Physical Sciences

7-Azaindole Derivatives as Potential Antibacterial Agents
Zafar S. Saify, S.M. Moazzam, Mehrun Nisa, Shakeel Ahmed Khan, Aqueel Ahmed, Shazia Haider, Arshad Aryne, Munawer Khanum, Nudrat Arshad and Mariam Ghani

Synthesis of Some New Substituted Quinazolin-4-3H-Ones as Potent Anticonvulsant Agents
Neha Garg, Trilok Chandra, S. Lata, K.K Saxena and Ashok Kumar

Synthesis of Blue Pigment from Kaolin
Amin Ur Rahman, Faridullah Khan, Muhammad Riaz and Atif Latif

Biological Sciences

Evaluation of the Seed Oil of Three Citrus species, for the Control of the Bean beetle, Callosobruchus maculatus (F) (Coleoptera: Bruchidae)
R. F. Ogunleye

Growth Measurement of Some Amylolytic Bacillus Species in Three Media
Adedayo Olajide Ajayi

Endemicity of Urinary Schistosomasis in Ogbese-Ekiti Community of Ise-Orun Local Government Area of Ekiti State, Nigeria
C.A. Ologunde

Dynamics of Clay Mineralogy With Profile Depth in Relation to Long Term Potassium Fertilizer Application to Sugar Cane Crop
M. Yousuf, S. Ali, M. Waheed and M.S. Akhtar

The Effects of Industrial Soil Pollution on Prosopis juliflora Swartz Growth Around Karachi
Syed Atiq-ur-Rehman and Muhammad Zafar Iqbal

Short Communication

Investigation of Starch Modification Potential of 'Kanwa'-an Alkaline Salt
A.K. Oladele, U.I. Ibanga and J.O. Aina

Technology

Bactericidal Efficacy of Silver Impregnated Activated Carbon for Disinfection of Water
Liaquat Sultana, Ishratullah Siddiqui, Farooq Ahmed Khan and Tanzil Haider Usmani
A 15N Tracer Study to Evaluate the Effects of Nitrogen and Copper Fertilization on Fertilizer Nitrogen Efficiency in Rice Production
Abu Turab Mohammad Ali Choudhury and Mohammad Khanif Yusop
7-Azaindole Derivatives as Potential Antibacterial Agents

Zafar S. Saify a *, S. M. Moazzam b, Mehrun Nisa a, Shakeel Ahmed Khan c, Aqueel Ahmed d, Shazia Haider e, Arshad Aryne d, Munawer Khanum b, Nudrat Arshad c and Marium Ghani c

a H E J Research Institute of Chemistry, University of Karachi, Karachi-75270, Pakistan
b Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Karachi, Karachi-75270, Pakistan
c Department of Microbiology, University of Karachi, Karachi-75270, Pakistan

(Received December 16, 2008; revised February 10, 2009; accepted February 12, 2009)

Abstract. Azaindole analogues, as antimicrobial agent, have shown significant response against a number of gram positive and gram negative bacteria. In the present work, synthesis of novel derivatives of 7-azaindole and their antibacterial and cytotoxic activities are reported.

Keywords: azaindole, antibacterial agent, cytotoxicity

Introduction

Much work has been rendered on the antimicrobial activity of azaindole derivatives (Mushtaq et al., 2008; Saify et al., 1994a; Saify, 1986, 1984) which showed significant response against a number of microorganisms (Minakala et al., 1992). The azaisatogens synthesized by Hooper et al. (1965) were effective against gram positive organisms. Also the 2-pyridyl-6-aza-indoles showed a broad spectrum of antibacterial activity and were generally more effective than the analogues of indoles.

Bayomi et al. (1985a) described the synthesis of various pyrrolo (3,2-b) pyridine-6-carboxylic acid derivatives as potential antimicrobial agents against several gram positive and gram negative organisms. The results of microbial evaluation in vitro of most of the compounds exhibited moderate activity. Remarkable compounds, active against Shigella sonnei, are 1, 4-dimethyl-3-carboxomethoxy, 7-oxo-pyrrolo (3,2-b)pyridine-6-carboxylic acid and 1-methyl, 4-ethyl, 3-carboxomethoxy 7-oxo-pyrrolo (3, 2-b)pyridine-6-carboxylic acid.

In their next communication, Bayomi et al. (1985b) reported the synthesis of a series of 1, 4-dihydro-4-oxo-pyrrolo (3, 4-b) pyridine-3-carboxylic acid as an extension of the interest in fused pyrrolopyridines as potential antimicrobial agent. Few compounds of this series were found to exhibit a relatively broad spectrum of activity.

During the last decade a considerable attention has been focused on azaindole analogues as antimicrobial agents. A series of derivatives of 7-dihydro-4-oxo-7-azaindole-5-carboxylic acid were synthesized by Toja et al. (1986).

One compound of this series, 4,7-dihydro-4-oxo-1, 2-dimethyl-7-ethyl-7-azaindole-5-carboxylic acid, was found to be the most potent antibacterial agent. Mohamed (1992) introduced some new azaindole derivatives as antimicrobial agents. These compounds had high moderate and weak inhibitory effect against the tested gram positive and gram negative bacteria. In a similar attempt, some more azaindole derivatives were prepared showing satisfactory antibacterial activity on the basis of related biological activity (Saeed et al., 1997, Saify et al., 1994b).

