Effect of osmotic dehydration on volatile profile of mango

Researchers of Polytechnic University of Valencia, Spain studied the effect of osmotic dehydration on the volatile fraction of mango (*Mangifera indica* Linn.) fruit. Osmotic treatments were carried out at atmospheric pressure (OD) and by applying a vacuum pulse (PVOD). Sucrose at 35, 45, 55 and 65°Brix was used as osmotic solution until reaching 20 or 30°Brix in the liquid phase of dehydrated mango. Volatile compounds of fresh and dehydrated samples were obtained by simultaneous distillation-extraction, and analyzed by GC-MS. In general, osmotic dehydration provoked changes in the concentration of analyzed compounds to different extents, depending on process conditions. The use of highly concentrated osmotic solutions, and the high level of sample osmodehydration, induced losses of volatiles with respect to the fresh samples. On the other hand, more heavily diluted solutions and shorter treatment times (lower osmodehydration level) could give rise to the enhancement of volatile production. In these cases, sample mass loss was reduced during treatment since sugar gain was promoted against water loss [Torres Juan Diego, Talens Pau, Carot José Miguel, Chiralt Amparo and Escriche Isabel, Volatile profile of mango (*Mangifera indica* L.), as affected by osmotic dehydration, *Food Chem*, 2007, 101 (1), 219-228].

Biodiesel production using anionic ion-exchange resin

Scientists at Japan conducted the transesterification reactions of triolein with ethanol using various ion-exchange resin catalysts to produce ethyl oleate as a biodiesel. The effects of the resin’s structural factors and the operating factors on the reaction rate were investigated. The possibility of a continuous biodiesel production was studied by constructing an expanded bed reactor packed with active resin. The anion-exchange resins exhibited much higher catalytic activities than the cation-exchange resin. The anion-exchange resin with a lower cross-linking density and a smaller particle size gave a high reaction rate as well as a high conversion. By combining the three-step regeneration method, the resin could be repeatedly used for the batch transesterification without any loss in the catalytic activity. A continuous transesterification reaction was carried out using an expanded bed reactor packed with the most active resin. The reactor system permitted the continuous production of ethyl oleate with a high conversion [Shibasaki-Kitakawa Naomi, Honda Hiroki, Kuribayashi Homare, Toda Takuji, Fukumura Takuya and Yonemoto Toshikuni, Biodiesel production using anionic ion-exchange resin as heterogeneous catalyst, *Bioresour Technol*, 2007, 98 (2), 416-421].

Enzymatic production of biodiesel from cotton seed oil

The enzymatic production of biodiesel by methanolysis of cottonseed oil was studied by scientists at Argentina using immobilized *Candida antarctica* lipase as catalyst in t-butanol solvent. Methyl ester production and triacylglycerol disappearance were followed by HPLC chromatography. It was found, using a batch system, that enzyme inhibition caused by undissolved methanol was eliminated by adding t-butanol to the reaction medium, which also gave a noticeable increase of reaction rate and ester yield. The effect of t-butanol, methanol concentration and temperature on this system was determined. A methanolysis yield of 97% was observed after 24 hours at 50°C with a reaction mixture containing 32.5% t-butanol, 13.5% methanol, 54% oil and 0.017 g enzyme/g oil. With the same mixture, a 95% ester yield was obtained using a one step fixed bed continuous reactor with a flow rate of 9.6 ml/hour/g enzyme. Experiments with the continuous reactor over 500 hours did not show any appreciable decrease in ester yields [Royon D, Daz M, Ellenrieder G and Locatelli S, Enzymatic production of biodiesel from cotton seed oil using t-butanol as a solvent, *Bioresour Technol*, 2007, 98 (3), 648-653].
Potential of restaurant waste lipids as biodiesel feedstocks

Biodiesel is usually produced from food-grade vegetable oils that are more expensive than diesel fuel. Therefore, biodiesel produced from food-grade vegetable oil is currently not economically feasible. Waste cooking oils, restaurant grease, and animal fats are potential feedstocks for biodiesel. These inexpensive feedstocks represent one-third of the US total fats and oil production, but are currently devoted mostly to industrial uses and animal feed. The characteristics of feedstock are very important during the initial research and production stage. Free fatty acids and moisture reduce the efficiency of transesterification in converting these feedstocks into biodiesel. Hence, researchers at the Department of Mechanical Education, Kocaeli University, Umuttepe-Izmit, Turkey conducted a study with the objective to present the availability and properties of restaurant waste oils and rendered animal fat as low-cost feedstocks for biodiesel production and determined the level of these contaminants in feedstock samples from a rendering plant. Waste restaurant oils and animal fats have relatively high levels of saturation. Levels of free fatty acids varied from 0.7 to 41.8% and moisture from 0.01 to 55.38%. These wide ranges indicate that an efficient process for converting waste grease and animal fats must tolerate a wide range of feedstock properties [Canakci Mustafa, The potential of restaurant waste lipids as biodiesel feedstocks, Bioresour Technol, 2007, 98 (1), 183-190].

