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Industrial Applications of Limestone Deposits of Kohat, NWFP: A Research Towards the Sustainability of the Deposits

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Abstract. Chemical analyses, petrographic studies and physical tests of limestone deposits in the vicinity of Kohat along Bannu Road, Hangu Road and Rawalpindi Road were carried out to categorize these reserves, locality-wise, for their specified industrial uses. Limestone of Kohat area was found to be generally good for construction purposes. The deposits on the Hangu Road were of good quality with more than 97% CaCO3 and suitable for use in chemical, iron and steel industries, for glass making, soda ash manufacture etc. The deposit of Bannu Road with 96.5% CaCO3 can be used for sugar refining, paint industry, flue gas desulfurization, animal feed etc. The limestone deposit of Rawalpindi Road is inferior in quality having 95.2% CaCO3. It can be utilized in rubber industry, as ceramic whiting, building materials, rock wool etc.

Keywords: limestone, Kohat (NWFP), industrial applications, sustainable development

Introduction

The North West Frontier Province (NWFP) of Pakistan limestone has huge reserves of limestone, besides of other minerals, comprising rocks dating back from Eocene to Precambrian period. This limestone is mostly used for construction purpose and in a few non-constructional industries, locally as well as in developed countries. The non-constructional uses or high purity applications include, in industries concerning manufacture of glass, paper, chemicals, sugar, animal feed, agriculture, paints, rubber, pharmaceuticals, foods and drinks etc. Searle (1935) was the first to carry out work on limestone. Gillson (1960) examined the physical and chemical properties of carbonate rocks and discussed some of the uses of limestone and dolomite. The major compilation work on the carbonate rocks employed directly (e.g. dimension stone) or indirectly in a manufacturing process (glass manufacturing or sugar refining) was done by Lamar (1961). Oates (1998) and Boynton (1980) worked on the chemistry, technology, production and uses of lime and limestone. Tucker and Wright (1990), Wiersma (1990) and Scoffin (1987), studied the geology of the carbonate sediments and rocks.

In Pakistan, some work on the Nizampur limestone of NWFP has been generally carried out by Husain et al. (1989), and on the limestone of NWFP for the cement industry by Husain (1995). Present work is a first step towards the detailed evaluation of limestones deposits for their various industrial applications and comprises, a series of studies to be carried out on different limestones deposit occurrences in NWFP.
Delignification of Pakar Wood (*Ficus lacon* Buch) by Organosolv Pulping with Aliphatic Organic Acids

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Abstract. Pakar wood (*Ficus lacon* Buch) of particle size 0.315-1.00 mm was subjected to organosolv delignification with acetic, formic and propionic acids. Optimum delignification was achieved with 95, 80 and 70% of these acids, respectively, with optimum catalyst (HCl) concentration of 0.25, 0.20 and 0.15%, the time being 180, 120 and 120 min, respectively.

Keywords: organosolv pulping, pakar wood, delignification, aliphatic acids

Introduction

Lignocellulosic materials (LCM) are renewable resources having great potential for use as alternative raw material in the chemical industry. Efficient fractionation of LCM may allow the separation of their polymeric components (cellulose, hemicellulose and lignin) which could be separately processed to useful and economically competitive end product (Zargarian et al., 1988; Rijkens, 1984; Kouklos and Valkanas, 1982). Pakar wood (*Ficus lacon* Buch), due to its high content of α-cellulose, good pulp yield and fast growth is an important raw material for the pulp industries in the world (Siddiqui et al., 1986). The sulphate process is employed for pulping, but it is inconvenient due to environmental hazard and production of lignin (not recoverable for chemical uses) (Johansson et al., 1987).

Among the alternate processes, pulping with organic acids seems to offer the greatest versatility and potential. Organosolv pulping is an energy-efficient approach to the production of pulp with a wide spectrum of useses. However, no extremely satisfactory organic system has yet been found to delignify all the wood species to produce commercial pulp with low residual lignin content, without seriously degrading the cellulose (Lange, 1981).

Organic acids have advantage over mineral acids in facilitating pulping of softwoods as well. However, none of the tested catalysts had been able to produce pulp of high strength and viscosity at low residual Kappa no. In addition, the pH of the spent liquor remains low and some lignin condensation, cellulose degradation and hemicellulose hydrolysis also occurs (Siddiqui et al., 1986). In the present study, performance of acetic acid, formic acid and propionic acid was evaluated for delignification of Pakar wood, using HCl as catalyst.

Materials and Methods

Pakar wood was dried in oven at 105°C, chipped and disintegrated to a particle size of 0.315-1.00 mm, homogenized and stored in desiccator. It was then extracted with alcohol-benzene mixture (ASTM, 1983). The extracted sample was subjected to analysis of its α-cellulose (Doree, 1950), Klason lignin (ASTM, 1997) and hemicellulose content (Erickson, 1962). All the parameters were determined on the basis of initial dry weight of the raw material utilized in that particular set of experiments.

Delignification of 10 g sample was carried out in 250 ml round bottom flask under reflux conditions, at 101, 118 and 141°C with acetic, formic and propionic acids, (as delignifying media), respectively, and water and HCl (as catalyst) in different proportions (Sarkanen, 1990).

