Physical Sciences

Population Dose Distribution due to Soil Radioactivity in Designated and Undesignated Waste Dumpsites in the City of Lagos, Nigeria
Ebenezer Babatope Fawey and Ayo Babalola 175

Paleocurrent Analysis of the Early Pliocene Nagri Formation, Southern Kohat Plateau, Sub Himalayas, Pakistan
Abdur Rauf Nizami, Muhammad Khaliq, Syed Muhammad Kamran, Jamsheed Khan, Shahzad Anwar and H. Hafeez-ur-Rehman 180

Modelling Water Age as Surrogate for Water Quality in a Distribution System
Osadolor Christopher Izinyon and Benedict Ukeje Anyata 187

Characteristic Trend of Persistent Organochlorine Contamination in Imported Red Kidney Beans
Alia Bano Munshi, Fayyaz Ahmed Ansari, Hina Ahsan Siddiqi, Uzma Rashid and Tanzil Haider Usmani 192

Short Communication

Development and Evaluation of Combined Wavelet Based Palmprint Identification System
Atif Bin Mansoor, Hassan Masood, Mustafa Mumtaz and Shoaib Ahmad Khan 198

Biological Sciences

Biology of Parasitoid *Aganaspis daci* (Weld) (Hymenoptera: Eucolillidae)
Saiqa Andleeb, Muhammad Shafiq Shahid and Riaz Mehmood 201

N-Acetyltransferase 2 (NAT2) in Tunisian Population: Correlation Between Acetylation Phenotype and Genotype
Emna Gaies, Maher Kharrat, Nadia Jebabli, Basma Ben Njima, Anis Klouz, Habiba Chaabouni and Mohamed Lakhal 205

Bionomics of Rose Aphids and their Natural Enemies
Muhammad Naeeem, Abrar Ali Mohsan, Ata-ul-Mohsin and Nadeem Akhtar Abbassi 212

Effect of Storage Temperature and Time on the Vitamin C Contents of Selected Fruits and Vegetables
Shamma Firdous, Naheed Abdullah, Alim-un-Nisa and Nusrat Ejaz 218
Technology

An Experimental Study on Regulated and Unregulated Pollutants from a Spark Ignition Car Fuelled on Liquefied Petroleum Gas and Gasoline
Asad Naeem Shah, G. E. Yun-shan, WANG Jun-fang, TAN Jian-wei and Syed Asad Raza Gardezi 223

A New Process for the Synthesis of Naphthalene Based Tanning Agent
Sarwat Jahan Mahboob, Muhammad Ishaq Subhopoto, Rajkumar Dewani, Muhammad Kashif Pervez and Farrukh Nazir 230
Physical Sciences

Population Dose Distribution due to Soil Radioactivity in Designated and Undesignated Waste Dumpsites in the City of Lagos Nigeria

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Abstract. The radionuclide contents in soil from waste dumpsites in the city of Lagos were determined. The radioactivity concentration level due to $^{40}$K, $^{226}$Ra and $^{228}$Th in the soil were determined using gamma-ray spectrometry system. The average radioactivity level obtained was 1134 Bq/kg (designated dumpsite) and 1045 Bq/kg (undesignated) for $^{40}$K, 43 Bq/kg (designated) and 85 Bq/kg (undesignated dumpsite) for $^{226}$Ra, 34 Bq/kg (designated) and 38 Bq/kg (undesignated dumpsite) for $^{228}$Th. No artificial radionuclide was detected in any of the samples. The average outdoor effective dose rate due to gamma exposure was calculated as 0.11 mSv/y at designated and 0.13 mSv/y at undesignated dumpsites. These values are much smaller than 1 mSv/y, the limit recommended for the member of the public by United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR).

Keywords: soil, dumpsites, spectrometry, radionuclide, Lagos, Nigeria

Introduction

Main sources of wastes in cities are garbage from households, hotels and restaurants, refuses from offices and business establishments, hospitals and medical clinics; rejects from various leather, rubber, foam, plastic and textile, metallic and automobiles industries, left overs and discarded products from vegetable and fruit markets and slaughter houses (Rajiv, 2008). These broad sources can be divided as follows:

a Domestic wastes from the households and personal human excreta.
b Commercial wastes from the consumer stores, warehouses, offices and institutions.
c Industrial wastes from the manufacturing and processing industries.
d Biomedical wastes from hospitals and public health institutions (Isinkaye and Faweya, 2006; Faweya, 2004).

Contribution of natural radionuclides in surface soil to the overall background radiation burden of an environment has been established (UNSCEAR, 1988). This has not been established in soil from waste dumpsites. However, the contribution, distribution and availability of these radionuclides depend mainly on geological processes, atmospheric conditions and human activities (Wollenberg and Smith, 1990). Apart from the primordial sources of radionuclides, anthropogenic sources have been a major source of concern for radioprotection programmes (Arogunjo, 2007). Phenomena like weapon test, medical researches, mining, industrialization, agriculture, transportation, education, construction, trade, commerce as well as nutrition have disturbed the whole environmental system through increase in the radiation burden in the environment (Arogunjo, 2007; Eddy et al., 2006, Isinkaye and Faweya, 2006). The possible radon built up in indoor environment especially when radionuclide enriched soil is used as building materials call for detailed environment monitoring.

