Evaluation of size reduction and expansion on yield and quality of Cumin seed oil

The commonly used seed spice Cumin (*Cuminum cyminum* Linn.) contains 3-4% volatile oil and about 15% fixed oil. Conventional grinding of cumin is associated with problems of temperature rise, caking, clogging of sieves and deterioration of quality due to loss of volatiles. Shortcomings of the conventional size reduction were obviated by flaking and the effect of flaking on the yield and quality of volatile oil was comparatively evaluated by the scientists at Central Food Technological Research Institute (CFTRI), CSIR, Mysuru, India. For small batch size operations (200g), oil yield was found to be the same (3.4%) for both ground and flaked samples. Flaking resulted in 17-18% increase in the yield of oil. Selective collection of volatile oil at different intervals of time of distillation yields fractions of different flavour profiles. It is also possible to recover oil from the condensate to an extent of 25ml in a 10kg batch distillation which amounts to 0.2% of oil on charge basis both in case of flakes and powder. The oil recovered can be added back to the oil collected by steam distillation or blended in different proportions. [Sowbhagya HB, Sathyendra Rao BV and Krishnamurthy N, Evaluation of size reduction and expansion on yield and quality of cumin (*Cuminum cyminum*) seed oil, *J Food Eng*, 2008, 84(4), 595-600].

Many drawbacks associated with conventional method of grinding using hammer mill or plate mill such as mill clogging, rise in the temperature of the ground material and loss of volatile oil could be overcome by flaking. Pre-cooling of cumin seeds prior to flaking further improved the oil yield and resulted in higher retention of the flavour components (terpenic compounds). Hence, for the production of cumin seed oil by steam distillation, flaking is a promising alternate to conventional size-reduction methods.

Direct extraction of oil from Sunflower seeds by twin-screw extruder

The researchers at France carried out studies to evaluate the feasibility of an aqueous process to extract sunflower seed oil using a co-rotating twin-screw extruder. Aqueous extraction was carried out using whole seeds and the influence of the operating conditions on oil yield was examined. Operating conditions included screw profile, screw rotation speed and input flow rates of sunflower seeds and water. Liquid/solid separation required the addition of a lignocellulosic residue upstream from the filtration zone. However, even with maximum fibre input flow, drying of the cake meal did not improve. The lixiviation of the sunflower seeds was also incomplete. The aqueous extraction of the oil was more efficient in the twin-screw extruder than the reference trial conducted in a batch reactor. The best oil extraction yield obtained was approximately 55% and the residual oil content of the cake meal was approximately 30%. The hydrophobic phases produced were oil-in-water emulsions. These emulsions were stabilized by phospholipids and proteins at the interface, which are natural surface-active agents co-extracted during the process. [Evon Ph, Vandenbossche V, Pontalier PY and L. Rigal L, Direct extraction of oil from sunflower seeds by twin-screw extruder according to an aqueous extraction process: Feasibility study and influence of operating conditions, *Ind Crops Prod*, 2007, 26(3), 351-359].
Concentration-dependent antioxidant activities of conjugated linoleic acid and α-tocopherol in Corn oil

Antioxidants prevent rancidity (lipid peroxidation) and natural antioxidants, e.g., α-tocopherol, likely provide additional value to oil-based food products because of their health benefits. Conjugated linoleic acid (CLA) has potential health benefits and may exhibit antioxidant properties. Therefore, the scientists at University of Mansoura, Mansoura, Egypt and University of Nevada, Reno, USA carried out study to compare the antioxidant efficacy of α-tocopherol, trans-10, cis-12-CLA and cis-9, trans-11-CLA (in graded concentrations) added to antioxidant-stripped corn oil. As compared to α-tocopherol, both CLA isomers displayed significant inhibition of corn oil lipid peroxidation induced by copper. Inhibition of thiobarbituric acid reactive substances (TBARS) were CLA concentration dependent for both isomers but with significant inhibition occurring at 0.1 and 1 ppm of CLA isomers or α-tocopherol, respectively (P < 0.05). Graded concentrations of α-tocopherol and for both CLA isomers and time, had significant effects on TBARS formation (P < 0.0001). There were significant effects in interactions between graded concentrations and time for both CLA isomers (P<0.0001) but not for α-tocopherol (P > 0.05). Thus, CLA compounds could serve as useful food antioxidants and provide additional value because of their potential bioactivity in disease prevention [Nariman K Badr El-Din and Stanley T Omaye, Concentration-dependent antioxidant activities of conjugated linoleic acid and α-tocopherol in corn oil, J Sci Food Agric, 2007, 87(14), 2715-2720].

