

E2 - 231	E2 - 236	E2 - 241	E2 - 248	E2 - 254
E2 - 232	E2 - 237	E2 - 244	E2 - 249	E2 - 255
E2 - 233	E2 - 238	E2 - 245	E2 - 251	E2 - 256
E2 - 234	E2 - 239	E2 - 246	E2 - 252	E2 - 257
E2 - 235	E2 - 240	E2 - 247	E2 - 253	E2 - 258

E2 - 231

Solvation method for study of rubber-filter interaction

The use of solvation method for the identification of the adhesion bonds established across rubber-Kaolin interface was studied. A laminate of flexible rubber film stuck to rigid kaolin represented a model of kaolin filled rubber compound that was peel-tested under action of various permanent loads in the series of alcohols from methanol to butanol. The load providing separation of a lamina under equilibrium conditions was determined and treated as laminate peel strength.

The reduction in peel-strength with increasing dispersive component of the solubility parameter of the destructive medium, to which a lamina was exposed, indicated the presence of the dispersive bonds in the spectrum of adhesion bonds, while decreasing in peel-strength due to increasing of associative component of solubility parameter related to weakening of the polar bonds. Appropriate modification of kaolin with chemicals that improved its reactivity and compatibility with rubber facilitated action of non-polar (dispersion) and polar (orientation and induction) forces upgraded the low cost inactive filler to obtain a creditable performance as reinforcing filler in the rubber formulation technology.

E2 232

An evaluation of joints made with natural rubber components containing cashew nut shell liquid based resin as tackifier

A lightly loaded natural rubber black mix, containing cashew nut shell liquid (CNSSL) based resin as tackifier is prepared in the form of strips. The joints made with the strips are tested for their bond strength values before and after vulcanization. The values thus obtained are then assessed by comparing with the bond strength values of joints made with the strips of corresponding natural rubber mix containing coumarone-indene (CI) resin, the imported tackifier.

The study reveals that as compared to the joint made with coumarone-indene resin added rubber mix strips, although the joint made with CNSL-based resin added rubber mix strips shows slightly weaker bond strength in the unvulcanised state, its bond strength is considerably greater in the vulcanized state. This suggests that the joints made with CNSL- based resin added natural rubber components are stronger than the joints made with coumarone-indene resin added natural rubber components.

Ion-exchange process to activate the rubber grade kaolin

Kaolin clay a non-reinforcing filler is originally used as a diluent in rubber compounds to reduce their cost. Ion-exchange properties of Kaolin were used to convert its unusually inert structure into active one towards rubber polymer in order to improve performance of kaolin filled rubber compounds. Ion-exchange process concerned specifically with counter cations strongly attached to unbalanced ions at the edges of planer surfaces of kaolinite minerals.

These cations were replaced by leaching the clay with basic organic electrolytes dissociated in aqueous medium. Chosen exchangeable cations' structure included active functional groups, that internsified attraction of rubber polymer to filler surface by means of better compatibility of organic filler with organic rubber or formation of sufficiently strong adhesion bonds across rubber-kaolin interface.

Swelling test results of rubber compounds filled with activated kaolin displayed increased bound rubber content. Mooney and Monsanto rheographs showed increase in vulcanization rate. Differential Thermal Analysis test recorded the endo thermal peaks on the thermograph curves that supported interaction between rubber and activated kaolin.

Physico-mechanical properties of tested rubber compounds containing modified kaolin were found to be better in tensile abrasion and flex racking. The conclusions can be made:

1. Ion-exchange process could be successfully used for activation of rubber grade kaolin.
2. Developed modification upgraded low-cost reinforcing filler to obtain creditable performance as could be achieved with expensive reinforcing fillers in rubber compounds.

Photosensitized oxidation of Triaminophenylmethane pigments

Triaminophenylmethane pigments, Magenta and Crystal violet are used in textile and printing ink industry. In view of the toxicity, detoxification appears to be of great interest. Photosensitized oxidative degradation processes have been show to play an important role in destroying organic pollutants when compared to traditional methods such as adsorption, coagulation, ect.

In our recent work, visible light excited hematoporphyrin 1Xdihydrochloride in oxygenated solutions has been found to be promising material for photobleaching of Magenta and Crystal violet.

During a 24 h period of photoirradiation using a 20 W fluorescence lamp, complete decolouration of both dyes was achieved. Visual colour change of both dyes and loss of optical absorbance at 545 nm for magenta and at 580 nm for crystal violet at pH 3, 6 and

8 were observed upon continuous irradiation. No photobleaching was observed for controlled experiments performed exactly as above but in the absence of one of the components, oxygen, photosensitizer and light. The use of singlet oxygen scavenger (sodium azide) and superoxide anion scavenger (benzoquinone) in the above experiments, revealed that at high pH the photobleaching is due to singlet oxygen produced by the photosensitizer while at low pH both singlet oxygen and superoxide anion are involved in photoassisted decomposition of the dye species. The estimated redox potential of the excited photosensitizer is -1.8 V in comparison to -0.35 V for one electron redox potential of dioxygen vs Ag/AgCl, confirms the feasibility of an electron transfer from the excited sensitizer molecule to ground state oxygen to yield a superoxide anion.