For each acid, 4 sets of experiments were performed for determination of operational conditions relating to percentage of delignifying media (acids), percentage of catalyst (HCl), S/L ratio and time. Percentage of acids varied from 60% through 65, 70, 75, 80, 85 to 95%; percentage of HCl used was 0.15, 0.20 and 0.25 whereas S/L ratio used was 1:10, 1:12.5 and 1:15. The fourth set of experiments was conducted using the established best three parameters for determining the optimum time giving the best result relating to α-cellulose, Klason lignin content and Kappa number (Ericson, 1962).

Detailed kinetic study of the pulping conditions of Pakar wood, was carried out at 15 min. intervals, from 15 to 120 min. The fractionated products obtained from each set of experiment were then evaluated for their yield, α-cellulose,
Chromium used in the electroplating and tanning industries causes environmental pollution through the generation of effluent. Processes based on “recovery-reuse” are now being increasingly projected and used.

Earlier, Van Andel and Janssen (2002) used a new anode material, namely boron-doped diamond, to investigate the oxidation of Cr$^{+3}$ to Cr$^{+6}$. It was found that the current efficiency for Cr$^{+3}$ oxidation decreases with increasing total current density. The current density of Cr$^{+3}$ oxidation increases linearly with increasing its Cr$^{+3}$ concentration and is practically independent of the Cr$^{+6}$ concentration. It was concluded that the diffusion of Cr$^{+3}$ is the rate-determining step for its oxidation at Cr$^{+6}$ concentrations from 40 to 160 mol/m$^3$. A filter-press type cell divided into two compartments by a cation exchange membrane was proposed.

Ahmed et al. (2001) carried out work on an electrolysis cell with an ion exchange membrane (Nafion-117), used as a simulated plating bath containing Cu$^{+2}$, Fe$^{+2}$, Ni$^{+2}$, and Cr$^{+3}$ as contaminants, with a lead anode and a gas diffusion cathode, for different experimental conditions at room temperature. The results indicated the possibility of decreased energy consumption and better removal rates over traditional methods.

For regeneration of spent hard chrome plating solution, Ahmed et al. (2001) carried out work on an electrolysis cell with an ion exchange membrane (Nafion-117), used as a simulated plating bath containing Cu$^{+2}$, Fe$^{+2}$, Ni$^{+2}$, and Cr$^{+3}$ as contaminants, with a lead anode and a gas diffusion cathode, for different experimental conditions at room temperature. The results indicated the possibility of decreased energy consumption and better removal rates over traditional methods.

The regeneration of Cr$^{+6}$ and the recovery of etched copper from chromium etching solutions by electrodialysis was improved by the addition of a concentrator cell in the catholyte chamber containing ion-exchange resins or activated carbon cloth (Chaudhary et al., 2006). The maximum regeneration of chromium and recovery of copper were however less than 80% and 90% respectively. A novel combination of electrolysis with electrodialysis and concentrator cell technology was developed that achieved 92% chromium regeneration and 90% copper recovery.

Welch et al. (2004) examined the electrochemical oxidation of Cr$^{+3}$ to Cr$^{+6}$ species in aqueous solution. The responses of boron-doped diamond glassy carbon and gold electrodes were probed towards the oxidation of trivalent chromium over a wide pH range (1.0-13.0). High quality voltametric profiles were found to appear only at a gold electrode and in solution of pH greater than 12. The oxidation reaction proceeded via multi-step mechanism.

Devilliers et al. (2003) proposed a procedure for preparing lead dioxide-based electrodes with a platinum under-layer deposited on titanium. The current efficiency of the prepared electrodes was compared with that of lead/lead dioxide and Ebonex®/lead dioxide electrodes with different pH conditions. The titanium/platinum/lead dioxide were found to have a very good electrochemical behavior (current efficiency: $\Phi=0.93$ for pH 2), and may be used as dimensionally stable anodes for the oxidation of Cr$^{+3}$.

Recently, streams/wastes containing chromium suitable for electroplating have been identified and the applicability of conventional and promising techniques to treat such substances have been reviewed (Agarwal et al., 2006). Membrane electrochemical reactor was developed for continuous regeneration of spent chromium baths (Sanchez et al., 2006). Electrooxidation of Cr$^{+3}$ to Cr$^{+6}$ species was investigated on the (111) plan of a gold single crystal in a highly alkaline...
Proximate Analysis and Fatty Acid Composition of *Nigella sativa* (Kalonji) Seed Oil Growing in Pakistan

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Abstract. Physical and chemical characteristics including fatty acid composition of samples of seven commercially available *Nigella sativa* oil and three freshly extracted seed oil, collected from different localities, were determined by gas liquid chromatography. The average and standard deviations found were: refractive index at 20 °C, 1.473 ± 0.0018; specific gravity at 20 °C, 0.9166 ± 0.0002; iodine value (IV, Wij’s), 119.98 ± 1.8; saponification value, 201.80 ± 2.2 and unsaponifiable matter, 0.61% ± 0.05. Fatty acid (FA) profile was based on high levels of unsaturated FA like oleic acid, 24.17% ± 0.61; linoleic acid, 53.64% ± 0.799 and eicosadienoic acid, 2.3% ± 0.37. Saturated FA such as palmitic acid and stearic acid amounted to 14.82% ± 0.49 and 2.95% ± 0.37, respectively. Myristic and palmitoleic acids were also detected in minor quantity.