Anaerobic co-digestion of algal sludge and waste paper to produce methane

The unbalanced nutrients of algal sludge (low C/N ratio) were regarded as an important limitation factor to anaerobic digestion process. Adding high carbon content of waste paper in algal sludge feedstock to have a balanced C/N ratio was undertaken for study by researchers at Taiwan and USA to assess the possibility of co-digestion of algal sludge and high carbon content of waste paper at different fraction to produce methane and evaluate the waste paper adding effects on the methane production.

The results showed that adding 50% (based on volatile solid) of waste paper in algal sludge feedstock increased the methane production rate to 1170 ± 75 ml/l day, as compared to 573 ± 28 ml/l day of algal sludge digestion alone, both operated at 4 g VS/l day, 35°C and 10 days HRT. The maximum methane production rate of 1607 ± 17 ml/l day was observed at a combined 5 g VS/l day loading rate with 60% (VS based) of paper adding in algal sludge feedstock. Results also suggest that an optimum C/N ratio for co-digestion of algal sludge and waste paper was in the range of 20-25/l. The increase in cellulase activity might be helpful in the biodegradation of algal sludge, which could provide nutrients in the digester, which finally would improve methane production rate [Yen Hong-Wei and Brune David E, Anaerobic co-digestion of algal sludge and waste paper to produce methane, Bioresour Technol, 2007, 98 (1), 130-134].

Alternative fuel properties of tall oil fatty acid methyl ester-diesel fuel blends

Blended fuels can be used as alternative fuels in conventional diesel engines without any major modification. Crude tall oil in Turkey is obtained at 25,000 tonnes/year and is cheaper than other vegetable oils. It is a by-product in the manufacture of paper pulp by pulping processes and contains 40-50% resinic acids, 30-40% fatty acids and 10% neutral or unsaponifiable material. It is widely used in industrial applications, e.g. nylon, adhesives, iron-steel, etc. and also as an additive to improve cetane number in diesel fuel. Scientists of Gazi University, Ankara, Turkey conducted experimental
work to study, tall oil methyl ester-diesel fuel blends as alternative fuels for diesel engines. Tall oil methyl ester was produced by reacting tall oil fatty acids with methyl alcohol under optimum conditions. The blends of tall oil methyl ester-diesel fuel were tested in a direct injection diesel engine at full load condition. The effects of the new fuel blends on the engine performance and exhaust emission were tested. It was observed that the engine torque and power output with tall oil methyl ester-diesel fuel blends increased up to 6.1% and 5.9%, respectively. It was also seen that CO emissions decreased to 38.9% and NO_x emissions increased up to 30% with the new fuel blends. The smoke opacity did not vary significantly. At low engine speeds, specific fuel consumption increased with blended fuels depending on the amount of tall oil methyl ester. But, relative to diesel fuel, specific fuel consumption for blended fuels did not increase significantly at higher engine speeds [Altiparmak Duran, Keskin Ali, Koca Atilla and Gürü Metin, Alternative fuel properties of tall oil fatty acid methyl ester-diesel fuel blends, *Bioresour Technol*, 2007, 98 (2), 241-246].

**Biodiesel production using a membrane reactor**

The immiscibility of canola oil in methanol provides a mass-transfer challenge in the early stages of the transesterification of canola oil in the production of fatty acid methyl esters (FAME or biodiesel). To overcome or rather, exploit this situation, a two-phase membrane reactor was developed by researchers at Department of Chemical Engineering, University of Ottawa, Ottawa, Ont., Canada to produce FAME from canola oil and methanol. The transesterification of canola oil was performed via both acid- or base-catalysis. Runs were performed in the membrane reactor in semi-batch mode at 60, 65 and 70°C and at different catalyst concentrations and feed flow rates. Increases in temperature, catalyst concentration and feedstock (methanol/oil) flow rate significantly increased the conversion of oil to biodiesel. The novel reactor enabled the separation of reaction products (FAME/glycerol in methanol) from the original canola oil feed. The two-phase membrane reactor was particularly useful in removing unreacted canola oil from the FAME product yielding high purity biodiesel and shifting the reaction equilibrium to the product side [Dubé MA, Tremblay AY and Liu J, Biodiesel production using a membrane reactor, *Bioresour Technol*, 2007, 98 (3), 639-647].

**Gum/Rubber**

**Rheological and sensory properties of dessert sauces thickened by starchñxanthan gum combinations**

The scientists at Poland prepared strawberry sauces thickened with oat, potato and corn starches blended with xanthan gum and evaluated their sensory, textural and rheological properties. The sensory analysis was performed with the five-point scale of quality. The products were also characterized rheologically at 25°C in the controlled rate of shear (CR) mode. Resulting flow curves were fitted to the Herschel–Bulkley and Ostwald–de Waele rheological models. The second model provided worse fitting. The $K$ and $n$ parameters of the Herschel–Bulkley model revealed that, although to a different extent, all thickener combinations were suitable for thickening of sauces. The textural analysis of the sauces involving so-called back extrusion tests, providing maximum positive and negative extrusion force, revealed that thickening with potato sauce requires less xanthan gum for reaching desired effect, than corn and oat starches did. Sensory analysis distinguished the potato starch containing 0.12% xanthan gum as superior thickener. The sensory properties of the