E2 235

Production of coconut shell based charcoal and enhancement of its adsorptive properties

Activated carbon is used as an excellent because of its very high adsorption capacity which is due to its fine pore distribution. Coconut shell based charcoal has better characteristics than wood based charcoal. However, its maximum potential has not been realized yet. Since coconut shells are cheap and readily available in Sri Lanka, it is imperative that we develop its adsorptive and catalytic properties.

The basic structure of the activated carbon can be created by the carbonization process in which the raw material is heated in an inert gas atmosphere at high temperature. After carbonization, the activation step is carried out using steam as the activating agent. Activated carbon with different textures can be obtained by varying the raw material as well as by changing the conditions of carbonization, activation processes and also activating agents. In order to measure the adsorptive capacity of charcoal, methylene blue and acetic acid were used as adsorbates in this study. The extent of adsorption of these adsorbates was determined using spectrophotometric and titrimetric methods, and the results were compared with those for several commercially available charcoal samples. By this study parameters were those for several commercially available charcoal samples. By this study parameter were developed to enhance the adsorption characteristics of coconut shell charcoal. A 400% enhancement of adsorption capacity was achieved by activation of charcoal samples.

All the charcoal samples so produced exhibited high activity for adsorption of acetic acid compared to the commercially available and BDH charcoal, owing to their micro pore structure formed as a result of the low activation and carbonization time at relatively low temperatures.

E2 236

Fluoride content in infusions of black tea produced in different regions of Sri Lanka

Tea plants accumulate fluoride. Here, tea consumption significantly contributes to the dietary intake of fluoride. Accumulation of fluoride in the plant depends on the fluoride levels in soil and ground water. Therefore, tea produced in different regions of Sri Lanka may provide different amounts of dietary fluoride. Previous studies on fluoride content of Sri Lanka tea had not adequately studied this aspect.

In the present study tea samples were collected from fifty estates in different tea growing regions of Sri Lanka. Tea infusions were prepared by adding 125 ML of boiling deionised water to 1.25 g tea and allowing to stand for five minutes.

Following fluoride concentrations were observed in the liquors; Nuwara Eliya - 1.87 mg L⁻¹, Udapussellewa - 2.40 mg L⁻¹, Dimbulla - 1.62 mg L⁻¹, Bogovally and Maskeliya - 1.35 mg L⁻¹, Uva - 2.57 mg L⁻¹, Kandy and Matale - 2.38 mg L⁻¹, Ratnapura and Balangoda - 1.52 mg L⁻¹, Galle and Matara - 1.60 mg L⁻¹. Significantly higher fluoride concentrations were found in tea produced in Udapussellewa, Uva, Kandy and Matale regions when compared with tea produced in other regions of Sri Lanka.

Results obtained show that Sri Lanka tea provides 1.37 - 2.05 mg fluoride per day assuming that the daily consumption is 4 - 6 cups. This amounts to 38 - 57% of recommended daily allowance. Therefore, drinking normal amounts of Sri Lankan tea provide significant amounts of fluoride, which is important in teeth and bone mineralisation. However, consumption of normal amounts of Sri Lankan tea alone will not provide excessive fluoride, which could lead to fluorosis.

E2 237

Quantitative assessment of fluoride adsorption on kaolinite mineral water interface for development of a de-fluoridating methodology for ground waters

Excessive ingestion of fluoride through drinking water causes dental and skeletal fluorosis in human. Concentration of fluoride in domestic wells in north central and certain south-eastern regions of the island exceeds WHO drinking water limits. The objective of this study is to investigate the fluoride adsorption process on kaolinite and to determine the trapping capacity of fluoride by kaolinite in order to develop a de-fluoridation method for ground waters.

Extent of fluoride ion adsorption on kaolinite has been investigated over a range of environmentally important pH values (4 - 9) and three ionic strengths (0.1, 0.01 and 0.001 mol dm⁻³ with NaNO₃). The amount of fluoride retained by kaolinite was found to be a function of pH, ionic strength of the medium. The lowest ionic strength gave the highest adsorption. Fluoride uptake by kaolinite was minimal at pH > 7 and increased with decreasing pH. Adsorption of fluoride decreased in the presence of calcium and magnesium in the medium over the pH range. Potentiometric titrations of calcium and magnesium in the medium over the pH range. Potentiometric titrations of kaolinite were performed under above three ionic strengths. The surface charge of kaolinite was pH dependant and the highest ionic strength gave the highest surface charge. pH zpc for kaolinite was 6.98 and kaolinite surface was found to be positively charged below 6.98. The active surface area of kaolinite was 17m² g⁻¹. With a column (1.5 cm² cross section and 4.00 cm long) packed with kaolinite and silica (volume ratio 1:1) it was found that 40

% of fluoride could be adsorbed in a water samples of 200 cm³ passed at a rate 1.00 cm³ min⁻¹.