**Keywords:** *Nigella sativa* oil, oleic acid, linoleic acid, eicosadienoic acid, fatty acid composition

Introduction

*Nigella sativa* (black cumin) is well known in western countries, the Middle East and Western Asia due to its traditional and medicinal applications (Randhaw and Al-Ghamdi, 2002; Ghaznavi, 1996). In Pakistan and India it is cultivated as an annual herb and is called Kalonji (Randhaw and Al-Ghamdi, 2002; Nadkarni, 1976). Intake of 1g seeds orally, twice a day for two weeks, decreased human blood glucose level (Bamosa et al., 1997). In other toxicity studies, low toxicity of *N. sativa* fixed oil is found to contribute to its safe application at therapeutic dose levels (Zaui, 2002). Traditionally, the fixed oil expressed from seeds of *N. sativa* is used topically for the treatment of eczema, arthritis, back pain and psoriasis. Anti-inflammatory effect of the fixed oil has also been investigated (Teuscher, 2006; Mahfouz and El-Dakhkhany, 1960).

As far as the nutritional value of *N. sativa* oil is concerned, it contains valuable nutrients, such as fixed and volatile oils besides protein, ash, minerals, essential amino acids and some vitamins. (Takruri et al., 1998). Fixed oil of *N. sativa* seeds yields triglycerides of fatty acid; the latter help to determine the biological properties of the body cells. Much recent research has confirmed that a dietary source of Omega-6 and Omega-3 fatty acids is essential for optimum tissue functions in humans. These essential fatty acids cannot be manufactured by the human body and thus must be taken through essential fatty acid containing food supplements in order to sustain health. *N. sativa* oil is a rich source of linoleic fatty acid (ω6) which has the ability to boost human immune system significantly.

In the present study, the physicochemical properties and fatty acid composition of freshly extracted *N. sativa* oil (from 3 seed samples) and seven samples of commercially available seed oil have been determined through the classical and instrumental methods. Such work has not been reported previously on *N. sativa* cultivated in Pakistan.

Materials and Methods

**Product selection.** The seeds of *N. sativa* are tiny, sharp cornered and deep black in color. Seeds were purchased from three different localities and assigned codes: KLJ, HOC and SOS. Seven branded samples of expressed oil of *N. sativa* were also purchased from the local market and coded as ASA, BPS, SAE, DOS, BCS, VER, and STS.

**Reagents and glass wares.** All the chemical reagents such as iodine monochloride, potassium iodide, hydrochloric acid and some pure standards of fatty acid methyl esters used in the analytical work were purchased from E. Merck and Sigma Chemical Company. The glasswares were cleaned with 1:1 HNO₃ before use.

**Apparatus.** A Perkin Elmer gas chromatograph model Clarus 500 fitted with a polar capillary column SP 2330, 60x0.25x0.20 film thickness, flame ionization detector and a HP Laser jet 1300 printer was used for fatty acid quantification.
Introduction

For the last six decades, despite competition from man-made fibres, cotton fibre has maintained its importance and utility to date. It plays an important role in the global economy. The total world production of cotton in the year 2005-2006 was reported at 24.85 million tons (www.fas.usda, 2005). The price of this production is estimated at more than US$ 35 billion with a very high potential of value addition.

The quality of cotton fibre is important in spinning and subsequent processes. It not only influences the lint price but also determines the use to which it is to be best put. Innovations in textile machinery demand increasingly better fibre quality to meet the processing needs and the quality of the end product. Fibre length, fineness, length distribution, strength, elongation and maturity are the most important quality factors of cotton for textile processing. In spinning, the importance of fibre quality varies with the spinning techniques e.g. ring, rotor and air-jet. Fibre qualities determine the yarn strength, yarn regularity, and handle and lustre of fabrics (Zeidman and Sawhney, 2002; Patel and Patil, 1975; Iyengar and Gupta, 1974a, 1974b; Weiss et al., 1964).

A large number of cotton varieties are grown in more than seventy countries under different conditions of climate, soil and environment. The varied conditions and different varieties of cotton plant affect the ultimate cotton fibre characteristics. The present work was designed to study the physical properties of various cotton varieties and their correlation among one another.

Materials and Methods

Samples of the following nineteen varieties of cotton fibres originating from ten different countries of origin were obtained:

American varieties: SJV Pima; Elpaso; Memphis; Mote
Egyptian varieties: Giza 70; Giza 88; Giza 86
CIS varieties: Elisa; Sultop
Sudanese variety: Barkat
Indian varieties: MCU 5; Shanker 6
Mali variety: Mali
Greek variety: Greece
Brazilian variety: Brazil Lot 1832, Lot 1017, Lot 992
Ivory Coast variety: Ivory Coast
Pakistani variety: Pak

Representative specimens from the cotton samples were prepared, using standard sampling procedure (ASTM-D, 2000). The specimens were conditioned in the laboratory as per prevalent practice (ASTM-D, 1998). The physical properties, viz., length (mm), length uniformity (%), short fibre index (%), strength (g/tex), elongation (%), fineness (Micronaire), reflectance (Rd value) and yellowness (+b value) were measured by using the Uster HVI system (ASTM-D, 1995). Then correlation of these physical properties was determined.

Results and Discussion

Table 1 shows the summary of the test results obtained.