Solid waste problem has received attention by many environmental scientists and many studies have been carried out on solid waste. Most of these studies are aimed at evaluating the potential problems associated with solid wastes and their impact on the environment (Jibiri and Adewuyi, 2008; Gilbert, 1987) but not on soil. Despite the best attempts at waste avoidance, reduction, re-use and recovery (recycling, composting and energy recovery) landfill and waste disposal sites are still used for ultimate disposal of refuse and incineration residues, world-wide (Waite, 1995). Hazardous waste can cause pollution, damage to health, death, offensive odour and increase in the ambient temperature (Eddy et al., 2006). The overall effect is environmental degradation.

In many parts of Nigeria, major materials used in construction at both urban and rural locations are made from the soil (Ademola and Farai, 2006) and most urban dwellers spend almost 78% of their time indoor (Arogunjo et al., 2004). Determining the potency of wastes on soil through soil analysis will be useful in providing the information required for developing the techniques for tackling the problem of soil pollutants such as wastes. On the other hand, data on the radioactivity levels in soil from dumpsites will help us to
Paleocurrent Analysis of the Early Pliocene Nagri Formation, Southern Kohat Plateau, Sub Himalayas, Pakistan

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Abstract: The present study is based on the paleocurrent analysis of sandstone of the Early Pliocene Nagri Formation, exposed in the southern limb of Shahbazgarh Syncline, Shahbazgarh area, southern Kohat Plateau, sub Himalayas, Pakistan. The readings of paleocurrents were taken from the cross beds of the sandstone by following a traverse of one and a half kilometer along the strike of formation. The analysis of data and its graphical presentation indicated that the orientation of paleostreams and direction of their paleocurrents was north 30° east at the time of deposition of early pliocene Nagri formation. The paleo position of the Indo-Pakistani plate was in the north-east orientation during the pliocene. Based on the present study, it is concluded that the Himalayan Hinterland was the probable sediment source of the Nagri formation in the study area and the sediments were transported through paleostreams flowing in the north-east south-west orientation.

Keywords: paleocurrent Nagri formation, southern plateau, Pakistan, Kohat plateau, sandstone

Introduction

The study area lies in the southern Kohat Plateau, sub Himalayas, Pakistan. This part of plateau is occupied by a complex assemblage of rocks, sandstones, shales, limestones, gypsum and salt of tertiary system (Meissner et al., 1974). The paleocurrent analysis and paleostream orientation have been carried out to decipher the direction of flow of paleo channels along with gradient by measuring the attributes of cross beds of sandstone of the early pliocene Nagri formation from the Shahbazgarh area, southern Kohat Plateau, Pakistan. The formation is exposed in the southern flank of the Shahbazgarh syncline. The Shahbazgarh structure is doubly plunging syncline; southern flank of the syncline is east-west trending and is gently dipping. Detailed field observation manifested that the Nagri Formation is widely exposed in most of the southern part of this syncline. The study area lies in the Kohat quadrangle and forms a part of the southern Kohat plateau (Fig. 1). The Shahbazgarh area is located at about 25 km NE of Karak town, about 65 km south of Kohat city and lies within the longitudes 71° 11’ E to 71° 15’ E and Latitudes 33° 12’ N to 33° 15’ N (Survey of Pakistan Toposheet No. 38 O/4). Indus Highway is the main and easy access to the study area.

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Fig. 1. The location of Shahbazgarh area, southern Kohat Plateau, sub Himalayas, Pakistan.
Modelling Water Age as Surrogate for Water Quality in a Distribution System

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Abstract. Extended period simulation study of the water quality was made through construction of a waterCAD model of the existing Ikpoba Hill water distribution system to simulate the age of water as surrogate for water quality throughout the network. The average age of water in the network fluctuated between 0.5 and 4 h during 24 h; applying literature values of 0.00007/min and 0.00003/min for chlorine decay coefficients to the most critical time (4 h), it was indicated that the chlorine residual could degrade in the network by 1-2% only. This suggests that areas presently served by the network are not likely to suffer water quality problems on account of travel time. However, considering the age of the network, adequate attention should be paid to the possible unaccounted reasons for water problems in a network for maintaining the water quality integrity of the network viz., management of metering, billing and collection, and illegal connections and theft which create higher chances of drinking water contamination and outbreak of water-borne diseases.

Keywords: extended period simulation, water age, calibration, waterCAD

Introduction

The safety of drinking water depends on a number of factors including quality of source water, effectiveness of treatment and integrity of the distribution system that transports water to consumers (Stevens et al., 2004). In most cities of the world, there have been years of neglected maintenance of water storage, treatment and distribution system leading to deterioration in these water infrastructures thereby threatening the quality and reliability of water services. These deterioration processes are more severe in developing countries due to ageing of the systems, poor construction practices, little or no maintenance and rehabilitation activities due to limited financial resources, and operation at higher capacities than permissible by the design.