E2 238

Determination of deposition velocities of tritium on soil

In the case of airborne tritium release, a part of the tritium dispersed in the atmosphere will be deposited on a soil surface. The behaviour of radioactive HT (T= Tritium) in the environment is probably essentially the same as that of H₂. It is well know that soil can quickly oxidize atmospheric HT to tritiated water (HTO) mainly via a biological process. When HT is released, the dry deposition of HT to Soil arises from the oxidation of HT to HTO by micro-organisms in soil. HTO vapor in the atmosphere is much more harmful, due to the possibility of incorporation of tritium in the body fluids through the skin and the lungs, and subsequently of an internal exposure which lasts until the complete biological elimination of Tritium. Since the limits for intake of HT by workers is about 10, 000 times that of HTO, it is important to quantify the oxidation rate of HT in the environment for the purpose of radiation protection. The present study was carried out to obtain HT deposition velocities which are used to assess tritium doses to the general public. The deposition velocities obtained ranged from 3.4×10^{-4} m.s⁻¹ to 9.8×10^{-4} m.s⁻¹ .

The lowest value (3.4×10^{-4} m.s⁻¹) was obtained for the soils collected from a vegetable field. For the experiments dealing with undisturbed soil, the average deposition velocity was found to be $(7.2 \pm 0.7) \times 10^{-4}$ m.s⁻¹ . An average of $(7.5 \pm 2.0) \times 10^{-4}$ m.s⁻¹ was obtained for the sandy soils.

E2 239

A non-destructive multi-element analytical procedure to determine elemental concentrations in plant material by X-ray fluorescence (XRF) technique

To determine element concentrations in plant material the samples the sample is first digested using conventional analytical methods. An analytical method is described to analyze the plant material without digesting the sample but pulverizing the sample into a fine powder and making a pellet. The plant material is first oven dried at 40 °C overnight and pulverized to obtain a fine homogenous powder by using an agate ball-mill. Then a small portion (100-150 mg) of the finely powdered sample is pressed into pellets using a pelletizer. The diameter of a pellet was 1.72 cm and the mass density of the pellets was about 40 mg/cm³. The pellets of intermediate thickness were analysed by X-ray fluorescence spectrometry with emission transmission arrangement. The pellet is then measured X-ray fluorescence technique employing the Mo secondary target mode. Resulting X-ray spectra were analyzed by AXIL (Analysis of X-ray spectra by Iterative Least square method) software package to obtain characteristic X-ray intensities corresponding to the analyte elements. The calibration of spectrometer was performed using pellets of intermediate thickness prepared from pure chemical compounds. Intermediate thickness pellets of the reference materials. IAEA V-10, HAY (Powder) and

CL -1 Cabbage leaves, were prepared and measured for the validation of the method. Three plant materials [*Centella asiatica* - *Imomea aquatica* (Kankun) and *Alternanthera sessilis*, (Mukunuwanna)] were analyzed as unknown samples and the results are reported.

E2 240

Metal- metal interaction and properties of some novel, covalently linked transition metal complexes with tetraazamacrocyclic ligand

Straightforward synthetic routes have been developed for homobimetallic donor-acceptor complexes by means of the nucleophilic substitution reactions of M^{II} (5, 7-Me₂ [14]4, 7-dieono (-1) N₄)⁺ complex (where M = Ni^{II}, Cu^{II}, Co^{II}, Co^{III}) with *α, α'*-dibromo-o-xylene in 2:1 ratio. These systems contain o-xylene linked, face-to-face macrocyclic ligand complexes bridged by halide ions and can serve as simple models for fundamental studies of hole-transfer. The complexes were characterized by their elemental analysis, FAB mass spectroscopy, HNMR spectroscopy, electronic spectra and electrochemical of some of these complexes. Metal-metal interaction inferred by donor-acceptor coupling of homo-bimetallic systems was evaluated by means of UV-Visible spectroscopic measurements. Electrochemical potentials (shown in the table below) and/or magnetic susceptibility measurements. The face-to-face macrocyclic homo bimetallic complexes show a surprising affinity for halide bridged homobimetallic complexes are the first simple molecular models of inner sphere electron transfer system (donor/acceptor systems) in which the transition metal donor and acceptor σ -orbitals are mixed by ligand σ -orbitals.

