

Pumpkin (*Cucurbita pepo* Linn.) seed oil as an alternative feedstock for the production of biodiesel in Greece

In recent years, the acceptance of fatty acid methyl esters (biodiesel) as a substitute to petroleum diesel has rapidly grown in Greece. The raw materials for biodiesel production in this country mainly include traditional seed oils (cotton seed oil, sunflower oil, soybean oil and rapeseed oil) and used frying oils. In the search for new low-cost alternative feedstocks for biodiesel production, a study done by researchers at National Technical University of Athens,

Athens, Greece emphasizes the evaluation of pumpkin (*Cucurbita pepo* Linn.) seed oil. The experimental results showed that the oil content of pumpkin seeds was remarkably high (45%). The fatty acid profile of the oil showed that is composed primarily of linoleic, oleic, palmitic and stearic acids. The oil was chemically converted via an alkaline transesterification reaction with methanol to methylesters, with a yield nearly 97.5 wt%. All of the measured properties

of the produced biodiesel met the current quality requirements according to EN 14214. Although the study showed that pumpkin oil could be a promising feedstock for biodiesel production within the EU, it is rather difficult for this production to be achieved on a large scale [Schinas P, Karavalakis G, Davaris C, Anastopoulos G, Karonis D, Zannikos F, Stournas S and Lois E, Pumpkin (*Cucurbita pepo* L.) seed oil as an alternative feedstock for the production of biodiesel in Greece, *Biomass Bioenergy*, 2009, **33** (1), 44-49].

Blends of PVC and epoxidized liquid natural rubber: Studies on impact modification

Liquid natural rubber of different molecular masses L-LNR and H-LNR were subjected to varying degree of epoxidation (L-ELNR-10, L-ELNR-20, L-ELNR-30, L-ELNR-40, L-ELNR-50, H-LNR-20 and H-LNR-50) and the products were incorporated into PVC at various compositions by the solution blending method. The scientists at Kottayam, Kerala subjected these blend systems to tensile testing, tensile impact measurements and SEM studies. It was observed that blends with L-ELNR-20 showed highest impact strength modification, followed by

L-ELNR-10 and L-ELNR-30. High impact properties shown by these blends are attributed to the optimum level of compatibility existing between the blend components. Tensile impact fracture studies revealed that the failure pattern for this blend system is intermediate between the brittle fracture of rigid PVC and ductile fracture of PVC/L-ELNR-50 samples. Blends up to 30 mol% of epoxidation showed partially compatible heterogeneous nature exhibiting domain morphology. Blends of liquid rubber with higher degree of epoxidation showed

deterioration in tensile strength, modulus, yield strength and tensile impact strength due to plasticization of PVC caused by the higher polar interaction between PVC chains and the oxirane rings. Effect of ELNR molecular weight was studied and found that the impact modification is higher for the L-ELNR blends compared to the H-ELNR blends [Nair Radhakrishnan MN, Biju PK, Thomas George V and Nair Gopinathan MR, Blends of PVC and epoxidized liquid natural rubber: Studies on impact modification, *J Appl Polym Sci*, 2009, **111**(1), 48-56].

Effect of bis (3-triethoxysilylpropyl) tetrasulfide on the crosslink structure, interfacial adhesion and mechanical properties of natural rubber/cotton fibre composites

The scientists at China used bis (3-triethoxysilylpropyl) tetrasulfide (TESPT) to improve the interfacial adhesion between cotton fibre and natural rubber (NR). The crosslink density, interfacial adhesion, mechanical properties, dynamic mechanical properties and morphology of NR/cotton fibre composites were investigated. In this study, natural rubber cotton fibre composites were prepared. TESPT was

used as a coupling agent between the fibre and matrix to enhance the interfacial adhesion.

The composites with TESPT had higher crosslink density, better mechanical properties, higher initial modulus and higher yield strength than the composites without TESPT because of the difference in interfacial adhesion. The results of an interfacial adhesion evaluation, the high storage modulus and

low damping values of the composites with TESPT and the coarse surfaces of the pullout fibres implied the enhancement of interfacial adhesion [Zeng Zheng, Ren Wentan, Xu Chi, Lu Weiqiang, Zhang Yong and Zhang Yinxi, Effect of bis(3-triethoxysilylpropyl) tetrasulfide on the crosslink structure, interfacial adhesion, and mechanical properties of natural rubber/cotton fibre composites, *J Appl Polym Sci*, 2009, **111**(1), 437-443].