Hence, the quality of treated drinking water may vary considerably both from system to system and within a system as a result of deterioration after water leaves the treatment plant and comes in contact with the distribution piping thereby affecting the quality of water available to the end user (Hughes, 2002). This has necessitated the global emphasis on conforming to the water quality standards at the point of use (consumer taps) rather than at the source treatment plant (USEPA, 2005); the scenario has thus shifted the focus to water quality within the distribution system. This is why a disinfectant is added typically at the end of water treatment at plant to provide some protection against microbial growth and limit the effects of contamination while the water is being conveyed through the distribution system.

A disinfectant residual is normally consumed by exposed surfaces of materials in the network, deposits in the pipes, microorganisms and chemical species in the water. It may also be consumed by contaminants entering the network. Consequently, at the end of long networks or networks with long transit times, the disinfectant residual concentration can be zero and in this circumstance many water utilities consider it prudent to maintain adequate residual to the extremities of the system by ensuring a high residual concentration as water leaves the treatment works or by establishing booster or relay disinfection station(s). However, the earlier method may mean that consumers immediately downstream of treatment works receive concentration of disinfectant that is undesirable because of taste and odour.

The water quality within the distribution system (at the consumer taps) can be measured by sampling for bacteria or positive coliforms, chlorine residual, discolouration, taste, odour and other indicators (Hughes, 2002). Each of these attributes or surrogate values can be correlated to determine the effectiveness of the distribution system in meeting water quality performance expectations. Since, water quality sampling can be difficult on a routine basis and very expensive or cost prohibitive exercise to sample in sufficient density to assess the whole of a network, the need for computer based
Characteristic Trend of Persistent Organochlorine Contamination in Imported Red Kidney Beans

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Abstract. Residual level of persistent organochlorines (OC) such as ΣHCH, dieldrin and endrin were measured in red kidney bean samples from consignments imported from Ethiopia during 2004-2006. OCs, mainly ΣDDT and ΣHCH along with breakdown products (>65%), were detected in 80% of the samples analyzed and the highest concentration was 37 ng/g. In 2004, 20% and in 2006, 40% samples were found contaminated with detectable levels of OCs. Beta-HCH, however, was not detected in any sample in 2004 and HCB, in 2005. In 2004, average residual concentration of OCs in individual sample was 0.03-0.180 mg/kg and in 2005, 0.004-0.09 mg/kg.

Keywords: red kidney bean, organochlorine pesticides, Ethiopia, GC/ECD analysis

Introduction
Pakistan imports red kidney bean (RKB) from developing countries such as Ethiopia for human consumption as a source of protein, carbohydrates, dietary fiber, calcium, magnesium, zinc, iron, copper, phosphorus, potassium and vitamins.

Pakistan Export Promotion Bureau has implemented WTO standards for the import and export of agricultural products. Accordingly, pesticide residues are not permitted beyond the permissible limits of 0.1 ppm for ΣOCs including DDT. Pakistan Export Promotion Bureau has issued a list of pesticides (Table 1) which are banned in Pakistan (Mazari, 2005).

In the present work, 50 samples of red kidney bean (RKB) were screened for a total of 37 pesticides and the results were compared with the standard values. Calibration curves of working standards were used to evaluate the linearity of the gas chromatograph response each day of analysis and pesticide residues were quantified based on these external standards.

Materials and Methods
The analytical method was validated and based on AOAC (2005).

Chemicals. High purity pesticide grade solvents (hexane, dichloromethane) and certified ACS reagents were used as received, but reagent grade acetone and hexane were distilled and evaluated by GC. Florisil was activated at 675 °C for one hour and deactivated with few drops of water with gentle shaking before use.

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Pesticide standards. A mixture of 37 pesticide standards was purchased from Dr. Ehrenstorfer’s Laboratory, Germany and certified reference material (IAEA-406) from International Atomic Energy Agency. Stock solutions of pesticides (Table 2) were prepared using pesticide grade solvents.
Development and Evaluation of Combined Wavelet Based Palmprint Identification System

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Abstract. Palmprint based identification is fairly recent biometric modality gaining popularity due to its traits like user comfort, reliability and easy acquisition. A wavelet based palmprint identification system has been proposed. Euclidean distance based classification is performed using Biorthogonal, Symlet and Discrete Meyer wavelets on 500 palmprints obtained from 50 users for individual and combined features, employing locally developed acquisition platform. An equal error rate (EER) of 0.0217 and genuine acceptance rate (GAR) of 97.12% demonstrate the effectiveness of the combined system.

Keywords: biometrics, palmprint, wavelet transform, distance transform

Palmprint based identification is fast gaining popularity due to user acceptance, ease of acquisition, reliability and uniqueness (Kong et al., 2009). Scanners and pegged systems are used for acquiring the palmprints (Zhang et al., 2004). Scanners are hygienically susceptible while systems with pegs are not user friendly. Different wavelet transforms and their combination for palmprint identification, through developing a user friendly peg free system are being reported here (Fig. 1a).

The system comprises of an enclosed black box, with ring shaped lighting tube for uniform illumination and two flat plates, 14 cm apart. The camera and the light source are fixed on the upper plate while the bottom plate is used to place the hand for image acquisition. As dataset, 10 images from 50 male individuals were collected, resulting in total of 500 images. The age distribution of individuals was between 22 to 56 years, with 80% between 22 to 25 years. SONY DSC W-35 cyber shot camera was utilized for imaging.