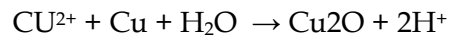
Complex	E ¹ ½, V	E ² ½, V	ΔE ½, V
[LCu ₂ Cl] ³⁺	0.915	0.94	0.025
[LNi ₂ Cl] ³⁺	0.668	1.268	0.6
[LCo ₂ Cl] ³⁺	0.268	0.684	0.42

E2 241

Investigation of n-type Cu₂O layers prepared by a low cost chemical method for use in photo-voltaic thin film solar cells

This investigation reports the simple method of preparation of Cu₂O and the properties of this layer as determined by XRD, GDOES and SEM techniques. The amount of Cu₂O grown on the copper plate and the variation of the pH value of the solution as a function of boiling time in the CuSO₄ solution are investigated. The oxide layer grows rapidly at the beginning and slow down after about first 40 minutes. The variation of pH value shows similar trend showing a rapid reduction at the beginning and the saturating a value close to 3.8.

During the growth of Cu₂O layer, the acidity of the solution increased rapidly and settles down at a constant value. At this equilibrium, the growth rate Cu₂O must have been equal to rate of dissolution of the oxide layer due to increased acidity of the solution. The formation of Cu₂O on copper surface can be explained by the following reaction ie



The XRD patterns were obtained for there different layers with boiling times of 20, 40 and 60 minutes. The XRD pattern is dominated by there peaks (111), (200), (220) and from the copper substrate. The 20 minutes boiling in CuSO₄ solution forms a polycrystalline becomes stronger and Cu₂O (200) peak also appears next to Cu (111) increases with prolonged boiling time of Cu plates in CuSO₄ solution. From SEM data the liner arrangements of grains observed must have been originated from the scratches found on the Cu surface during surface preparation. Further annealing in air at temperature in excess of 400 °C does not show any major changes of grain sizer or the improvement of XRD patterns. Glow discharge optical emission spectroscopy (GDOES) profiling experiment have been carried out on these Cu₂O / Cu systems and the presence of Cu₂O layer is indicated by the presence of more Oxygen and less Cu on the surface when compared to the bulk Cu plate.

E2 244

Development of Maize-Soy based supplementary food and evaluation of quality parameters

Throughout history, hunger and malnutrition caused by lack of nutrients or by poor health, particularly infectious diseases, which prevent the body from absorbing and utilizing food efficiently.

Studies were conducted to develop low cost nutritious Maize-Soy based supplementary food which also can be using as breakfast food using less capital intensive method. In addition, green gram and chickpea were added to increase the organoleptic properties and to enhance the consumer acceptability.

Proximate analysis indicated that the blend containing flours of maize, soybean, green gram and chickpea has high protein content (24.5%) and low fat content (9.7%) which is suitable for human consumption. Sensory evaluation revealed that there was no significant difference among the formulated blends. However, comparatively higher percentage of the panelists selected the blend which consist flours of maize, soybean, green gram and chickpea as the best.

Moisture sorption studies were conducted to determine the ideal safe level of moisture content for long storage. Sorption isotherm determination unit was prepared to determine the Brunner Emmet Teller (B.E.T.) monolayer value. Using the B.E.T. monolayer values, the optimal level of moisture in the product for long term storage at different temperatures of 30 °C and 40 °C were determined. The monolayer values for

the blend at 30 °C and 40 °C were determined 3.19 and 3.05 g moisture / 100G dry weight, respectively.

E2 245

Reduction of fat absorption in deep fried food products

Deep fried foods are becoming increasingly popular as fast foods. As a result, oil consumption has increased by many folds. This may pose a serious threat to health. Some water soluble hydrocolloids, such as starches, protein and food gums (i.e. ; Methyl Cellulose-MC and Hydroxy Propyl Methyl Cellulose-HPM C) have a film forming ability by physically and / or chemically interaction with batter systems, during thermal gelation. This is useful in reducing oil uptake in fried foods.

The objective of this study was to evaluate the effects of HPMC on reducing oil absorption and the effect on textural properties of some batter and crumb coated food products.

HPMC (METHOCEL-food gums supplied by the DOW Chemical Company) was applied to the batter system at low concentrations (~0.5%). The moisture content of fried and unfried products was determined by the oven method (AOACC-1990) and percentage oil absorption was determined by the soxhlet extraction method (AOAC-1990)> appearance and texture qualities were determined by hedonic sensory evaluation.

The moisture content shows that, experimental samples have significant water retention than standard (1%-3%) during frying. The thermal gel structure of METHOCEL gum was highly effective as an oil barrier. Products absorbed up to about 20%-25% less oil during frying. Sensory evaluation showed enhanced quality improvement (significant at 5% probability level) in the finished fried products.

E2 246

Antifungal properties of essential oils of cinnamon (*Cinnamomum zeylanicum*) against dermatophytes

Skin diseases caused by dermatophytes are common in Sri Lanka. *Tricophyton mentagrophytes*, *Tricophyton rubrum*, *Microsporum gypseum* and *Microsporum canis* are the major dermatophytic species found through clinical studies. The objective of this study was to evaluate the antidermatophytic properties of cinnamon essential oils.