Fibre length. A graphical representation of the comparison of average length of different varieties of cotton is given in Fig. 1. As can be seen, out of nineteen cotton varieties tested, nine had an average fibre length of 30 mm or above. USA (SJV Pima) cotton fibres were found to be the longest in the tested
Level of Organochlorine Pesticides and Polychlorinated Biphenyls in Shellfisheries and Flounder Eggs at Virginia Beach Using Matrix Solid Phase Dispersion

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Abstract. Concentrations of polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs) including \( \Sigma \) DDTs, \( \Sigma \) chlordanes, \( \Sigma \) BHCs, dieldrin, heptachlor epoxide etc were measured in the tissues of different shell fishes and flounder eggs of River James at Virginia Coast, USA. PCBs were the most predominant contaminants, followed by \( \Sigma \) chlordanes, \( \Sigma \) BHCs, \( \Sigma \) DDTs, and other OCPs. Concentration of OCPs decreased by an order of magnitude during the last decades in this region; nevertheless, the concentration of PCBs and OCPs in shell fishes are still elevated. Concentrations of organochlorines were highly correlated with one another, and were in the range of a few to several ng/g on a wet weight basis. In the tissue of shell fishes, the sum of \( \Sigma \) OCPs ranged from 193.5-665.53 ng/g, predominated by \( \Sigma \) chlordanes. \( \Sigma \) PCB had an overall range of 287.7-28207.9 ng/g and were predominated by \( \Sigma \) Aroclor 1248.

Keywords: endocrine disrupting chemicals; organochlorine pesticides; polychlorinated biphenyls; shellfishes; flounder eggs

Introduction

Organochlorine pesticides are generally, highly toxic to aquatic organisms. The legislation provides that their concentration in sediment/shellfish/fish must not increase significantly with time.

Organochlorine pesticides tend to be highly bioaccumulated by aquatic organisms; their high concentrations or of their residues in marine mammals have been suggested as the cause of pathological changes and reproductive failures in Baltic sea lions, seals and Beluga whales (Zakharov and Yabloko, 1990).

Organochlorine compounds (pesticides and PCBs) are also known as endocrine disrupting chemicals (EDCs) (Portelli et al., 1999) having ability to disturb the normal hormonal systems of animal species through mimicking or blocking natural hormones or by interfering with their production and metabolism (De Jager and Andrews, 2000).

All of the EDCs tested so far are toxic to marine animals at levels far below the recommended application rates. Most pesticides, particularly the chlorinated hydrocarbons, have a toxic effect on marine shellfish (Munshi et al., 2004). Oysters exposed to minute concentrations of agricultural chemicals show abnormal pumping activity, decreased shell growth and significant mortality during summer. The affected animals when returned to clean water, soon recovered from all visible signs of damage. Oysters exposed to DDT at levels of 1 to 1,000 ppb (\( \mu \)g/liter) show a progressive decrease in shell deposition as compared with controls (Fisk et al., 1998) Environmental pollution by DDT at levels as low as 0.001 ppm causes marked reduction in oyster growth. Molluscs and fish concentrate and store organochlorine pesticides at levels many thousand times greater than that present in their environment. Some pesticides caused damage at the lowest levels tested when the exposure was sufficiently long (Falandysz et al., 2001).

Applications of pesticides inevitably lead to residues in soils which may evaporate to the air or be washed into watercourses, causing contamination of marine environment. In the early 1990s, the World Health Organization estimated that 3 million people a year suffered from acute pesticide poisoning with as many as 200,000 of them dying, most of them being in the developing world, where village conditions virtually prohibit safe use of the dangerous pesticides.

Protection and preservation of marine environment from possible adverse effects of agricultural chemicals is as important as the search for safe pesticides for improving the quality and...
Leaf Cuticle Variations in *Amaranthus spinosus* as Indicators of Environmental Pollution

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Abstract. Investigation of the leaf epidermal characteristics of *Amaranthus spinosus* from polluted and non-polluted populations revealed that the stomatal pores of the leaves of the plants of the polluted areas were closed whereas those of the non-polluted areas were open. Mean length x mean width of stomatal pores on the upper leaf surface were 0.86 μm x 0.43 μm and 1.23 μm x 0.45 μm on the lower leaf surface of the non polluted microhabitats. Also, the leaves of the polluted population were smaller than those of the non-polluted population. The average leaf area of the plants of the polluted population was 7.64 cm² as against 12.13 cm² of the plants of the non-polluted areas. The results were attributed to the combined effects of air pollutant that predominated road sides from where the samples were taken. Thus, it is inferred that this plant could serve as bio-indicator of air pollution.

Keywords: *Amaranthus spinosus*, stomatal pores, air pollution

Introduction
The use of botanicals as bio-indicator of environmental contamination has constituted an important research area in the recent times (Kayode and Otoide, 2006). The concentrations of polluting gases, or their solutions, to which plants are exposed are highly variable depending on location, wind direction, rainfall and sunlight. Study by Bonnie and Joel (2000) had revealed that gaseous pollutants such as ozone and sulfur dioxide, enter plants through natural openings, usually stomata, and react within leaf tissues to inhibit photosynthesis. Similarly, Eduardo (2002) revealed that the burning of hydrocarbons in motor vehicle engines gives rise to carbon(IV)oxide, carbon(II)oxide, sulfur(IV)oxide, nitrogen monoxide, ethylene and a variety of other hydrocarbons. Udo and Oputa (1984), Nyawuame (1992), as well as Udo and Fayemi (1999) reported that such pollutants damage the chloroplast, causing chlorosis, necrosis, glazing, etc.