The captured palmprint colour images having RGB (red, green, blue) components (Kumar and Zhang, 2006) were changed to hue saturation intensity (HSI) parameters and analyzed by its intensity values (I). The obtained gray level images were normalized and then hysteresis was thresholded to obtain a binarized image. Rotational alignment, incorporated using the second order moments, helped analyze the elongation and eccentricity. Second order statistical moments gave the parameters of best fitting ellipse (Kumar and Zhang, 2006). Ratios between eigen values helped examine the shape whereas direction of elongation was evaluated using the direction of the eigenvector corresponding to the highest eigen value. Subsequently, the offset (θ) between the normal axis and the major axis of the ellipse was calculated (Fig. 1b). The palmprint was then vertically aligned and further processed to remove noise in the binary image and to evaluate the centre of palmprint.

Five images of each user were utilized for training while the rest five were used for validation. Wavelet families namely Biorthogonal 3.9, Symlet 8 and Demeyer 5 were used to extract the textural information of palmprint images. ROI decomposed into three scales using each wavelet type, and resultantly ten directional details were obtained for each wavelet. The approximation level was ignored and the directional energy in nine detailed levels was calculated. The directional energy in each level was normalized to reduce variation in the gray levels of palmprint images due to illumination variance (Mumtaz et al., 2009; Masood et al., 2008). The energy values computed from each block for the three wavelet types are concatenated to form a feature vector of length 27 for an individual palmprint. The normalized energy of the region of interest (ROI) image block B associated with subband ‘a’ is given by the formula:

\[ E_a = \sum_{u,v \in B} | f_a(u,v) | \]

where, \( u \) and \( v \) are the coordinates of the pixel in consideration and summation indicates the sum of all normalized energies of the particular ROI.

The normalized energy is given as:

\[ E = \frac{\sum_{a=1}^{3} E_a}{\sum_{a=1}^{3} E_a} \]

where ‘n’ is the total number of blocks present in the image.
Biology of Parasitoid Aganaspis daci (Weld) (Hymenoptera: Eucoilidae)

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Abstract. In view of the importance of *Aganaspis daci* (Trybliographa daci) and *Diachaishmimorpha longicaudata* parasitoids in the use of fruit fly control, biology of *A. daci* was studied under controlled temperature and humidity conditions. *A. daci* was found to be more dominant and easy to use as a biological control agent than the *D. longicaudata*.

Keywords: biological control, fruit fly, *Aganaspis daci*, *Trybliographa daci*, *Bactrocera dorsalis*

Introduction

Fruit flies attack fruit trees and vegetables and not only reduce their yield but also affect the quality. Damage to fruits cause loss of about 7 billion rupees to farmers annually in Pakistan besides the losses to traders, retailers and exporters. The host fruits and vegetables attacked by fruit flies like *Bactrocera zonata* and *Bactrocera dorsalis* include guava, plum, peach, apricot, loquat, bitter gourd, citrus, mango, sponge gourd and pear. Some fruits such as guava were severely damaged by fruit flies causing up to 100% loss of harvested fruits at Huripur, Kohat. (Syed et al., 1970; CIBC, 1972) and 76.5 % at Bannu (Marwat et al., 1992). Some of the American species like *A. pelleranoi* (Brèthes) and *Aganaspis nordlanderi* (Wharton) can be easily differentiated from the Asian species group (*A. daci* (Weld), *A. contracta* (Lin), *A. ocellata* (Lin), and *A. major* (Lin)) by several morphological features such as the shape of the scutellar disc, female antennae, absence of setae on the eyes and lack of the median depression in the metapleuron (Wharton et al., 1998). Fruit flies are biological controlled by these specific parasitoids.

Profusion of fruit flies. *Bactrocera zonata* and *Bactrocera dorsalis* are serious pests of soft fruits and affect most of economically important fruits. Syed et al. (1970) reported that *B. dorsalis* is dominant in the foot hills of Rawalpindi, Haripur and common in Peshawar valley but rare in Saaidu, Muzafarabad and Abbottabad. In recent studies, it was found that the large numbers of *B. dorsalis* males were caught almost throughout by the methyl eugenol baited troop in Rawalpindi Islamabad by PARC-CIBC (1987). On the other hand *B. zonata* is dominant in the plains, semi deserts, coastal and sub coastal areas, and lower altitudes in South western hills whereas rare in the foot hills of Rawalpindi and Peshawar valley (Syed et al., 1970).

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Control strategies for fruit flies. Fruit flies are controlled by different techniques such as male annihilation technique (MAT) with methyl eugenol baited traps. It has been very successful in eradication of oriental fruit fly from Rota Island, Amami Island and Okinawa Island. Sterile insect technique (SIT) was also used to eradicate *Bactrocera dorsalis* from the Ogasawara Islands and *Bactrocera cucurbitae* from Kume Island, Japan (Shiga, 1989).