Persulfate/ascorbic acid initiated synthesis of poly(acrylonitrile)-grafted tamarind seed gum: A potential commercial gum

The scientists at University of Allahabad and Indian Institute of Technology, Kanpur, India grafted acrylonitrile on to tamarind seed gum using persulfate/ascorbic acid redox initiator and a representative sample of the graft copolymer (Tm-g-PAN) was characterized using infrared spectroscopy (FTIR), X-ray diffraction (XRD) and scanning electron microscopy (SEM).

Grafting conditions were optimized where % grafting (%G) and % efficiency (%E) were found to increase with the increase in the concentration of the monomer; initiator and the reaction temperature, whereas increase in gum concentration decreased the %G in the concentration range of 4-12g/l. The maximum %G and %E achieved were 305 and 75%, respectively. Water/saline retention, gel

forming ability, and the shelf-life of the grafted gum solutions were also studied to explore the possibility of its commercial utilization [Singh Vandana, Tripathi Devendra Narayan, Malviya Tulika and Sanghi Rashmi, Persulfate/ascorbic acid initiated synthesis of poly(acrylonitrile)-grafted tamarind seed gum: A potential commercial gum, *J Appl Polym Sci*, 2009, **111**(1), 539-544].

Liquefaction of wheat straw and preparation of rigid polyurethane foam from the liquefaction products

The performances of polyurethane foams manufactured from liquefied plant raw materials, especially those from non-wood fibres, have seldom

been investigated. Therefore, the scientists at South China University of Technology, China and Guangzhou Institute of Chemistry, Chinese Academy of Sciences,

China manufactured rigid polyurethane foam from diisocyanate and liquefied wheat straw, a widely distributed non-wood fibrous raw material in China. The

characteristics of liquefaction products and those of the polyurethane foams were also investigated. Wheat straw was liquefied in the mixture of polyethylene glycol (PEG 400) and glycerin in the presence of acid at the temperature 130-160°C. The final liquefaction products having the hydroxyl number of

250-430 mg KOH/g and the M_n of about 1050 can be used as the polyol component to manufacture polyurethane. A kind of polyurethane foam was prepared from liquefied wheat straw, commercial polyol and di-isocyanates in the presence of organotin catalysts and foaming agents. The polyurethane foam presented better

compressive strength and thermal stability than that manufactured from di-isocyanate and polyol alone. The polyurethane foam presented faster biodegradation at ambient temperature than normal polyurethane foam did [Chen Fangeng and Lu Zhuomin, Liquefaction of wheat straw and preparation of rigid polyurethane foam from the liquefaction products, *J Appl Polym Sci*, 2009, **111**(1), 508-516].

Rheological and functional properties of gelatin from the skin of Bigeye snapper (*Priacanthus hamrur*) fish

The rheological and functional properties of gelatin from the skin of Bigeye snapper (*Priacanthus hamrur*) fish were assessed by scientists of India and UK. The protein content of dried gelatin was 94.6% and moisture content was 4.2%. The amino acid profile of gelatin revealed high proportion of glycine and imino acids. The bloom strength of solidified gelatin was 108g. The average molecular weight of fish skin gelatin was 282kDa as determined by gel filtration technique. The emulsion capacity (EC) of gelatin at a concentration of 0.05% (w/v) was 1.91ml oil/mg protein and with increase in concentration, the EC values

decreased. The gelling and melting temperatures of gelatin were 10 and 16.8 °C,



respectively as obtained by small deformation measurements. The flow behaviour of gelatin solution as a function of concentration and temperature revealed non-Newtonian behaviour with pseudoplastic phenomenon. The Casson and Herschel-Bulkley models were suitable to study the flow behaviour. The yield stress was maximum at 10°C with

the concentration of 30mg/ml. Thermal gelation behaviour of threadfin bream (*Nemipterus japonicus*) mince in presence of different concentration of gelatin was assessed. Gelatin at a concentration of 0.5% yielded higher storage modulus (G') value than control. Frequency sweep of heat set gel with gelatin revealed strong network formation [Binsi PK, Shamasundar BA, Dileep AO, Badii F and Howell NK, Rheological and functional properties of gelatin from the skin of Bigeye snapper (*Priacanthus hamrur*) fish: Influence of gelatin on the gel-forming ability of fish mince, *Food Hydrocol*, 2009, **23**(1), 132-145].