*Amaranthus spinosus* Linn. is an annual herb which occurs as weed at road-sides, waste areas and plantations (Akobundu and Agyakwa, 1987). Thus, *Amaranthus spinosus* is liable to be exposed constantly to the dust in its environs. The present study has been carried out with a view to understanding the role of foliar morphology of *A. spinosus* which could serve as an indicator of environmental air pollution.

Materials and Methods
Mature leaves of *A. spinosus* were collected from 3 vehicular polluted roadsides at Oluku (A₁), Agbor (A₂) and Sapele roads (A₃) and 3 microhabitats free of vehicular pollutants Ebvomodu (B₁), Ebvoneka (B₂) and Eyaen (B₃), all situated in Edo State of Nigeria. The Oluku, Agbor and Sapele roads are extremely busy due to high traffic on them, to and from Benin-City, Nigeria. Despite the importance of these roads, they lack adequate maintenance such that in several portions of the roads, the asphalt overlays had been worn out completely. Leaf samples were collected from worn out areas on these roads. Ebvomodu, Ebvoneka and Eyaen are forest communities situated at 25, 30 and 20 kilometers away from roads, respectively.

Ten leaves per population were selected and their leaf areas were determined according to Bako et al. (2002) as follows:

\[ A = (L) \times (W) \times (0.75) \times 2 \]

where:

- \( A \) = leaf area/plant
- \( L \) = length of leaves
- \( W \) = width of leaves
- 0.75 = constant leaf area factor

The epidermis was gently and carefully peeled off the mesophyllic tissues of the leaves with the aid of sharp razor blade, placed on a flat surface with the outer surface facing downwards and was flooded with commercial bleaching agent (household bleach with active ingredients, sodium hypochlorite 3.5% m/v when packed).

The peels were stained with the combination of safranin and Delafield’s haematoxyline and mounted temporarily on slides.
Introduction

Many researchers have reported adverse effects of crude oil on plants and the ecosystems. Mackin (1950a; 1950b) reported that crude oil causes death of saltgrass and saltwort. Other antagonistic effects on plant growth reported include inhibition of germination, stunted growth, brown leaves and pale stems (Udo and Fayemi, 1975), reduction and blocking of gaseous exchange in seeds (FEPA, 1990), prevention of water and nutrient uptake by seeds thereby reducing germination and subsequent growth of plants (Adesiyan and Osuji, 1993), reduction in the number and distortion of stomata, morphological and anatomical aberrations (Cole, 1994; Holmer and Bale, 1987). Kinako (1981) found that crude oil pollution leads to reduction of number of plant species within the range of 67-92% with the same trend in productivity and that crude oil tends to cause a drastic slow-down in vegetation recolonization.

Like other contaminants, the effects of crude oil on the biological systems can be studied using test systems or assays, based on plants, mammalia, bacteria, drosophila, etc. which can be used to determine genotoxic effects of the contaminants. Plant assays have been developed to determine the genetic changes induced by contaminants, their metabolites and residues (Veleminsky and Gichner, 1988), based on laboratory, greenhouse or field studies (Ma and Harris, 1985; Plewa, 1985; Grant, 1982). Grant and Zura (1982) and Constantin (1982) reported that several plant assay systems have been used for monitoring genotoxic substances in the environment and assessing the risks to humans. Odeigah et al. (1997a; 1997b) used Allium test to evaluate the genotoxic effects of waste water and leachate from solid industrial wastes. Most plant assays are usually based on macroscopic studies, wherein the morphological features like growth rate, leaf areas and leaf colouration are used to ascertain the effects of chemicals on plants and microscopic studies using chromosomal aberrations for the same purpose.

Although the importance of using plant assays for determining the effects of contaminants on biological systems has been reviewed by many researchers (Fiskesjo, 1997; Wang, 1992; Sandhu et al., 1991; Kihlman, 1966; Levan, 1951), only few researches used Glycine max in the study. The aim of this study is, therefore, to determine the effects of crude oil on G. max so as to evaluate its use as a biomonitor of crude oil pollution.

Materials and Methods

Sources of crude oil and Glycine max. The crude oil (wellhead medium) used in this study was obtained from Shell Petroleum Development Company, Port Harcourt, Nigeria. The seeds of the four accessions of G. max (TGX 1805-31F, TGX 1019-1E, TGX 1440-1E and TGX 1448-2E) were obtained from the Gene-Bank section of the International Institute for Tropical Agriculture (IITA), Ibadan, Nigeria.

Planting of seeds. Ten seeds of each accession were planted in a petri-dish lined with a layer of filter paper wetted with a given concentration of crude oil-water mixture. The concentrations used were 1%, 5%, 10%, 15%, 20% and 25%, with each serving as a treatment and replicated thrice. For control treatment, the filter paper was kept wet with distilled water.

Germination experiment. The number of seedlings that emerged from each petri-dish four days after planting was counted and used to determine the rate of germination. The protrusion of radicle was used as yardstick for germination. The number of seeds that germinated from each treatment for each accession was summed and the mean germination percentage for each treatment was calculated.