Biological control through parasitoids (natural enemies). In previous studies it was demonstrated that these fruit flies are biologically controlled by natural enemies like *A. daci* and *D. longicaudata*. The present studies on parasite have been carried out in the field as well as in the laboratory of CAB International, Rawalpindi. *D. longicaudata* is wide spread in Pakistan with parasitism rate exceeding 36% on *B. dorsalis* in the foot hills whereas *Aganaspis daci* with *D. longicaudata* parasitized more than 44 % on *Bactrocera zonata* in unsprayed orchards in the plains (CIBC, 1972).

*A. daci* (originally described as *Trybliographa daci* Weld), was first collected in Malaysia and Borneo, and introduced into Hawaii as a potential biocontrol agent for *B. dorsalis* (Hendel) (Clausen et al., 1965). This species is the only one of the four Asian species for which hosts have been recorded. *A. daci* was introduced in Florida (USA) where it established successfully on *Anastrepha suspense* (Loew), although in low numbers (Baranowski et al., 1993). It was released in Mexico (Jiménez-Jiménez, 1956), and Costa Rica (Wharton et al., 1981) for biological control of *Anastrepha* spp., but its establishment in both countries is doubtful (Wharton et al., 1998). In a cladistic analysis of the subfamily Eucoiline (Fontal-Cazalla et al., 2002), the genus *Aganaspis* was included in the “Neotropical grade”, an unresolved group of Neotropical taxa representing a morphological transition between the Zaeucoila group of genera and the 5 genus groups of higher eucoilines (The *Ganaspis*
N-Acetyltransferase 2 (NAT2) in Tunisian Population: Correlation Between Acetylation Phenotype and Genotype

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Abstract. One hundred tuberculous patients were studied during 2004-2005 to determine acetylation phenotype, frequent mutations of NAT2 gene and to compare acetylation phenotype with NAT2 genotype in Tunisian population. Acetylation phenotype was determined by determination of acetylation index. Five mutations of NAT2 gene were evaluated by PCR/RFLP. Results show bimodal distribution of acetylation SA and RA phenotype, 75% and 25% and genotype 56% and 44%, respectively. Ten NAT2 alleles were found, NAT2*4 being the major one. Thirty-two different genotypes were found (9 RA and 23 SA). The major one was NAT2*6 B/NAT2*4. The concordance value was 79%. A good sensibility (98.2%) of acetylation test for SA detection was found. Thus, acetylation phenotype in SA is predicted with poor error risk.

Keywords: Tunisian population, phenotype, genotype, N-acetyltransferase 2, polymorphism

Introduction
The acetylation polymorphism was discovered over 40 years ago, following isoniazid toxicity differences observed in patients treated for tuberculosis (Hughes et al., 1954). Subsequently, the differences in isoniazid toxicity were attributed to genetic variability in N-acetyltransferases which are important for transformation of many drugs (isoniazid, dapsone, procainamide, sulfamethazine) (Weber, 1987) and carcinogens (2-naphthylamine, 2-aminofluorene, 4-aminobiphenyl and benzidine) (Hein et al., 1992; Grant et al., 1991).

There are two functional human arylamine N-acetyltransferases. The first is NAT1 which was originally thought to be monomorphic (Zhao et al., 1998; Blum et al., 1990), the second is polymorphic NAT2 (Grant et al., 1989).

In humans, NAT1, NAT2 and a pseudogene N-acetyltransferase (NATP) are located on chromosome 8p213 (Sim et al., 2008; Hickman et al., 1994; Blum et al., 1990) and are produced on single intronless protein coding exons of 870 bp (Graf et al., 1992, Grant et al., 1991). Gene expression is autosomal and codominant (Blum et al., 1990, Vincent-Viry et al., 1994).

In human population, 26 alleles have been reported for NAT2 (Gross et al., 1999). Several studies (Vatsis et al., 1995; Bell et al., 1993; Deguchi et al., 1990; Blum et al., 1990) admitted that NAT2 contains seven different mutations: five mutations led to amino acid changes and two exerted no influence on the amino acid sequence.

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Generally mutant alleles are known to show slow acetylation activity (Hein et al., 1994). A slow acetylator phenotype is frequently observed in subjects with two germ line copies of alleles containing any of several single nucleotide substitutions. Rapid acetylators have at least one wild type NAT2*4 (Vatsis et al., 1995). Distinction between rapid acetylator and slow ones can be easily determined using phenotypic tests by administration of a probe drug as isoniazid, dapsone, caffeine, sulfamethazine (Kita et al., 2001; Attitallah et al., 2000; Meisel et al., 1997; Queiroz et al., 1997; Grant et al., 1984). The aim of this study was to determine the acetylation phenotype, to identify the frequent mutations of the NAT2 gene and to compare acetylation phenotype with NAT2 genotype in a Tunisian population.

Materials and Methods
The prospective study (July 2004 - April 2005) included 100 tuberculosis patients (suffering for pulmonary tuberculosis, lymph nodes tuberculosis, urogenital tuberculosis, cerebral tuberculosis and peritoneal tuberculosis).

Determination of acetylation phenotype. The acetylation phenotype was determined in 100 subjects by determination of acetylation index, 3 h after isoniazid administration according to Vivien method (Vivien et al., 1973).

