform for BD synthesis could offer a new opportunity to produce BD with a more sustainable manner. Indeed, the massive amount of wastewater to neutralize alkaline solution is generated from the conversion process of BD. The use of edible oils in BD production has been also discouraged due to ethical dilemma linked to crop price increase. In these contexts, it could be very desirable to convert valueless/inedible oils into BD through an environmentally benign conversion platform. To this end, non-catalytic transesterification of *Camellia japonica* seed/oil was mainly studied by **Jong-Min Jung *et al*** in this work [**Industrial Crops and Products**, 174, Article 114194, (2021)]. As a reference, base-catalyzed transesterification of *Camellia japonica* oil was also tested. *Camellia japonica* kernel contained the high content of oil (60.4 wt%). Non-catalytic transesterification of *Camellia japonica* oil resulted in 96.77 wt% BD yield at 370 °C in 1 min. However, base-catalyzed transesterification of *Camellia japonica* oil led to 86.13 wt% BD yield at 63 °C for 2 h. Non-catalytic transesterification of *Camellia japonica* seed was tested to directly convert oil in *Camellia japonica* seed into BD. The yield of BD from the direct transesterification of *Camellia japonica* seed was higher (37.14 wt% per dried biomass) than transesterification of *Camellia japonica* oil (35.42 wt%). Such fact offers that direct conversion of oil-bearing seed into BD could be realized non-catalytically.

Thermostability and kinetics analysis of oil color, carotenoids and capsaicinoids in hotpot oil models (butter, rapeseed oil, and their blends)

The thermostability of carotenoids and capsaicinoids in a butter model (B), a rapeseed oil model (RO) and a blended model (BRO) was investigated by **Rui Zhang *et al*** under heating at 120–180 °C [**LWT**, 152, Article 112216, (2021)]. The kinetic deterioration rate of each compound was described by a first-order kinetic model, while changes in L*, a*, and b* values were fitted to a zero-order model. Moreover, based on activation energy (Ea), the most and least temperature-sensitive oil models were B and RO, respectively. Across all oil models, carotenoid rate constants could be ordered as $k_{capsanthin} > k_{zeaxanthin} > k_{\beta\text{-cryptoxanthin}} > k_{\beta\text{-carotene}} > k_{capsorubin}$, and color index values could be ordered as $k_a > k_b > k_L$. The Ea values of capsaicin and dihydrocapsaicin in RO were 52.77 and 51.78

kJ/mol, respectively. Our results suggest that the stability of carotenoids and capsaicinoids can be influenced by the oxidizability and antioxidant content of oil.

Stability and stabilization of omega-3 oils : A review

Omega-3 oils are rich sources of essential fatty acids and play a key role in biological functions in the body and sensory attributes in food systems. The high content of long chain polyunsaturated fatty acids leads to high vulnerability of omega-3 oils to oxidation, and thus causes deterioration of their nutritional values and biological functions. Stabilization technologies continue to be important research topics for both academia and industry. **Jiankang Wang *et al*** reviewed traditional and newly-developed stabilization technologies applied to omega-3 oils with proven efficacy in preventing or inhibiting lipid oxidation [**Trends in Food Science & Technology**, 118, Part A Pages 17-35, (2021)]. These methods were developed to target one or more factors that determine oxidative stability of omega-3 oils. The effective traditional stabilization technologies, including the removal of oxygen and catalysts, and the addition of antioxidants should be further studied for their safety, synergistic effect and as affected by packaging material. Newly-developed stabilization technologies, such as blending, randomization and enzyme-catalyzed conversion to omega-3 phenolic antioxidants provide new approach not only to stabilize omega-3 oils, but some also provide new omega-3 oil based antioxidants as nutraceutical products. The conversion rate and position specificity of structural modifications and incorporation of antioxidants as well as safety of newly prepared compounds for human consumption require future attention. Emulsion and encapsulation technologies, especially those involved in micro/nano-technologies should also be promoted to protect omega-3 oils due to the convenience of release control, improved stability and bioavailability, but high processing efficiency and low cost are required for large scale production.