Abstract. Study of the effects of crude oil on four accessions of Glycine max showed that the rate of germination, root length development and rate of cell division of the accessions decreased with increasing concentration of crude oil. However, the extent of effects on the accessions varied showing differences in the abilities of the accessions to survive in crude oil polluted sites, the tolerance being in the order of TGX1019-1E < TGX1805-31F < TGX1440-1E < TGX1448-2E suggesting TGX 1019-1E to be the best indicator of and TGX1448-2E to be the best tolerant accession to the crude oil pollution.

Keywords: Glycine max, mitotic index, pollution, crude oil pollution, mutagenic effect of crude oil
Partial Replacement of Soybean Cake with *Amaranthus spinosus* Leaf Meal in the Diet of Nile Tilapia (*Oreochromis niloticus*)

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**Abstract.** The study, designed to assess the potentials of oven dried *Amaranthus spinosus* leaf meal as partial replacement for soybean cake in the diet of Nile Tilapia, revealed no significant difference (P>0.05) in feed and protein intake. Fish fed on *Amaranthus spinosus* leaf meal diets had significant (P<0.05) higher survival percentage, while that on soybean cake meal (control diet) recorded significant (P<0.05) better weight gain, average daily rate of growth, efficient feed and protein utilization as well as average final weight.

**Keywords:** *Amaranthus spinosus* leaf meal, soybean cake, Nile tilapia, feed efficiency ratio, protein efficiency ratio

**Introduction**

Over the years oil seed cakes have been evaluated as fish feed ingredients. With advanced processing techniques their nutritive values have been enhanced to such an extent that they are now considered as conventional ingredients in aquaculture. However, the increasingly scarce supply of conventional plant protein sources and concomitant rise in prices have made it necessary to seek a cost effective replacement to supply dietary protein in aquaculture feed. Thus, research studies into cheaper alternative plant protein sources for development of low cost feeds for small scale farmers has become an utmost priority in developing countries like Nigeria, in order to maximize profit (Fashina-Bombata et al., 2005; Akebejo-Samsons and Ojini, 2004; Fasakin and Balogun, 1998). This is necessary because a greater percentage of fish supply comes from small-scale peasants and rural farmers (Omotoso and Fagbenro, 2005; FAO, 2002; Ogbe et al., 2001).

*Amaranthus* is an annual plant distributed world wide in both humid and warm regions and is now widely cultivated in most tropical areas (Steentoft, 1988; Tindall, 1983). *Amaranthus spinosus* are usually short-lived annuals, with potential for self and cross pollination. They are widely available, especially during the rainy season, and widely dispersed by wind, growing almost on every soil, thus regarded as weed. Presence of thistles on the stem limit their consumption by man; however, the leaves are high in pro-vitamins (A and C), minerals (iron, calcium and potassium) and proteins, with lysine constituting as much as 5.9% of the proteins which is equal to that in soybean and more than that in some of the best maize strains (Steentoft, 1988; Tindall, 1983). Nile tilapia (*Oreochromis niloticus*) is one of the most cultured tilapia species in Nigeria; it is planktivore or herbivore. In view of the above, this study was conducted to assess the utilization of oven dried *Amaranthus spinosus* leaves as partial replacement for soybean cake in the diet of *Oreochromis niloticus* fingerlings, with the aim of widening the choice of available plant protein sources.

**Materials and Methods**

**Materials and feed preparation.** *A. spinosus* leaves were collected from Lagos State University, Ojo Campus, Lagos, Nigeria. The leaves were oven dried at 60 °C until constant weight was obtained. The leaves were later ground with electrical food blender. Four experimental diets were prepared, containing approximately 32% crude protein. Diet I contained 0% Amaranthus leaves or 100% soybean cake (SBC) protein and served as the control. Diets 2, 3, and 4 contained varying levels of the leaves at 25, 50 and 75% of SBC protein, respectively. The percentage composition of the diets is presented in Table 1.

**Experimental fish management.** A total of 96 fingerlings of *Oreochromis niloticus* were purchased from Habib Farm at Agric-complex near Volkswagen Nigeria Limited, Badagry Expressway, Lagos. The fish were fed on commercial diet for 2 weeks to allow for acclimatization. They were randomly distributed to four treatments in three replicates, each making 8 fish to each replicate and 24 fish to a treatment in a randomized complete block design. The fish were managed for 56 days in the laboratory in plastic bowls with capacity for 80 litres of water. Partial replacement of water was made daily before feeding. Feeding was done twice daily between 9.00-10.00 h and 16.00 - 17.00 h.
Effect of Different Auxins on the Establishment of Damask Rose Cuttings in Different Media

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Abstract. Effect of indole-3-acetic acid and naphthalene acetic acid treatments on the establishment of damask rose (Rosa damascena Mill.) cuttings in different growth media was evaluated and it was revealed that the average number of roots and rooting percentage gradually increased with increase in hormone concentration. The maximum number of roots (15.72), rooting percentage (94.17%), plant height (134.2 cm), plant spread (46.3 cm), primary shoots (6.3), secondary shoots (25) and survival percentage (94.72%) was recorded for 50 mg/l naphthalene acetic acid application; the results were superior to indole-3-acetic acid, the optimum level being in the range of 50 and 75 mg/l. No such conclusion could be drawn for indole-3-acetic acid. The leaf mold was the best growth medium giving the maximum number of roots per cutting (10.78), rooting percentage (87.68%), plant height (125.1 cm), plant spread (37 cm), primary shoots (5.2), secondary shoots (19.48) and survival percentage (85.67%), followed by soil + leaf mold, while soil medium was the least effective.