Blood samples were collected 3 h after administration of isoniazid (5 mg/kg). For 2 mL of serum saturated with 2 g ammonium sulphate, 3 methybutanol and trichloroacetic acid were added. Then the mixture was shaken and centrifuged.
Bionomics of Rose Aphids and their Natural Enemies


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Abstract. Aphids and their natural enemies were enumerated on 11 rose cultivars at weekly basis during the year 2005, at PMAS-Arid Agriculture University, Rawalpindi, Pakistan. Rose plants were found to be colonized by rose aphid (Macrosiphum pachysiphon), potato aphid (Macrosiphum euphorbiae, Rhodobium porosum), 7-spotted lady bird beetle (Coccinella septempunctata), syrphid fly (Episyrphis balteatus) and Aphidius rosae. Significantly, greater aphid populations were observed on the cultivar Blumonia than on other varieties. Higher percentage of parasitism and predation were observed on the cultivars, Good News and Golden Master, respectively.

Keywords: bionomics, rose aphids, predators, parasitoids, rose cultivars

Introduction

Roses (Rosa indica Linn.) are popular in landscaping but are attacked by several insect pests, including rose aphids and the large rose sawfly. Aphids can cause defoliation of the plant and deformation of buds if populations are left unchecked (Becker, 1997). Rose aphids Macrosiphum rosae L. and Macrosiphum rosaeformis, potato aphid Macrosiphum euphorbiae (Thomas), cotton aphid Aphis gossypii are serious pests of rose plants. Thirty-one species of aphids were reported on Rosa species (Blackman and Eastop, 1984). Aphids reproduce either sexually or parthenogenetically (Becker, 1997).

Both biotic and abiotic factors have the potential to influence the aphid population dynamics (Caralyn and Hunter, 2007). Predators including several species of coccinellids and syrphid flies as pest control agents are of interest in conservation and biological control (Symondson et al., 2002). Coccinellid beetles are important predators that contribute to pest suppression in the agricultural landscape (Gardiner et al., 2009). The bushes of Rosa rugosa (Thunb.) are a reservoir of aphid predators and parasitoids and rose bush flowers provide a source of nectar and pollen (Frete et al., 2007).

Recent studies have suggested that parasitoid wasps Braconidae (Aphidiinae and Apheilidae) contribute more to the natural control of aphid than was previously thought (Schmidt et al., 2003). The ladybird beetle Coccinella septempunctata L. can consume approximately 200 aphids in a day. Both larvae and adult of the beetle are ferocious predators of aphids (McBride and Glogozo, 1993). The larval voracity of C. septempunctata was 518 aphids per larva (Devjani and Singh, 2006). The syrphid fly or hover fly larva (Diptera: Syrphidae) can eat up to 1200 aphids during its development. Hover fly, Episyrphis balteatus, is an abundant and efficient aphid predator (Almohamed et al., 2007).

The objective of the study described here was to quantify the population dynamics of aphids and their natural enemies on rose cultivars in relation to environmental factors.

Materials and Methods

Aphid populations and those of their natural enemies were counted on rose varieties during the year 2005. Eleven rose cultivars were selected in three replications. Following randomized complete block design (RCBD), three plants from each cultivar were marked as replication and tagged individually as Golden Master, Diamond, Good News, Pink Beauty, Elizabeth of Giammer, Sukha Rose, Pink (Victoria), Yellow (Golden Shower), Red (Queen Elizabeth), White (Ice-land) and Blumonia. Each plant was divided into upper, middle and lower part and each part was further divided into stem, leaves and buds for taking population samples. These plants were tagged to count the population of aphids and their natural enemies.

Data collection was started at the beginning of aphid immigration to roses in the month of March and counts were made weekly until the collapse of aphid population and their natural enemies. Meteorological data (temperature, humidity and rainfall) were obtained from the Regional Agro-Meteorological Centre, Rawalpindi. Population changes in predators and parasitoids in relation to aphid population were also recorded. Aphids and their natural enemies from stems, leaves and buds were
Effect of Storage Temperature and Time on the Vitamin C Contents of Selected Fruits and Vegetables

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Abstract. The vitamin C contents of 5 fruits and 7 vegetables, as a whole and in diced form, were determined by HPLC during cold storage. Results showed a decrease in vitamin C contents during 15 days refrigeration (7 °C) as well as freezing at -20 °C. It was found that fruits are more stable than vegetables since the rate of degradation of vitamin C was higher in vegetables as compared to fruits, either during freezing or refrigeration. During 15 days freezing, fruits showed a decrease of 41.05 - 51.44%, whereas, this loss augmented to 54.12 – 89.10% in vegetables. In addition to this, it was also observed that fruits and vegetables which have peels are less vulnerable to vitamin C degradation; the ratio of degradation of vitamin C in all the fruits studied and potato was not more than 51.44%. In fruits, apple was more susceptible and in vegetables, potato was more stable to vitamin C degradation.