Effect of fruit ripeness and method of fruit drying on the extractability of Avocado oil with hexane and supercritical carbon dioxide

Oil yield from Avocado fruit may be influenced by fruit pre-treatment and extraction method. Therefore, the scientists at University of Pretoria, Pretoria, South Africa; Tshwane University of Technology, South Africa; and Council for Scientific and Industrial Research, Pretoria, South Africa deep-frozen the unripe and ripe Avocado fruit pieces at −20ºC and either freeze-dried or oven-dried (80ºC). Oil yield from these samples was determined after extraction with hexane and supercritical carbon dioxide (SC-CO₂). The fruit samples were examined using scanning electron microscopy before and after oil extraction. Average oil yield from ripe fruit (freeze-dried and oven-dried combined) was 72 g/kg higher than from unripe fruit for SC-CO₂ extracts and 61 g/kg higher for hexane extracts. This may be due to enzymatic degradation of parenchyma cell walls during ripening, thus making the oil more available for extraction. Freeze-dried samples had a mean oil yield 55 g/kg greater than oven-dried samples for SC-CO₂ extracts and 31 g/kg higher for hexane extracts. However, oil yields from ripe fruit (freeze-dried and oven-dried) subjected to hexane extraction were not significantly different. All hexane extracts combined had a mean oil yield 93 g/kg higher than SC-CO₂ extracts. Thus, it can be concluded that SC-CO₂ may be more selective and may create paths of least resistance through the plant material. Hexane, on the other hand, is less selective and permeates the whole plant material, leading to more complete extraction and higher oil yields under the experimental conditions [Mostert Mathilda E, Botha Ben M, Plessis Lourens M Du and Duodu Kwaku G, Effect of fruit ripeness and method of fruit drying on the extractability of avocado oil with hexane and supercritical carbon dioxide, J Sci Food Agric, 2007, 87(15), 2880-2885].
Oil extraction rates of enzymatically hydrolyzed Soybeans

The researchers at G.B. Pant University of Agriculture and Technology, Pantnagar, India, CCS Haryana Agricultural University, Hisar, Haryana, India, Sant Longowal Institute of Engineering and Technology, Sangrur, Punjab, India and University of Manitoba, Winnipeg, Man, Canada hydrolysed soyflakes and soybrokens enzymatically using a mixed-activity crude enzyme prior to extraction of oil using hexane. To enhance oil availability and extractability, a second order response surface methodology was used to obtain optimal process conditions for soyflakes and soybrokens of 24.6 and 24.7% wet mass basis (wb) moisture during hydrolysis, 14.2 and 7.1% volume per weight of the sample (v/w) enzyme concentration and 13.3 and 13.9h hydrolysis time, respectively. Enzymatic hydrolysis significantly increased the extraction rates. The enzymatic hydrolysis reduced the extraction time for over 99% extraction from 28 to 14h in soyflakes and from 32 to 21h in soybrokens under the optimum process conditions [Kashyap MC, Agrawal YC, Ghosh PK, Jayas DS, Sarkar BC and Singh BPN, Oil extraction rates of enzymatically hydrolyzed soybeans, J Food Eng, 2007, 81(3), 611-617].

Separation of palm kernel oil using pressure swing technique

Separation of palm kernel oil (PKO) from undehulled ground palm kernel was studied by the scientists at Tohoku University, Sendai, Japan and Universiti Sains Malaysia, Pinang, Malaysia for extractions performed with supercritical CO2 using initial pressurization-depressurization treatments. The pressurization-depressurization treatments are denoted as pressure swing (PS) extractions. Extractions were performed at 353.2K and at pressures from 10 to 25MPa. Results were compared with continuous extractions, in which supercritical CO2 was flowed through the packed bed of solids for a given time period. For the PS extractions, some intact or bound oil could be extracted from the third PS step at 15MPa, while for continuous extractions, pressures of 20MPa were required to obtain comparable yields. In the PS extractions, disruption of the oil glands in palm kernel granules probably lead to higher yields obtained at 20 and 25MPa and this was confirmed with SEM micrographs. However, almost all of the oil of 47g/100g palm kernel (wet basis) could be extracted using combined PS and continuous extraction at 25MPa. A simple correlation was developed based on the kinetic mass transfer model, which allows one to estimate the minimum amount of CO2 required for a given yield. Results are applicable to processes for separating and fractionating palm kernel oil for cocoa butter replacers [Zaidul ISM, Norulaini NA Nik, Omar AK Mohd, Sato Yoshiyuki and Smith Jr RL, Separation of palm kernel oil from palm kernel with supercritical carbon dioxide using pressure swing technique, J Food Eng, 2007, 81(2), 419-428].