Keywords: Damask rose, Rosa damascena Mill., auxins; indole-3-acetic acid; naphthalene acetic acid; hormones

Introduction

Rose is one of the most important ornamental plants of the family Rosaceae. Damask rose is widely grown for its multiple uses such as for making rose oil (attar), rose water (ark-e-gulab), extraction of perfumes and vitamin C, as cut flowers besides for its medicinal uses.

Plants propagate through sexual as well as vegetative means. Sexual method of propagation, though plays important role in the development of new species but scores of plant species show complexities and produce off springs with undesirable characters. Vegetative propagation, lead to the plant species with desirable characters true to the type from somatic cells through cutting, budding, grafting, layering etc. Among these, the use of stem cuttings is the most easy and common method applied for growing roses (Anderson and Woods, 1999).

Establishment and growth rate of the cuttings depend upon many factors like the season of cutting, age and portion of the branch, growth media, moisture level, nutrient status and temperature etc. (Kristiansen et al., 2005). Provision of optimal growth conditions, proper timings and plant growth regulators play vital role in establishment of cuttings influencing the important phases of plant growth and development.

Auxins, also known as phytohormones or plant hormones, play an essential role in coordination of many growth and behavioral processes in the plant life cycle e.g. rooting of cuttings, flowering, aging, root growth, prevention or promotion of stem elongation, colour enhancement of fruit etc.

Among the auxins, both indole-3-acetic acid (IAA) and naphthalene acetic acid (NAA) are the principal auxins used for rooting of cuttings and majority of plant species are responsive to them (Ercisli and Guleryuz, 1999). These chemicals are available in commercial preparations, dispersed in talc or in concentrated liquid formulations.

IAA is a naturally occurring compound having a carboxyl group attached to another carbon-containing group (usually CH,) that in turn is connected to an aromatic ring. These compounds cause enlargement of plant cells, cell division, lateral branching of shoots and roots, vascular differentiation and early embryonic development (Hobbie et al., 2000). Chaudhry and Khan (2000) reported that IAA promoted expansion of roots. Yang and Davies (1999) suggested that endogenous IAA may play an important role in controlling stem elongation. Sun et al. (1998) found that auxins affected the apical dominance of axillary buds. Fatima and Chaudhry (2004) reported that the number of compound leaves increased with IAA application. Chaudhry and Khan (2000) reported that IAA promoted the initiation of cambium and maturity of
Assessment of Pest and Pesticide Trends in Vegetable Crops in the United Arab Emirates and Sultanate of Oman


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Abstract. A preliminary survey on pesticide uses in 40 vegetable-growing farms representing different agricultural areas in Oman and the UAE, twenty farms from each country, revealed that all the vegetable farms used pesticides for crop protection. Among the major insect-pests, whiteflies (Bemisia tabaci), leafminers (Liriomyza trifolii), melon fruit flies (Bactrocera ciliatus), aphids (Aphis spp.) and tobacco leafworm (Spodoptera litteralis) were recorded in Omani farms. In the UAE, whiteflies, leafminers, cutworms (Agrotis ypsilane), tomato fruitworms (Helicoverpa armigera) and eggplant fruitworms (Leucinodes orbonalis) were the 5 top insect-pests. Among the plant diseases, powdery mildew (Erysiphe spp.), blight (Alternaria spp.), damping off (Pythium spp.), leafspot (Alternaria spp.) and mosaic (CMV) were major cause of vegetable diseases in Omani farms; whereas, damping off (Pythium aphanidermatum), downy mildew (Pseudoperonospora cubensis), early blight (Alternaria solani), septoria leaf spot (Septoria lycopersici) and anthracnose rip rot (Colletotrichum spp.) were the most predominant diseases encountered in most UAE farms. Among the most commonly used pesticides, 29 insecticides, 16 fungicides and 3 herbicides were used by the vegetable farmers. Around 55% of Omani farms used routine application of pesticides, irrespective of the pest presence. Whereas, in the UAE, most farmers started to spray pesticides at 6-20% pest (insect, disease & weeds) infestation. Over 65% of the farms, in both the countries, received chemical pest management information from the sales representatives.