Keywords: fruits, vegetables, vitamin C, refrigeration, freezing

Introduction

Vitamin C is a water soluble vitamin, essential for the synthesis of collagen and inter-cellular material. Several substances have vitamin C activity, notably ascorbic acid and its sodium and calcium salts. Daily dietary intake of about 30-100 mg of vitamin C has been recommended for adults (Sweetman, 2007). Vitamin C functions in a number of biochemical reactions, mostly involving oxidation. Thus, it is required for and facilitates the conversion of certain proline residue in collagen to hydroxyproline in the course of collagen synthesis (Myllyla et al., 1978), the oxidation of lysine side chains in proteins to provide hydroxytrimethyllysine for carnitine synthesis (Hulse et al., 1978), the synthesis of steroids by the adrenal cortex (Deana et al., 1975), the conversion of folic acid to folinic acid etc. (Stokes et al., 1975).

Humans are unable to form their own vitamin C, so a dietary source is necessary. Most dietary vitamin C is obtained from fruit and vegetable sources. Only small amounts are present in milk and animal tissues. Relatively rich sources include rose hips, black currant, citrus fruits, leafy vegetables, tomato and potato, green and red pepper etc. Vitamin C is readily destroyed during cooking. Considerable losses may also occur during storage (Sweetman, 2007). Studies indicate that vitamin C is by far the least stable nutrient during processing due to its sensitivity to oxidation and leaching into water soluble media during processing, storage and cooking of fresh, frozen and canned fruits and vegetables (Franke et al., 2004; Lathrop and Leung, 1980). In various earlier studies, the effect of processing and storage on the vitamin C contents in a variety of fruit products had been determined (Gil-Izaquierdo et al., 2002; Lima et al., 1999; de-Dios and Viteri 1991); loss vitamin C after six days at 5 °C was noted to be 5- 25 % in various fruits and vegetables (Gil et al., 2006). Vitamin C content of lemon juice decreased to about 36% of the initial value over a period of 12 weeks at various storage conditions (Abbasi and Niakousari, 2007). No considerable loss in vitamin C content of green beans occurred during blanching and freezing processes (Martins and Silva, 2003).

There has been an increasing demand for fresh cut fruits and vegetables for convenience as ready-to-eat products, along with their nutritional values requisite for healthy living (Martin et al., 2002; Liu et al., 2000; Block et al., 1992). A major benefit of greater intake of fruits and vegetables may be the increased consumption of vitamins and their antioxidant activity which may reduce the risk of cancer, heart diseases as well as prevention of degenerative diseases (Grassmann et al., 2002; Rimm et al., 1996; Gaziano and Hennekens, 1993; Tee, 1992; Doll 1990). Among all other valuable nutrients like phenols, carotenoids and vitamins etc., vitamin C is the most perishable (Gil et al., 2006). Degradation of vitamin C takes both aerobic and anaerobic pathways and depends upon many factors such as oxygen, heat, light, storage temperature and time (Uddin et al., 2002; Nunes et al., 1998; Sedas et al., 1994). Many fruits and vegetables contain over 90% water and once harvested they begin to undergo higher rates of respiration, resulting in moisture loss and quality deterioration. Harvesting separates the source of energy required by the fruits and vegetables for the above mentioned activities resulting in reduction of their nutritional values. Storage and
An Experimental Study on Regulated and Unregulated Pollutants from a Spark Ignition Car Fuelled on Liquefied Petroleum Gas and Gasoline

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Abstract. In the experimental study conducted on a spark ignition (SI) car running on a chassis dynamometer, fuelled on liquefied petroleum gas (LPG) and gasoline, carbon monoxide (CO) and total hydrocarbons (HC) decreased by 37.3% and 46.8%, respectively, while oxides of nitrogen (NOx) increased by 59.7% due to higher compression ratio with LPG, compared with gasoline. In case of LPG fuel, formaldehyde, acetaldehyde, propionaldehyde, 2-butanone, butyraldehyde, benzaldehyde and valeraldehyde decreased, leading to an overall decrease of about 35% and 26% in carbonyls and their ozone forming potential (OFP), respectively, compared with gasoline. Furthermore, benzene, toluene, ethyl benzene, xylene and styrene decreased, resulting in an overall decrease of 38.8% in volatile organic compounds (VOCs) and 39.2% in BTEX (benzene, toluene, ethyl benzene and xylene) species due to more complete combustion with LPG, compared with gasoline. Further, the OFP of VOCs with LPG was 6% lower than that with gasoline fuel.

Keywords: liquefied petroleum gas, regulated emissions, unregulated emissions, carbonyls, gasoline car

Introduction

During the past few years, there has been increased attention to the issues of exhausting fossil fuels deposits and increasing environmental pollution caused by vehicular exhaust, which has prompted researchers to explore alternative fuels for the transport sector. Economy, availability and environmental acceptability are the major criteria for a fuel to be accepted as an alternative fuel (Gandhidasan et al., 1991). LPG is deemed to be one of the promising and viable candidates for SI engines/vehicles to resolve the issues of both rapidly depleting fuel deposits and increasing environmental concerns. It has a high octane rating and is, therefore, much suited for SI engines, but it needs additives or other positive means to initiate the combustion when it is used in compression ignition (CI) engine because of its lower cetane number (Jothi et al., 2007). It is thought to be a major energy resource of the future because of its eventual availability and clean burning nature (Saleh, 2008). It is a more completely combusted fuel and hence has less impact on air quality (Chang et al., 2001). LPG is widely used as an alternative vehicle fuel in the US, Canada, the Netherlands and several other countries like Japan, where 94% of the taxi fleet (about 260, 000) has been converted to LPG operation, and Australia where, almost half a million (about 5%) of the vehicles run on LPG fuel (Ristovski et al., 2005). In Hong Kong, the government has completed the scheme of the importation of LPG taxis started in 1998, before which under an incentive programme nearly all the taxis (about 99.8% of the taxi-fleet in Hong Kong) running on diesel were switched to the LPG fuel in 2003 (Ning and Chan, 2007).