A simple thermal-detoxified method for castor bean (Ricinus communis L.) cake, and its potential nutraceutical properties

In order to search viable alternatives for detoxifying the castor bean toxic waste, and harnessing for diverse applications, **Mayra Denise Herrera *et al*** evaluated the thermal-detoxified method and determinate the castor bean cake nutraceutical potential properties [**Industrial Crops and Products**, 174, Article 114151, (2021)]. Autoclaving (15 psi, 15 min, 121 ° C) process in presence of humidity (30 %) was performed as detoxified method. Presence of ricin was evaluated using ELISA and the castor bean cake lethal dose (LD_{50}) determinate by acute toxicity assay in male Wistar rats. Additionally, the castor bean cake chemical and phytochemical characterization was evaluated and its nutraceutical potential determinate throughout antioxidant and hypoglycemic effects. The results showed that after the thermal-detoxified treatment, ricin concentration decreased over 99 %, and the castor bean cake LD_{50} was greater than 5000 mg/kg of body weight. After detoxified process, protein content increases 17.5 % and lipids decreases 10 %. In addition, a greater content of insoluble fraction (13 %) and 2.6-fold times more of resistant starch, as compared to un-detoxified cake, was observed. Furthermore, in comparison with untreated cake, thermal process led to an upsurge

of gallic acid (3.5-fold times) and 4-O-caffeoylquinic acid (8.8-fold times). About nutraceutical potential properties, a lower antioxidant capacity and a hypoglycemic effect, in comparison with the control, were observed. The thermal-detoxified method eliminates ricin of castor bean cake, providing to be a potential source of proteins, lipids, fiber, and bioactive compounds as well as exhibiting antioxidant and hypoglycemic effects.

The influence of vegetable oils composition on separation of transesterification products, especially quality of glycerol

Aleš Vávra *et al* described the properties of glycerol produced by transesterification, especially the ester content in the glycerol phase (ester losses) including the distribution of esters according to higher fatty acids [**Renewable Energy**, 176, Pages 262-268, (2021)]. Glycerol, produced by transesterification of oil as a side product – the polar glycerol phase, is an important chemical raw material. The decreasing of ester losses is important because it (i) increases the ester yield and especially (ii) decreases the cost of glycerol purification. The transesterification of oils (rapeseed, olive, palm, sunflower and *Camelina Sativa*) with various distributions of fatty acids was carried out by methanol, ethanol and butanol including different transesterification stopping. The losses of ethyl and butyl esters are much higher than losses of methyl ester (approximately 2–3x). The distribution of ethyl and butyl esters in the glycerol phase is the same as in the ester phase, whereas distribution of methyl ester is different and depends on the way of transesterification stopping. The reason is the different polarity of methyl esters, which depends on the type of fatty acid. The polarity increases with increasing of double bonds, i.e. the most soluble is methyl ester of linolenic acid in the glycerol phase.

Multilayer microencapsulation of chia seed oil by spray-drying using electrostatic deposition technology.

Claudia N. Copado *et al* carried out a multilayer microencapsulation process to protect and deliver chia oil, which presents high nutritional value but also a high susceptibility to lipid oxidation [**LWT**, 152, Article 112206, (2021)]. A high-pressure homogenization was performed with deoiled or hydrolyzed sunflower lecithins (pH 5) to obtain the primary emulsion. The secondary and tertiary layers were deposited, applying the layer-by-layer technique with the addition of chitosan and chia mucilage, respectively. After spray-drying these emulsions, the corresponding microcapsules were obtained and the influence of the types of lecithin (deoiled or hydrolyzed) and microcapsule (mono or multilayered) were studied. The ζ-potential evidenced the electrostatic deposition of the layers through the inversion of the electric charge. Microcapsules presented high microencapsulation efficiency (84–99%) and low moisture content and water activity levels. Most microparticles exhibited whitish and light color, spherical shapes, with continuous and slightly rough walls. The powder dispersibility was compatible with instant foods. All the microcapsules presented low oxidation levels after storage, especially the three-layer systems. This information suggests that multilayer systems can contribute by providing high stability against the oxidative deterioration of functional lipid components present in chia oil.