Essential oils of bark and leaf were tested against human isolates of *T. mentagrophytes*, *T. rubrum*, *M. gypseum* and *M. canis*. Bioassay followed the agar-well diffusion assay and 70% ethanol was used as a control. Liquid dilution method was used to determine the Minimal Inhibitory Concentration (MIC).

Cinnamon bark oil showed 100% growth inhibition at 0.5% (v/v) concentration against all species tested. Leaf oil showed 100% activity at much higher concentration than bark oil, i.e. at 2.4% (v/V) concentration. The MIC of bark oil ranged between 0.4-0.9% and that of leaf oil ranged between 0.4-0.1% concentrations against all species tested. Gas Liquid Chromatographic analysis using a Supelcowax TM 10 Capillary column showed that eugenol is the major component of leaf oil and cinnamaldehyde in the bark oil. The standard compounds of cinnamaldehyde and eugenol also showed 100% growth inhibition at 0.5% and 2.4% (v/v), concentrations, respectively, against the dermatophytes tested. The MIC of eugenol cinnamaldehyde are also comparable to those of leaf and bark oils.

This study indicates that both cinnamon bark and leaf oils have potential lethal properties against the dermatophytes tested and could be used as promising ingredients in fungicidal preparations.

E2 247

Mosquitocidal and larvicidal activities of *Piper betel* essential oil

Malaria, Dengue and Filariasis are mosquito-borne infections, which have become major international public health concerns. WHO has estimated that 300-500 million cases of malaria occur annually killing more than 1 million people.

Essential oil hydrodistilled from *Piper betel* was tested for activity against mosquito species using two bioassays. The WHO standard method for adult mosquito susceptibility test was performed against *Culex quinquefasciatus*, *Anopheles tessellatus* and *Aedes aegypti* to determine its knock-down and mortality effects.

Filter paper impregnated with 2 ml betel oil (2% v/V) in ethanol was air dried and inserted into a chamber. 20 adult mosquitoes were put in to it and knocked down insects were counted, after 30 min. They were transferred to a non-treated chamber and after 24 h the number dead counted. 2% betel oil solution showed 100% knock-down and mortality against both *A. tessellatus* and *A. aegypti* while a 1% solution although weakly toxic to *A. tessellatus*, was sufficient to cause 100% Knock-down and mortality against *C. quinquefasciatus*.

The oil was also tested following WHO standard method for mosquito 3rd instar larvae against the larvae of *C. quinquefasciatus* and *A. tessellatus*. Betel oil solutions were introduced into beakers containing 25 larvae and % mortality at 1h, 3h, 20 h, 24 H, 48 calculated. 1% ethanol served as control.

125 ppm solution in ethanol showed 100% mortality against *A. tessellatus*. At 500 ppm it also showed 100% mortality and at 125 ppm, 98.67% mortality against *C. quinquefasciatus*. *P. betel* leaf oil has promising mosquitolarvicidal and mosquitocidal properties against the species tested.

E2 248

Insecticidal activities of *Piper betel* essential oil

Insect damage in stored grains and pulses is a major problem in countries where modern storage technologies are not introduced. Currently, measures are taken to control pest infestation in grain and dry food products by heavy use of gaseous and liquid insecticides. These pose health hazards and environmental contamination. Therefore, the attention is now focused on plants as a source of alternative insecticides. House fly is a major pathogenic vector in tropical countries. Ticks are important ectoparasites of livestock in tropics.

Essential oil of *Piper betel* was tested against some insect species, *Musca domestica* (House fly), *Sitophilus oryzae* (Rice weevil), *Callosobruchus sp.* (Pulse brochid) and tick (*Ixodes pacificus*) for their knock-down and mortality effects. (Ticks *wewa* supplied by Dr *kala Santha*) WHO standard method was employed for the bio assays.

A filter paper was impregnated with betel oil solution and air dried. The filter paper was placed in a conical chamber and house flies were introduced. For rice weevil, pulse beetle, and ticks, filter paper containing test solution was placed in a Petri dish. And insects were introduced. After 1h numbers of knocked-down insects were counted and after 24 h the mortality was calculated.

1% (v/v) betel oil solution in ethanol showed 100% knock-down and mortality against *M. domestica*, *S. oryzae* and *Callosobruchus sp.* 0.5% (v/v) solution was weakly toxic against *Callosobruchus sp.* while 2.5% (v/v) solution showed 100% mortality against ticks. This study showed that *P. betel* leaf oil has promising insecticidal properties against the species tested.