Keywords: insecticides, fungicides, herbicides, insect-pests, pesticide resistance, pesticide residues, Oman, UAE

Introduction
The Gulf’s agricultural production has dramatically increased during the last 32 years. For example, the value of Omani agricultural and fisheries production has risen from 17 million Omani rials in 1970 to 156 million Omani rials by 1994. Due to increased farming intensities (i.e. addition of more lands to cultivation and increasing number of crops per land), agricultural production has an extraordinarily upward trend. Omani cereal yield increased from 0.90 tones/hectares in 1980 to 2.17 tones/hectares in 1998 (Thacker et al., 2001). FAO reports showed that the value (cost) of pesticide imports to Oman increased more than 10 folds since 1960. Due to intensive modern farming practices and pest problems, Omani and the UAE crop producers used large amount of agrochemicals, especially pesticides for crop protection (Tivy, 1991). A total of 835 pesticides are registered in the UAE, among which 49.8% are insecticides and 22% fungicides (Kaakeh et al., 2004). The increased use of different pesticides in the Gulf countries caused serious concern, including the potential for lethal effects of some pesticides on certain species of birds and fish, the possibility of pesticide residues in food and the environment, potentially harmful effects in humans and domestic animals and the unintentional effects of pesticides on pollinating insects including the honeybee, beneficial predators and parasites (Perry et al., 1998). A recent survey showed that for crop protection, 95% of the farms in Northern Oman used insecticides, 60% used fungicides and 20% used herbicides (Thacker et al., 2001).

Worldwide reports show that insects, fungi and weeds have become resistant to major pesticide classes. Currently, around 500 species of insect pests are resistant to 14 major pesticide classes including the organochlorines, organophosphates, carbamates and pyrethroids (Clark and Yamaguchi, 2002). A recent report showed that tomato fruitworms (Helicoverpa
**Short Communication**

**Effect of Plant Growth Regulators on Production of Vindoline in the Callus of Catharanthus roseus**

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**Abstract.** Callus of *Catharanthus roseus* cultured from leaf explant was proliferated on MS medium supplemented with different plant growth regulators either individually or in combination. One month old callus was used for extraction and quantification of vindoline in the callus. The highest amount of vindoline (34.49 μg/g) was found in the callus sub-cultured on MS medium supplemented with 6-benzyl-amino purine (BA, 5 mg/l) while 26.82 μg/g vindoline was observed in callus produced on BA and Kinetin (Kin) at 1.0 mg/l of each in combination. The callus produced at different concentration of auxins failed to produce singly detectable concentration of vindoline. It is concluded that cytokinins supplemented in MS medium enhance the production of vindoline in the callus of *Catharanthus roseus*.

**Keywords:** Catharanthus roseus, callus, vindoline, kinetin, auxins

Besides vincristine and vinblastine, around a hundred other indole alkaloids of medicinal properties have been isolated from *Catharanthus roseus* (van Der Heijden et al., 1992). The alkaloid serpentine is a tranquilizer, while catharanthine and vindoline lower blood sugar level, thus reducing the symptoms of diabetes (Goodman and Gilman, 1990). Ajmalicine is used in the treatment of hypertension and obstructive circulatory diseases (Beck, 1984). Lately, the semi-synthetic drug, vindensine (a vinblastine analogue) has been introduced for the treatment of melanoma and lung cancer (Budavari, 1989).

Attempts to improve the yield of such bioactive compounds through cell and tissue culture techniques and metabolic engineering have led to intensive studies on the indole alkaloid biosynthesis and its regulation (Verpoorte et al., 1999 and 1997; Meijer et al., 1993). However, production of secondary metabolites in these undifferentiated plant material is mostly lower than that in the fully developed plant. The production level can be increased by optimization of the media composition or by elicitation (Verpoorte et al., 1997).

Several studies have been carried out on the influence of the concentration of various growth regulators, especially auxins, on the alkaloid production by *C. roseus* cultures (Ganapathi and Kargi, 1990; van Der Heijden et al., 1989). The present study was conducted to examine the effect of plant growth regulators on the production of vindoline in the callus of *C. roseus*.

For callus production, the leaf explant from ornamentally grown plants was cultured on Murashige and Skoog (MS) (1962) medium supplemented with 1.0 mg/l, 2, 4-D in combination with 0.5 mg/l naphthalic acid acetic acid (NAA) for callus induction.

The methanolic extract of plant leaves contains 85.35 μg/g vindoline while stem contains only 10.29 μg/g (Table 1). The results were consistent with the previous experiment of Furmanowa et al. (1994) who found that vindoline and catharanthine were main alkaloids in the leaves of *C. roseus* but vindoline was always dominant.

**Table 1.** Presence of vindoline in *Catharanthus roseus* plant

<table>
<thead>
<tr>
<th>Plant part</th>
<th>Description</th>
<th>Fresh weight</th>
<th>Vindoline μg/g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flower petals</td>
<td>Whitish</td>
<td>1 g</td>
<td>-</td>
</tr>
<tr>
<td>Stem</td>
<td>Green</td>
<td>1 g</td>
<td>10.29</td>
</tr>
<tr>
<td>Leaves</td>
<td>Lush green</td>
<td>1 g</td>
<td>85.35</td>
</tr>
</tbody>
</table>

Callus of *C. roseus* can be a source of indole alkaloids. Plant growth regulators significantly (p<0.05) influenced the biosynthesis of vindoline depending on type and concentration in the medium. The callus produced through different hormones, had two margins, green and white. Level of greenness part also affected vindoline production because vindoline is present in photosynthetic parts of plants and so on in callus. Loyola-Vargas et al. (1986), observed vinblastine and vincristine in white and green lines of callus of *C. roseus* during testing of the effect of various growth regulators on induction of green callus in 3-year-old cell lines. The green line had approx. twice as much of the above mentioned alkaloids as the white one. Vindoline and catharanthine, (monomeric alkaloids) are precursor for vincristin and vinblastin (dimeric alkaloids) as reported by Verpoorte et al. (1997).