The composition, extraction, analysis, bioactivities, bioavailability and applications in food system of flaxseed (Linum usitatissimum L.) oil: A review

(*Linum usitatissimum* L.) oil is an excellent functional oil containing various unsaturated fatty acids, mainly composed of linolenic acid, which is believed to have a variety of beneficial physiological and functional properties. However, the conversion efficiency of linolenic acid in the human body is low, and the research on flaxseed oil lacks a systematic review and evaluation. This review by **Jing Yang *et al*** summarizes the research progress of flaxseed oil in recent years, including the main components, extraction and analysis methods of flaxseed oil; the main biological activities of flaxseed oil and its digestion, absorption, bioavailability and application in food; existing problems, possible solutions and prospects for future research [**Trends in Food Science & Technology**, 118, Part A, Pages 252-260, (2021)]. Flaxseed oil is rich in alpha-linolenic acid (ALA) and other active ingredients, but the stability of ALA and its conversion to eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in human body are very low. Improving the stability of ALA can promote its digestion and absorption in the gastrointestinal tract, thereby playing a beneficial role. The establishment of fat emulsion delivery system is an effective way to improve the stability and bioavailability of flaxseed oil. This review could benefit comprehensive understanding the value of flaxseed oil and promote its nutrition research and commercial product development.

Catalytic high-yield biodiesel production from fatty acids and non-food oils over a magnetically separable acid nanosphere

Biodiesel, a kind of promising alternative renewable energy, is of great significance in replacing conventional fossil energy resources. Herein, for purpose of improving the preparation technology of biodiesel through efficient and convenient modifying the well-dispersion of active sites of magnetic catalysts, Fe_3O_4@SiO_2-SO_3H (P) and Fe_3O_4@SiO_2-SO_3H (S) catalysts were synthesized by **Heng Zhang *et al*** respectively *via* co-precipitation and solvothermal preparation methods, were successfully employed for biodiesel production [**Industrial Crops and Products**, 173, Article 114126, (2021)]. Fe_3O_4@SiO_2-SO_3H (S) bearing the uniform core-shell nanometer microsphere structure and good dispersibility that was beneficial to the substrates touch with efficient acidic sites along with acid density of 1.8 mmol g^{-1}, was demonstrated to furnish biodiesel in a higher yield of 97.8 %, which was better than that of Fe_3O_4@SiO_2-SO_3H (P) (88.2 % yield) at 65 °C within 4 h. The kinetic study revealed that Fe_3O_4@SiO_2-SO_3H (S)-catalyzed esterification fitted the first order model along with a low activation energy (47.9 kJ/mol), further clarifying the reason for the good catalytic performance of Fe_3O_4@SiO_2-SO_3H (S). More importantly, thermal filtration and reusability experiments confirmed the catalyst heterogeneous catalytic behavior and good reusability. The involved reaction mechanism was also interpreted, in which the Fe_3O_4@SiO_2-SO_3H (S) acid catalyst was determined to be favorable for accelerating oleic acid conversion to biodiesel *via* density

functional theory (DFT) calculations. Finally, given economic and environmental perspective, by analyzing the potential of the industrial application of Fe_3O_4@SiO_2-SO_3H (S) and comparing its catalytic performance with other reported catalysts, its promising value in terms of transforming fatty acids and non-food oils into biodiesel could be anticipated.

Physicochemical properties and oxidative stability of duck fat-added margarine for reducing the use of fully hydrogenated soybean oil

Dong-Min Shin *et al* used soybean oil (SBO) and fully hydrogenated soybean oil (FHSBO) have been used for margarine production[**Food Chemistry**, 363, Article 130260, (2021)]. However, SBO-based margarine requires a considerable amount of trans fatty acid-containing FHSBO due to its low melting point. We aimed to reduce the FHSBO content in margarine by employing duck fat, which has a higher melting point than SBO. Margarines were prepared using different ratios of duck fat and reduced levels of SBO and FHSBO. Physicochemical, sensory, and oxidative properties of the margarines were evaluated. The quality characteristics of margarine improved when duck fat replaced SBO and FHSBO. Furthermore, the lipid oxidation parameters were lower in duck fat-added margarines than the control during storage at 60 °C for 28 days. The margarine containing 80% duck fat showed the best sensory properties. Collectively, duck fat can replace SBO in margarine while reducing the use of FHSBO and maintaining desirable physicochemical properties, oxidative stability, and sensory properties.