LPG consists mainly of propane (nearly 80% by volume), with 11% butane and about 5% isobutane (Chang et al., 2001). Due to its higher octane number, LPG can be used at higher compression ratio; consequently, the engine power and thermal efficiency (performance) are improved (Bayraktar and Durgan, 2005). It has been reported that relative to gasoline, LPG has 40% and 60% reduction in HC and CO, respectively, along with substantial reduction in carbon dioxide ($CO_2$) emissions (Snelgrove et al., 1996). According to Yang et al. (2007), LPG fuelled vehicles can significantly reduce the emissions of greenhouse gases, ozone forming precursors, particulate matter, metal elements, and polycyclic aromatic hydrocarbons.

The current work is aimed at the experimental investigation of CO, HC and NOx, as regulated, and carbonyls and VOCs as unregulated pollutants emitted from an SI car fuelled with LPG and gasoline. In addition to this, it has been attempted to make the comparison of these pollutants in terms of their
A New Process for the Synthesis of Naphthalene Based Tanning Agent

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Abstract. A new process developed for the preparation of naphthalene catechu tanning agent consisted of sulphonation of naphthalene, condensation with formaldehyde, combining with naturally occurring catechol, followed by neutralization of the reaction mixture. The product was then dried, analyzed and tested for application on wet blue leather which showed excellent tanning properties.

Keywords: syntan, catechu, naphthalene, tanning agent

Introduction

Different aromatic substances i.e., phenol, cresol and naphthalene have been treated with formaldehyde in presence of sulphuric acid and sodium hydroxide as catalyst to form polymeric substances that may be used as syntan (Romaniv and Berkman, 1970; Berkman et al., 1968). The synthesis was based on three main steps comprising of sulphonation, condensation and neutralization. Naphthalene after sulphonation forms naphthalene sulphonic acid (Berkman and Sergeeva, 1957), which then condenses with formaldehyde to form water soluble acid naphthalene syntan which may be marketed as an acid liquid for whitening chrome leathers or bleaching vegetable tannins. It may also be neutralized to form neutral salt of the syntan, which after drying may be marketed as solid syntan (Thorstensen, 1993). Naphthalene based syntan has remarkable properties as a tanning agent but its light fastness is not as good as other synthetic tanning agents (Palop et al., 2008) which are biodegradable as well (Danhong et al., 2008). Studies have been reported for effects of naphthalene syntan with vegetable tannins (Dalen, 2003). Addition of naphthalene sulphonic acid to other tannins has been found to be advantageous and white spots on vegetable tanned leather disappear when it is used in the tanning mixture (Alois, 1964). In order to enhance the tanning properties, a new effort for preparing syntan was carried out with locally available catechol based tanning material, called catechu. The resulting product showed excellent tanning characteristic with less environmental hazards. It could be economical and feasible commercial level (Covington and Song, 2003; Shuttleworth, 1952).

Materials and Methods

The chemicals used in the synthesis were conc. sulphuric acid, specific gravity 1.84%, obtained from BDH, formaldehyde 37%, obtained from Merck, sodium hydroxide commercial grade, obtained from Winlab while naphthalene and catechu were of commercial grade. Mechanical agitator was used for shaking the aqueous liquor. All steps of synthesis, retanning and analysis were carried out conventionally.

Official Method of Tannin Analysis of the Society of Leather Technologists and Chemists (Lampard, 1996) was used as reference in the analysis involving the steps as given below:

Sulphonation. Naphthalene (65.0 g) was melted in a closed reaction vessel fitted with electrical stirrer. Concentrated \( H_2SO_4 \) (84.65 g) was added over a period of approx., 10 min till the whole naphthalene melted. A pinch of catalyst, \( ZnSO_4 \) (commercial), was also added and stirring was continued for 2 h at 150-155 °C until reaction mixture became completely water soluble resulting in blackish grey highly viscous liquid.

Condensation with formaldehyde. Thereafter, formaldehyde (11.65 g) was added dropwise at a temperature of 40 °C during 10 min with further 2 h stirring on a water bath at 40 °C. Care was taken to control the temperature of the reaction mixture at 100 °C. Water soluble dark grey viscous liquid was obtained after completion of the reaction.

Blending with catechu. Water soluble and filtered form of catechu (65.0 g) was completely dissolved in minimum distilled water, and then added with constant stirring at room temperature till a homogenous liquid was obtained.

Neutralization. The mixture was then neutralized with soluble sodium hydroxide (35.0 g) with constant stirring until it