Sesbania aculeata Pers. seed oil contains (Z)-12-hydroxyoctadec-9-enoic acid

On the basis of various industrial applications of hydroxyl fatty acids researchers at Department of Chemistry, Aligarh Muslim University, Aligarh, India investigated Sesbania aculeata Pers. seed oil as potential source. The most interesting finding is the presence of a hydroxyolefinic fatty acid (9.24%) along with other fatty acids, viz. lauric (2.51%), myristic (0.37%), palmitic (10.94%), palmitoleic (3.54%), stearic (4.02%), oleic (17.10%), linoleic (45.92%), linolenic (5.29%), arachidic (0.03%) and behenic (1.04%). The structure of this hydroxy fatty acid was established on the basis of spectral data (IR, 1H NMR, 13C NMR, MS) and chemical (catalytic hydrogenation and oxidative degradation) methods as (Z)-12-hydroxyoctadec-9-enoic (ricinoleic) acid [Parveen Humaira and Raul Abdul, (Z)-12-Hydroxyoctadec-9-enoic acid in Sesbania aculeata seed oil, Ind Crops Prod, 2008, 27 (1), 118-122].
Fatty acid and oil variation in Kenaf seed

Kenaf (Hibiscus cannabinus Linn.) is a fibre plant native to East-central Africa. The potential for using kenaf seeds as a source of edible oil is often overlooked when considering kenaf as a fibre and feed crop. The researchers at South Africa conducted studies and compared the fatty acid composition and oil content of eight commercial kenaf cultivars from various countries. Linoleic, oleic and palmitic acids were the predominant fatty acids in all of them but percentage of fatty acids varied greatly. The cultivar ‘Gregg’ had the highest percentage of linoleic acid whilst ‘El Salvador’ had the lowest. ‘El Salvador’ had the highest percentage of oleic acid and ‘Endora’ had the highest percentage of palmitic acid. Stearic acid and palmitic acid were positively correlated, as well as stearic and linoleic acid. On an average the oil content was 19.84% and there was not much difference between the cultivars. The relatively high oil content and the unique fatty acid composition, suggested that kenaf seed could be used as a source of edible oil. Kenaf oil can be considered nutritionally healthy because of the relatively high amount of monounsaturated and polyunsaturated fatty acids [Coetzee R, Labuschagne MT and Hugo A, Fatty acid and oil variation in seed from kenaf (Hibiscus cannabinus L), Ind Crops Prod, 2008, 27 (1), 104-109].

Field performance of somaclones of Rose scented Geranium

Several randomly selected glasshouse grown somaclones of rose scented geranium, Pelargonium graveolens L’Herit ex Ait. cv. ‘Hemanti’ were successfully transferred to the field in Northern India for evaluation. Two distinct morphotypes were described on the basis of leaf dentation— one resembling the parental cultivar in having highly dentated leaves (HDL) and the other with less dentated leaves (LDL). After repeated field-testing for 3 consecutive years, the HDL clones closely resembled the parental cultivar with respect to the different quantity and quality determining traits, while the LDL group was clearly different. The field established LDL somaclones possessed higher herb yield, number of branches and other oil yield attributing traits as compared to the HDL clones and the parent cultivar. The chemical investigations of the essential oil revealed significant differences between the LDL clones, the HDL clones and the control. Selection of such somaclones, which are superior to the parental cultivar in most of the quantitative and qualitative traits and show better adaptability to different areas of cultivation, will help towards commercialization of geranium in India [Saxena Gauri, Laiq-ur-Rahman, Verma Praween Chandra, Banerjee Suchitra and Kumar Sushil, Field performance of somaclones of rose scented geranium (Pelargonium graveolens L’Her ex Ait.) for evaluation of their essential oil yield and composition, Ind Crops Prod, 2008, 27 (1), 86-90].