E2 249

Antioxidant properties of betel (*Piper betel*)

The antioxidants quench free radicals involved in the genesis of chronic and degenerative diseases of aging, including heart diseases and some cancers. Lipid oxidation is a major determinant in the deterioration of food. Toxic substances formed by lipid oxidation could develop some diseases. Antioxidants maintain food quality by reducing oxidative breakdown of lipids. Antioxidants such as BHA (Butylated Hydroxy Anisole) and BHT (Butylated Hydroxy Toluene) are used to control lipid oxidation in food. Consumers are concerned about the safety of synthetics. Thus use of natural antioxidants to enhance the oxidative stability of food lipids has received special attention.

Betel essential oil, common betel and Malabulath ethanolic extracts, betel hot water extract, green tea hot water extract, vitamin E, safrol and BHT were compared for antioxidant activities by Thio Barbituric Acid Reactive Substances (TBARS) assay based on egg yolk.

Test solutions (0.1 cm³) were added to tubes containing 0.5 cm³ egg yolk homogenate and pH value adjusted to 3.5 with 1 M NaOH. Then 1.5 cm³ of 0.8% TBA was added and adjusted final volume to 4 cm³ with deionised water. Samples were vortexed, left in a 95°

C water bath for 60 min. when the samples cooled. 5 cm³ of n-butanol was added, vortexed, centrifuged and absorbance of butanol layer was taken at λ 532 nm against n-butanol blank. Antioxidant index (AI) was calculated. Above procedure was followed for the control by using 0.1 of 8.1% (w/v) SDS instead of the test solution. Each experiment was done in triplicate.

Betel ethanolic extract has the highest AI (37.82) and safrol (24.34) the lowest. Antioxidant activity of betel ethanolic extract was significantly different ($p > 0.05$).

E2 251

Some studies on the carotenoids and flabelliferins of Palmyrah fruit pulp

Palmyrah (*Borassus flabellifer L*) fruit pulp (PFP) is an underutilized resource. The main strategy put forward for bulk use is alcoholic fermentation of PEP. Critical among integrated utilization of PFP are the pectins, carotenoids and bioactive steroidal saponins called flabelliferins. The objective of this study was to determine carotenoid profile and its heat stability under fermentation conditions and heat the stability of flabelliferins.

The carotenoids were separated by MPLC and analysed by UV- visible absorption spectra and identified through visible spectroscopic data in the literature and standards. The carotenoids found naturally were α carotene, lycopene, zeta carotene and β - zeacarotene. This is reported for the first time. Treatment with Bakers yeast and heating (100 ° C for 45 min, the conditions needed to recover alcoholic fermentation changed the structure of the natural carotenoids, forming oxygenated products of deeper colour of higher intensity.

Crude flabelliferins were isolated by dry cellulose chromatography and separated by TLC under the following conditions. (a) control (b) Heat at 75 °C for 6 hours (c) autoclaving (121 °C), 1050 Pa for min and (d) fermenting (c) with Bakers yeast. Results showed that only at 121 °C did flabelliferin profile change (but only slightly). Fermentation (18 h) resulted in a major change in flabelliferin profile including the appearance of the aglycone of the steroidal saponins.

Results indicate that fermentation of PFP will cause loss of carotenoids probably by oxygenation and also significant changes in flabelliferin profile, the latter probably by enzymes of yeast. This shows that if the flabelliferins and provitamin A activity of PFP are to be utilized they must be separated before the alcoholic fermentation step. The carotenoids however could be used as a food colour after fermentation.

E2 252

Separation, identification and quantification of carotenoids of two major varieties of *Carica papaya* grown in Sri Lanka using MPLC

The only study on papaya carotenoids has been done in Brazil. Papaya (*Carica papaya*) is one of the main fruits, which has been recommended for prevention of vitamin A deficiency in Sri Lanka. Carotenoids are important as natural antioxidant. *Carica papaya*

fruits from two major varieties found in Sri Lanka were analysed of carotenoids by both Medium Pressure Liquid Chromatography (MPLC) and Reverse Phase High-Performance Liquid Chromatography (RP-HPLC). Methanolic extracts of fresh papaya (30g) partitioned into hexane and applied to a MPLC silica gel column at 15 mL/ of 0%, 3.125%, 6.25%, 12.5%, 25% and 50% CH₂Cl₂ in hexane. The separated carotenoids were identified and quantified using characteristic visible spectra (Table 1). RP_HPLC was used to confirm the purity and identification of carotenoids.

Table 1: Major provitamin A carotenoids of (*Carica papaya*) Fruits pupl

Papaya (fruit pulp) carotenoids	Dry weight (µg/100g)	
	Common, orange	Solo (red fleshed)
Provitamin A carotenoids		
β - carotene	0.66	3.74
β - cryptoxanthin	9.14	8.64
β - carotene-5, 6-epoxide	-	1.34
Non provitamin A carotenoids		
Lycopene	-	6.13
-carotene	8.8	7.03

- not detected, Detection limit 0.08 ng/g

Solo (red fleshed) fruits contained a higher percentage of provitamin A carotenoids than common orange variety. Specifically β-carotene content was higher in the Solo variety.