One-pot production of jet fuels from fatty acids and vegetable oils in biphasic tandem catalytic process

Bio-jet fuel has already been used in commercial flights to decarbonize the aviation transportation sector. However, the widespread use of bio-jet fuel is still a challenge partly due to the high production costs. In particular, the production of commercial bio-jet fuel from lipids requires high temperatures and includes multiple reaction units, i.e., hydrodeoxygenation and hydrocracking, increasing operation costs. The integration of these processes in one pot was attempted but unsuccessful. Herein, a novel biphasic catalytic process was developed by **Chuhua Jia *et al*** to realize the one-pot production of bio-jet fuel from fatty acids with the supported ruthenium (Ru) catalysts and the mixed cyclohexane and water solvents under mild conditions [**Fuel**, 302, Article 121060, (2021)]. The cracking selectivity was tuned by adjusting the ratios of cyclohexane and water. The Ru/C catalysts modified by TiO_2 were synthesized and characterized with BET, XRD, SEM, TEM, NH_3-TPD, XPS, etc. Compared with the unmodified catalyst, the deoxygenation reaction rate increased up to five folds. The carbon yield of jet-fuel-range alkanes reached 35.2 wt% from oleic acid at a relatively low temperature (260 °C). The catalyst also showed good stability after five consecutive reuse cycles. This efficient biphasic catalytic process was further extended to convert triglycerides and crude vegetable oil to produce bio-jet fuel.

Mono- and diglyceride production from microalgae: Challenges and prospects of high-value emulsifiers

Monoglycerides (MAG) and Diglycerides (DAG) belong to the category of naturally-occurring

glycerolipids. They have wide applications in the food, pharmaceutical, and cosmetic industries, with commercial demand supplied by the consolidated industrial catalytic route of vegetable oil glycerolysis. Despite the economic competitiveness of producing these types of emulsifiers from vegetable oils, the increasing demand for products with high nutrition value makes some kinds of microalgae oil potential feedstock of high-quality fatty acids to serve this growing market .An alternative to the use of vegetable oils is the production of triacylglycerols from microalgae. Usually, microalgal oils have a high content of Polyunsaturated Fatty Acids (PUFA) and the cultivation of microalgae may present fewer environmental impacts, considering reduced use of arable land, efficient CO_2 biofixation, and high productivity. Microalgae lipids are mostly studied for biodiesel production, but the work by **Gabriela Filipini Ferreira *et al*** shows the potential to explore more valuable applications due to their composition, discussing the possibility of producing MAGs and DAGs from microalgae lipids [**Trends in Food Science & Technology**, 118, Part A, Pages 589-600, (2021)].While biodiesel B99-B100 costs USD3.56/gallon according to the U.S. Energy Dept. (April 2021), a food emulsifier (soybean lecithin) is sold for USD147/kg (Alfa Aesar, August 2021). Hence, it is imperative to consider high-value bioproducts from an economic point of view. Microalgal oil can be rich in ω-3 and ω-6 fatty acids, being a promising source of MAGs and DAGs with higher nutritional value. Glycerolysis studies of this feedstock are restricted to the enzymatic route, but different alternatives are shown in this work.

Rapid enzymatic hydrolysis of crambe oil catalyzed by castor seeds lipases

Oil hydrolysis is an important industrial process that requires high temperatures and pressure, or expensive enzymatic catalysts; it is, therefore, necessary to seek the use of inexpensive raw materials and process enhancement. In this work, a rapid and eco-friendly method, using ultrasound power, was successfully employed by **F. Tavares *et al*** to hydrolyze crambe (*Crambe abyssinica* Hochst.) oil using lipase enzymes directly from castor (*Ricinus communis* L.) seeds, in oil-free and fresh forms [**Industrial Crops and Products**, 171, Article 113890, (2021)]. A yield of 86 % conversion of triglycerides into free fatty acids (FFA) was achieved in 5 min using castor fresh seeds and 73 % of conversion when performing the reaction with oil-free seeds. The operational conditions of ultrasound power, mass ratio of buffer solution and oil, catalyst, and total substrate were evaluated using a central composite rotatable design (CCRD). The hydrolysis yield was optimized by response surface methodology (RSM). The optimum conditions were approximately 70 % of ultrasound power (350 W), 1.79 buffer solution/oil mass ratio, and 0.25 catalyst/substrate mass ratio for fresh seeds. For the oil-free seeds, the optimal conditions found were 68 % (340 W) of ultrasound power, 1.67 buffer solution/oil mass ratio, and 0.06 catalyst/substrate mass ratio. Mathematical modeling was applied to the experimental kinetic data, and it was possible to predict FFA concentration values from independent experiments.