Preparation of water-soluble chitosan from shrimp shell and its antibacterial activity

Chitin is the second abundant polymer next to cellulose over the world. Its deacetylated product, chitosan, is an important ingredient in medicine and food. However, the low solubility in water limits the application of chitosan. Scientists working at China prepared crude chitosan from shrimp shell by HCl, NaOH and ethanol solution successively.

Hydrogen peroxide was used to degrade the crude chitosan into water-soluble chitosan. A mathematical model between degradation conditions (H_2O_2 level, time and temperature) and the recovery of water-soluble chitosan was constructed using response surface methodology. Each factor showed a significant effect on the recovery. The model was confirmed to have

a good fitness by analysis of variance. The optimal conditions to obtain the highest recovery of water-soluble chitosan were 5.5% of H_2O_2 level, 3.5h of time and 42.8°C of temperature. The predicted recovery was 93.5%. Through testing the number of colony, both crude and water-soluble chitosan showed good inhibition activities against *Bacillus subtilis*. By

determination of inhibition zone diameter, water-soluble chitosan showed significantly ($P < 0.05$) higher inhibition

capabilities against *Escherichia coli*, *B. subtilis* and *Staphylococcus aureus* than crude chitosan [Du Yunjian, Zhao Yuqiao,

Dai Shuchao and Yang Bao, Preparation of water-soluble chitosan from shrimp shell and its antibacterial activity, *Innov Food Sci Emerg Technol*, 2009, **10** (1), 103-107].

Properties of biodegradable citric acid-modified granular starch/thermoplastic pea starch composites

Pea starch is mainly available as a by-product of protein extraction. It is therefore considered to be a relatively cheap source of starch as compared to corn, wheat and potato starches. Scientists at China and Canada prepared pea starch-based composites reinforced with citric acid-modified pea starch (CAPS) and citric acid-modified rice starch (CARS), respectively, by screw extrusion. The effects of granular CAPS and CARS on the morphology, thermal stability, dynamic mechanical thermal analysis, the relationship between the mechanical properties and water content, as well as the water vapour permeability of the

composite films were investigated. Scanning electron microscope and X-ray diffraction



reveal that the reinforcing agents, the granules of CAPS and CARS, are not disrupted in the thermoplastic process, while the pea starch in the matrix is turned into a continuous thermoplastic pea starch (TPS) phase. Granular CAPS and CARS can improve the storage modulus, the glass transition temperature, the

tensile strength and the water vapour barrier, but decrease thermal stability. CARS/TPS composites exhibit a better storage modulus, tensile strength, elongation at break and water vapour barrier than CAPS/TPS composites because of the smaller size of the CARS granules. These starch derivative/TPS composites may have great potential to replace conventional packaging such as edible films, food packaging and biodegradable packaging [Ma Xiaofei, Chang Peter R, Yu Jiugao and Stumborg Mark, Properties of biodegradable citric acid-modified granular starch/thermoplastic pea starch composites, *Carbohydr Polym*, 2009, **75** (1), 1-8].

Physicochemical characterization of chitin and chitosan from crab shells

Chitin is always made from crustaceans and therefore crab shell is a source of chitin and chitosan. The researchers at Taiwan conducted studies to purify crab chitin from commercial crab chitin using acid and alkaline treatments followed by decolorization with potassium permanganate. Crab chitosan was prepared by alkaline *N*-deacetylation of crab chitin for 60, 90 and 120 min and the yields were 30.0-32.2% with that of chitosan C120 being the highest. The degree of *N*-deacetylation of chitosans (83.3-93.3%) increased but

the average molecular weight (483-526kDa) decreased with the prolonged reaction time. Crab chitosans showed lower lightness and WI values than purified chitin, chitosans CC and CS but higher than crude chitin. With the prolonged reaction time, the nitrogen (8.9-9.5%), carbon (42.2-45.2%) and hydrogen contents (7.9-8.6%) in chitosans prepared consistently increased whereas N/C ratios remained the same (0.21). Crab chitosans prepared showed a melting endothermic peak at 152.3-159.2°C. Three chitosans showed similar

microfibrillar crystalline structure and two crystalline reflections at $2\theta = 8.8-9.0$ and $18.9-19.1$. Overall, the characteristics of three crab chitosans were unique and differed from those of chitosan CC and CS as evidenced by the element analysis, differential scanning calorimetry, scanning electron microscopy and X-ray diffraction patterns [Yen Ming-Tsung, Yang Joan-Hwa and Mau Jeng-Leun, Physicochemical characterization of chitin and chitosan from crab shells, *Carbohydr Polym*, 2009, **75** (1), 15-21].