Phenylbutanoid-rich rhizome oil of Zingiber neesanum (Graham) Ramamoorthy from Western Ghats, southern India

Essential oil from the rhizomes of Zingiber neesanum (Graham) Ramamoorthy found in Western Ghats region of southern India was isolated and characterized by scientists at Tropical Botanic Garden and Research Institute, Pacha-Palode, Thiruvananthapuram, Kerala, India. Oil constituents were identified by comparison of individual mass spectra with databases and the literature, linear retention indices and co-injection. Sixty-one constituents, comprising 97.4% of the oil, were identified. Phenylbutanoids, viz. (E)-1-3′, 4′-dimethoxyphenyl)butadiene (31.1%), a potential antiinflammatory compound, and (E)-1-(3′,4′-dimethoxyphenyl)but-1-ene (23.1%) were isolated from the oil by preparative TLC, characterized by IR, UV, 1H-NMR and MS and quantified by external standardization. (E)-β ocimene (12.7%), pinene (7.4%) and linalool (4.0%) were the major terpenoid constituents in Z. neesanum rhizome oil [Sabulal Baby, Dan Mathew, John J Anil, Kurup Rajani, Chandrika Sreeja Purushothaman and George Varughese, Phenylbutanoid-rich rhizome oil of Zingiber neesanum from Western Ghats, southern India, Flav Fragr J, 2007, 22 (6), 521-524].
Traditional hydrodistillation (HD), cold pressing (CP) and innovative microwave distillation or microwave-accelerated distillation (MAD) methods have been compared and evaluated by scientists at France for their effectiveness in the isolation of essential oil from fresh Citrus peels. The microwave method offers important advantages over traditional alternatives, viz. shorter extraction times (30 min vs. 3 h for hydrodistillation and 1 h for cold pressing); better yields (0.24 vs. 0.21% for HD and 0.05% for CP); environmental impact [energy cost is appreciably higher for performing HD and for mechanical motors (CP) than that required for rapid MAD extraction]; cleaner features (as no residue generation and no water or solvent used); increases antimicrobial activities; and provides a more valuable essential oil (with high amounts of oxygenated compounds). It also offers the possibility for better reproduction of the natural aroma of the essential oil from Citrus fruit compared with CP, but more than the HD essential oil. Further, the microwave procedure yields essential oils that can be analysed or used directly without any clean-up, solvent exchange or centrifugation steps. Scanning electron microscopy provides more evidence of the cleanness of microwave extraction, in contrast to the huge perforations on the external surface of the Citrus fruit peel in the case of conventional hydrodistillation.

Finally, a mechanism of microwave distillation is proposed and discussed [Ferhat Mohamed A, Meklati Brahim Y and Chemat Farid, Comparison of different isolation methods of essential oil from Citrus fruits: cold pressing, hydrodistillation and microwave ‘dry’ distillation, Flav Fragr J, 2007, 22 (6), 494-504].

Corn fibre oil and sitostanol decrease cholesterol absorption

The researchers at Macdonald Campus of McGill University, Ste-Anne-de-Bellevue, Canada and Crop Conversion Science and Engineering Research Unit, Wyndmoor, USA investigated the cholesterol-lowering mechanisms of corn fibre oil (CFO), ferulate phytostanyl esters (FPEs) and parent compounds of FPE, including sitostanol and ferulic acid in hamsters. Seventy male Golden Syrian hamsters were randomly assigned to six experimental diets for 4 weeks: (1) cornstarch-casein-sucrose-based control diet (control); and (2) control diet plus 0.1% (wt/wt) cholesterol (cholesterol-control). The remaining four groups were given cholesterol-control diet with: (3) 10% (wt/wt) CFO; (4) 0.5% (wt/wt) sitostanol; (5) 0.23% (wt/wt) ferulic acid; and (6) 0.73% (wt/wt) FPE. At the end of dietary intervention, total plasma cholesterol, high-density lipoprotein cholesterol and triglyceride concentrations were determined. Parameters of cholesterol kinetics, including cholesterol absorption and synthesis, as well as mRNA expression of sterol transporters such as Niemann–Pick C1 like 1 (NPC1L1), ATP-binding cassette G5 (ABCG5) and ABCG8, were assessed. Supplementation with CFO decreased (P<.0001) plasma total cholesterol levels by 29% as compared to the cholesterol-control group. Dietary intervention did not alter the intestinal gene expression of ABCG5, ABCG8 and NPC1L1. The results show that the CFO-induced and sitostanol-induced decrease in cholesterol absorption is independent of intestinal enterocyte sterol transporters such as ABCG5, ABCG8 and NPC1L1 in hamsters [Jain Deepak, Ebine Naoyuki, Jia Xiaoming, Kassis Amira, Marinangeli Christopher, Fortin Marc, Beech Robin, Kevin B Hicks, Moreau Robert A, Kubow Stan and Jones Peter JH, Corn fiber oil and sitostanol decrease cholesterol absorption independently of intestinal sterol transporters in hamsters, J Nutr Biochem, 2008, 19(4), 229-236].