StOSt-rich fats in the manufacture of heat-stable chocolates and their potential impacts on fat bloom behaviors

Chocolate softening and fat bloom are the main defects in many tropical and subtropical markets. Incorporation of hard fats with similar triacylglycerol-type to cocoa butter, 1,3-distearoyl-2-oleoyl-glycerol (StOSt)-rich fats, is considered the most effective way to solve both problems. This review by **Jun Jin *et al*** defines StOSt-rich fats based on the concepts of cocoa butter improvers and extenders, and further summarizes their potential sources, such as, mango kernel fat, illipe butter, sal fat, shea butter, kokum butter, algal butters and recombinant sunflower oils [**Trends in Food Science & Technology**, 118, Part A, Pages 418-430, (2021)]. Typical preparation techniques, including fractionation and esterification, are highlighted, with a clear focus on the improvement of StOSt levels by removing low-melting triacylglycerols and other interferants. Particular emphasis is given to the fat bloom formation in heat-stable chocolates formulated with StOSt-rich fats. The potential mechanisms in relation to compatibility between StOSt-rich fats and cocoa butter, dilution effects of low-melting triacylglycerols, and crystal changes affected by diacylglycerols are discussed as well.StOSt-rich fats consist of 30%–70% StOSt, 20%–60% low-melting triacylglycerols and 1.0%–7.2% diacylglycerols. Fractionation or *sn*-1,3 specific esterification is supposed to increase the StOSt levels as well as remove other components that may pose negative effects on chocolate structure. Mango kernel fats have attracted special interests because of the large amounts of kernels around the world, which have not been effectively utilized. Biotechnology and oilseed breeding are currently interesting technologies used to produce new StOSt-rich fats. Heat and bloom stabilities could be improved simultaneously by tailoring the StOSt-rich fats to suitable triacylglycerol compositions and diacylglycerol contents.

Synthesis and characterization of new Schiff base ester liquid crystals with fatty acids from palm oil as flexible alkyl chain

Palm oil plays an important role in both food and non-food industries. With the aim of further diversifying the non-food applications of palm oil, the viability of using palm fatty acids in the synthesis of liquid crystals (LCs) has been investigated by **Weng Nam Lee *et al***. In this study, three types of palm fatty acid, namely lauric acid, palmitic acid and stearic acid were used as a source of flexible alkyl chain, which is an influential structural feature of LCs [**Industrial Crops and Products**, 170, Article 113808, (2021)]. This flexible alkyl chain is usually derived from non-renewable petrochemicals. Three palm-based LCs (PBLCs), namely, PB_1 (lauric-based LC), PB_2 (palmitic-based LC) and PB_3 (stearic-based LC) have been synthesized and the presence of liquid crystallinity was further verified by Polarizing Optical Microscopy (POM), Differential Scanning Calorimetry (DSC) and Wide Angle X-ray Diffraction (WAXD). Mesophase was observed from POM analysis for PB_1-PB_3 and based on the scattering pattern of WAXD at small angle region, the texture of the mesophase was Smectic A phase. The synthesized PBLCs can be potential candidate for various practical applications such as

engineering of nanostructure and biomaterials due to the presence of curvatures which is a unique characteristic of smectic LCs. This study can be regarded as a continuous effort in realizing the concept of green chemistry by using non-toxic and renewable feedstock in organic synthesis.

The development of new homogenous and heterogeneous catalytic processes for the treatment of low grade palm oil

Low grade crude palm oil (LGCPO) presents as an attractive option as feedstock for biodiesel production due to its low cost and non-competition with food resources. Typically, LGCPO contains high contents of free fatty acids (FFA), rendering it impossible in direct trans-esterification processes due to the saponification reaction. Esterification is the typical pre-treatment process to reduce the FFA content and to produce fatty acid methyl ester (FAME). The pre-treatment of LGCPO using two different acid catalysts, such as titanium oxysulphate sulphuric acid complex hydrate (TiOSH) and 5-sulfosalicylic acid dihydrate (5-SOCAH) was investigated by **Adeeb Hayyan *et al*** for the first time in this study [**Journal of Molecular Liquids**, 344, Article 117574, (2021)] . The optimum conditions for the homogenous catalyst (5-SOCAH) were determined as: 1.5 wt% of acid catalyst dosage, 60 °C reaction temperature, 8:1 methanol molar ratio at 60 min. For the heterogeneous TiOSH, higher catalyst dosages such as 7 wt% is required with a methanol loading of 10:1 (molar ratio) at 120 min to reduce the initial FFA to less than 3%. Under these optimum conditions for both types of catalysts; the FFA levels were reduced from 11.3 % to less than 3 %, individually. This study introduces for the first time two types of acidic catalysts with high catalytic activity for the esterification of FFA content in low grade oils for biodiesel production which could be used for the treatment of wide range of low quality oils.