E2 253

Partial purification and characterization of inhibitors of aspartic proteinase from stem bark of *Spondias plannata*

Natural inhibitors of aspartic proteinases are very important as they are identified as likely therapeutic target point in the control of ADIS and malaria. Isolation of inhibitory activity from stem bark of *S. pinnata* was reported earlier. In this study potential inhibitors of aspartic proteinases were partially purified and characterized.

Fresh stem bark samples were ground and extracts were prepared in distilled water at 4 °C it shows 76/mL inhibitory activity for 60 mg/mL of crude protein extract. A crude extract was applied to a column of DEAE-52, equilibrated with 0.02M phosphate buffer at pH 7, and the bound material was eluted with a linear gradient of 0-1M NaCl in the same buffer. Inhibitory activity was detected in two peaks eluted at 0.02 M (a minor, 45% inhibitory activity). Fractions of the two peaks were collected separately and concentrated with ammonium sulphate at 80% saturation. Seventy- seven percentages and sixty-five percentage inhibitory activities were recovered in the pellets of the major and minor constituents respectively. The resulting pellets were dissolved in 0.02M phosphate buffer at pH 7, separately applied into Sephadex G-75. Major and minor inhibitory activities were eluted at 230 and 180 mL from Sephadex G-75 column and

their approximate molecular weights were 10 KD and 18 KD respectively. Gel filtered sample was further purified with Q-Sepharose chromatography at pH 7. Purified major inhibitor was analyzed on SDS polyacrylamide gel electrophoresis (15%) with silver staining and a single band appeared at 10kD. Inhibitory activity of the major peak (partially purified, protein concentration of 0.2 mg/mL) is 30.5/ mL. Inhibitory activity for the partially purified minor inhibitor is 33.5/ mL for the same protein concentration.

pH stability of the inhibitor was investigated by incubating the crude extract at different pH values (pH2-12) at 4 °C, 26 °C and 37 °C for two months and determining the remaining inhibitory activity. Inhibitor was stable from pH 2 to 7 at temperatures 4 °C to 37 °C, but at alkaline pH the inhibitory activity decreases. When the crude extracts made in pH 2, 5, 7 buffers were incubated at -20 to 80 °C, inhibitory activity didn't change significantly, suggesting higher thermal stability of inhibitors.

E2 254

Comparative stability of minor acid proteinase of *Nepenthes distillatoria* L. at different temperatures and pH levels

Isolation, purification procedure, and some enzymatic properties of the minor acid proteinase from the pitcher of *Nepenthes distillatoria* were reported previously. In this study the stability of the minor acid proteinase (NMP) was investigated at different temperatures and pHs.

The NMP was purified from crude juice of *Nepenthes* pitcher by elution through successive chromatographic of DEAE cellulose, sephacryl S200, pepstatin-sepharose and mono Q to a homogenous form or a single band at the SDS PAGE. The purified NMP and porcine pepsin in pH 3.0 buffer were incubated at different temperatures 4 to 70 °C NMP and porcine pepsin in buffers at different pH 3-10 were incubated separately at 40 °C and 37 °C for 7 and 30 days in pH 5.0 were 95 and 89, in pH 9.0 were 92 and 80 and in pH 10 were 86 and 60 respectively.

These results clearly demonstrate the comparable stability of NMP at higher and lower temperatures 40-37 °C as reported for *Nepenthes* major acid proteinase. Higher stability of NMP was observed at pH 3.0 (optimum pH) compared to porcine pepsin suggesting the absence of autodigestion of the purified enzyme at optimum pH. The high thermal stability and the absence of autocatalytic digestion of the minor proteinase show wide applicability in medicine, agriculture, and industry.

E2 255

Studies of essential oil based anti - mosquito cream

Mosquito born diseases are still a major problem in tropics. Commercial mosquito repellents mainly contain high dosage of diethyltoluamide and its derivatives. Recent studies highlighted that these synthetics have adverse effects on humans. Further to our studies in finding alternative methods for mosquito control, selected essential oils were assayed against vector mosquitoes with the aim of developing an anti-mosquito cream.

Cinnamon leaf, citronella neem and citral essential oils were tested for knockdown and mortality against *Culex quinquefasciatus*, *Anopheles tessellates* and *Aedes aegypti*. The bioassay followed the WHO standard method for adult mosquito susceptibility test. These essential oils were incorporated in to standard body formulation and the efficacy was evaluated in the field using human volunteers.

In susceptibility test, cinnamon leaf oil (2%, w/v) showed 100% knockdown and mortality against *A. tessellates* and *C. quinquefasciatus* but only knockdown (100%) was observed against *A. aegypti*. Citronella oil (2% and 1% w/v) was toxic (100% knockdown and mortality) only against *A. tessellates*. Neem oil (2%, w/v) had only 73.3% mortality against *A. tessellates* and *A. aegypti*. Citral (2%, w/v) showed 100% knockdown against all three tested and mortalities were above 77.0%. Results of field studies revealed that all four formulations have promising repellent activity and provided more than 80% protection against mosquitoes for 5h. Best protection was observed for formulation, containing a mixture of citronella and neem oil.

This study indicates that these repellents could be used as potential protective agents against mosquitoes.

E2 256

Quantitative assessment of arsenic adsorption on mineral - water interface

Concentration of arsenic in ground water sources in South Asian countries exceeds WHO limits. Industrial discharges application of arsenical insecticides and pesticides can elevate the levels of arsenic in soil. In this investigation AsO_3^{3-} and AsO_4^{3-} adsorption on common minerals such as gibbsite and kaolinite was studied as a function of pH and ionic strength (0.1, 0.01, 0.001 mol dm^{-3} NaNO_3). Hydride generation atomic absorption spectrophotometry was employed for direct determination of AsO_3^{3-} and AsO_4^{3-} . Active surface areas of the two minerals were determined by constructing a fluoride adsorption isotherm. It was revealed that, percentage adsorption of AsO_3^{3-} and AsO_4^{3-} were low (1- 85%) on gibbsite over the pH range of 4 - (when compared to kaolinite (60-95%). Active surface area in gibbsite was 13.467 $\text{m}^2 \text{g}^{-1}$ and in Kaolinite was 17.192 $\text{m}^2 \text{g}^{-1}$ according to this study.

The lowest ionic strength shows the maximum adsorption for AsO_3^{3-} and AsO_4^{3-} on both minerals. Percentage AsO_3^{3-} adsorption on gibbsite was not significant and observed a maximum of 15% when the initial AsO_3^{3-} concentration is 0.2669 $\mu\text{mol dm}^{-3}$ in acidic medium (pH 4 - 4.5). Percentage AsO_3^{3-} adsorption on kaolinite was significant and low between pH 7.5 - 9.5. When the initial concentration is increased in kaolinite suspension, Percentage AsO_3^{3-} adsorption was decreased but observed to be independent from pH and ionic strength. AsO_3^{3-} adsorption on both minerals were observed a maximum adsorption at pH 4 -7 and minimum when pH is higher than 7.

E2 257

Reproductive alkylative decarboxylation of amino acids with the retention of the optical activity; New approach to α -amino compounds

Highly stereoselective synthesis of α -amino compounds via radical process is presented. α -Amino compounds are important to modify the peptide backbone by replacing amino end of the peptide. Also α -amino compounds are important intermediates for the synthesis of N- containing pharmacologically active compounds.

Synthesis of α -amino compounds via reductive and alkylative decarboxylation of isoindolinone derivative of phenylalanine and L-serin is presented. The synthesis via acyclic system derived from phenylalanine was not stereoselective while the synthesis via cyclic system derived from phenylalanine was not stereoselective while the synthesis via cyclic system derived from L-serin was highly selective. The nature of the radical traps has a strong influence on the stereochemical outcome of the reactions. Nucleophilic radical traps such as Bu_3SnD showed *exo* selectivity while electrophilic radical traps such as [2-(methoxycarbonyl) propenyltributylstannane showed *endo* selectivity. The stereo electronic factor of the tricyclic. Enhancement of the diastereoselectivity with the temperature was observed for both the radical allylation and radical deuterization. The entropy of the activation plays the role for this stereochemical outcome at higher temperature.

E2 258

Synthesis of the aggregation pheromone of Coconut Rhinoceros Beetle from cane sugar

The rhinoceros beetle, *Oryctes rhinoceros* L. is an important pest of coconut in all coconut growing countries including Sri Lanka. Ethyl 4-methyloctanoate has been identified as an aggregation pheromone of coconut rhinoceros beetle.

The methods available for the synthesis of ethyl 4-oxopentanoic are laborious and expensive. We were interested in developing a synthesis of the pheromone, which could be conveniently carried out using cheap raw materials.

The aggregation pheromone was synthesized using cane sugar as starting material. Cane sugar was treated with concentrated hydrochloric acid to give 4-oxopentanoic acid (laevulinic acid) in 20% yield. Cyclisation of glucose formed from the hydrolysis of cane sugar yields furan derivatives whose break up gives formic acid and laevulinic acid. Fischer-Speier esterification of laevulinic acid gave ethyl laevulinate in 90% yield.

Wittig olefination of ethyl laevulinate with triphenylphosphoniumbutylide gave the ethyl 4-methyl-4-octenoate in 12% yield. In generating the ylide, some of the KH used as base reacted with ethyl levulinate to give cyclopentane-1,3-dione as a side product, lowering the yield. Hydrogenation of the alkene with hydrogen and palladium-carbon catalyst gave the pheromone in racemic form can be used in plant protection without resolution.