Novel pumpkin seed oil-based oleogels: development and physical characterization

Angela Borriello *et al* developd novel oleogels based on pumpkin seed oil and natural waxes. Crystallization and gelation of 4, 5, 6 and 8 % of beeswax and carnauba wax in pumpkin seed oil were investigated, and their physical properties were evaluated using an oleogel prepared with sunflower oil and beeswax as reference [**LWT**, 152, Article 112165, (2021)]. In order to obtain a complete three-dimensional network, after a cooling stage a setting stage was necessary at 25 °C for no longer than 60 min. Oleogels produced with pumpkin seed oil and beeswax were weaker than those made with sunflower seeds; pumpkin seed oil-based oleogels structured by carnauba wax presented higher viscoelastic properties, retained more oil and were firmer than oleogels based on beeswax. Based on scaling theory, all the oleogels followed a strong-link regime and the fractal dimension of the network (D) was comparable to fats widely used in food production. Therefore, pumpkin seed oil can be used to create novel oleogels.

A Nickel/Palladium/Ruthenium-Graphene based nanocatalyst for selective catalytic hydrogenation of vegetable oils

The catalytic hydrogenation of vegetable oils has long been the subject of study. Indeed, the reduction of un-saturations can to improve stability and increase properties suitable for a wide range of applications. Moreover, even with so much effort,

the results are still far from the objectives of obtaining cis isomer of monoenes in the presence of a low amount of stearic acid. A new catalyst, obtained from a one-step synthesis, operating in mild conditions with high activity and full selectivity towards the *cis* configuration of 9-octadecanoic acid was proposed by **Maria Sarno *et al***. A Ni/Pd/Ru active phase, with surfactant chains surfaces conjugated, results dispersed on few-layer graphene for increased efficiency exploiting the adsorbent properties of the support [**Industrial Crops and Products, 170**, Article 113815, (2021)]. The results demonstrate that the nano-hybrid made up of cheap and available Ni with very small amounts of palladium and ruthenium, allows achieving during hydrogenation of canola oil favorable *cis*-C18:1/C18:0 ratios, at a low catalyst loading of 1 wt.%. The addition of the Ru active phase allows successfully achieving up to 75.3 wt.% *cis* C18:1, and 2.46 wt.% of stearic acid, after 60 min. Additionally, it is worth noticing that only 2.6 wt.% of *cis* C18:1 is constituted of *cis* positional isomers. The graphene stabilizing nanoparticles ensures catalyst stability over cycles of use.

Lipid profiling and oil properties of Camelina sativa seeds engineered to enhance the production of saturated and omega-7 fatty acids

one of the preferred oil crops in plant biotechnology due to its agronomic performance, the quality of its oil and the ease with which it can be transformed. Oils with high levels of saturated fatty acids are in demand for structured lipid elaboration, whereas ω-7 fatty acids like palmitoleic or asclepic acids are of interest for other applications, such as in oleochemistry and biolubricant production. Several strategies have been followed to increase the levels of saturated and ω-7 fatty acids in the camelina plant in this work by **M. F. Rodríguez-Rodríguez *et al***, including silencing the β-ketoacyl-ACP synthase II (*Cs*KASII) condensing enzyme responsible for the elongation of palmitate to stearate, the expression of exogenous thioesterases, and the overexpression of the endogenous stearoyl-ACP desaturase [**Industrial Crops and Products, 170**, Article 113765, (2021)]. The silencing of *Cs*KASII produces an important increase in palmitate in the oil seed, whereas the expression of different alleles of sunflower FatA thioesterases favors the accumulation of both palmitate and stearate. The increase in intraplastidial desaturase activity through *Cs*SAD co-expression forced the desaturation of palmitate, inducing the accumulation of important amounts of ω-7 fatty acids. The phenotypes of the different transformants produced were characterized by profiling the different glycerolipid classes accumulated in their seeds. These oils displayed altered physical properties that were investigated by differential calorimetry studies.

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