Drug resistance to antibiotics and related natural and synthetic drugs poses a great challenge to the chemists, in general, and the drug designers, in particular. Haydon et al., 2008, report the discovery of a class of small synthetic antibacterials, 4,7-Dihydro-4-oxo-1, 2-dimethyl-7-ethyl-7-azaindole-5-carboxylic acid.
**Synthesis of Some New Substituted Quinazolin-4-3H-Ones as Potent Anticonvulsant Agents**

Neha Garg, Trilok Chandra, S. Lata, K. K. Saxena and Ashok Kumar*

Medicinal Chemistry Division, Department of Pharmacology, LLRM Medical College, Meerut-250004 (U.P.), India

(Received May 29, 2008; revised February 10, 2009; accepted February 12, 2009)

*Author for correspondence; E-mail: rajputak@gmail.com

**Abstract.** A new series of 3-(4-(2-(6,8-dibromo-3-(substituted phenyl)-4-oxo-3,4-dihydroquinazolin-2-yl)methyl)hydrazinyl)thiazol-2-yl)-2-phenylthiazolidin-4-ones were synthesized and their structures were elucidated on the basis of elemental analyses and spectroscopic studies (IR, ¹H-NMR). All the synthesized compounds 1-32 were screened for their anticonvulsant activity at a dose of 30 mg/kg. The compound 31 was found to be the most potent compound of this series showing 90% protection against MES.

**Keywords:** benzylidenoquinazolinones, thiazolylquinazolinones, thiazolidinoylquinazolinone, anticonvulsant activity, toxicity

**Introduction**

Quinazolinone derivatives have evoked considerable attention in recent years as these are endowed with a range of pharmaceutical activities. 3H-quinazoline-4-one represents a useful nucleus for preparation of some new anticonvulsant agents, since quinazolines exhibited interesting pharmacological properties like anticonvulsant activity (Georgey et al., 2008; Guan et al., 2007; El-Helby and Wahab, 2003; Zappala et al., 2003) and anti-inflammatory activity (Alagarsamy et al., 2006). Thiazoles and thiazolidinones having different heterocyclic nuclei were found to possess anticonvulsant activity (Shekarchi et al., 2005; Arachana et al., 2003; 2002). In the present study, a new series of 3-(4-(2-(6,8-dibromo-3-(substituted phenyl)-4-oxo-3,4-dihydroquinazolin-2-yl)methyl)hydrazinyl)thiazol-2-yl)-2-phenylthiazolidin-4-ones were synthesized and structures of these compounds were elucidated on the basis of elemental analyses and spectroscopic studies (IR, ¹H-NMR). All the synthesized compounds 1-32 were screened for their anticonvulsant activity at a dose of 30 mg/kg.

**Materials and Methods**

Compound 1 (3,5 dibromoanthranitic acid) synthesized according to the method of Wheeler and Oates (1910) and its reaction with acetic anhydride (Bogert and Seli, 1907) yielded compound 2 (6, 8-dibromo-2-methyl-4H-benzoxazin-4-one). Reaction of the latter with P-hydroxy amline furnished compounds 3-4. Bromination of 6, 8-dibromo-3-(substitute diphenyl)-2-methylquinazolin-4 (3H)-ones i.e., compounds 3-4 yielded 6,8-dibromo-2-bromomethyl- 3-(substituted phenyl) quinazolin-4(3H)-ones i.e., compounds 5-6. These brominated products on treatment with 99% hydrazine hydrate afforded 6,8-dibromo-2-hydrazinylmethyl-3-(substituted phenyl) quinazolin-4(3H)-ones i.e., compounds 7-8, which on reaction with chloroacetylchloride gave 2-chloro-(6,8-dibromo-3-(substituted phenyl)-4-oxo-3, 4-dihydroquinazolin-2-yl) methyl acetohydrilde compounds 9-10; these were converted to thiazole congeners i.e., 2-(2'-aminothiazol-4'-yl) hydrazinyl) methyl)-6,8-dibromo-3-(substituted phenyl) quinazolin-4(3H)-ones (compounds 11-12) by the reaction of thiourea. The compounds 11-12 reacted with different aromatic aldehydes to give 2-(2’-(benzylideneneamino-thiazol-4’-yl) hydrazinyl)-6, 8-dibromo-3-(substituted phenyl) quinazolin-4(3H)-ones (compounds 13-22). Substituted benzylidene congeners 13-22 were cyclized on reacting with thioglycolic acid in the presence of a pinch anhydrous ZnCl₂ to yield 3-(4-(2-(6, 8-dibromo-3-(substituted phenyl)-4-oxo-3, 4-dihydroquinazolin-2-yl)methyl)hydrazinyl)thiazol-2-yl)-2-phenylthiazolidin-4-ones (compounds 23-32).

The melting points of compounds were determined in open capillaries and are uncorrected. Homogeneity of the synthesized compounds was routinely checked by thin layer chromatography on silica gel-G plates. The eluent was a mixture of different polar and nonpolar solvents in different proportions and spots were located in iodine chamber. The IR spectra were recorded on Bruker IFS-66 V FT IR (ν_max in cm⁻¹). The ¹H NMR spectra were recorded by Bruker DRX-400 FT NMR instrument using CDCl₃ and DMSO-d₆ as solvent and tetramethyl silane (TMS) as internal reference standard. All chemical shift (δ) values were recorded in ppm. Elemental analysis (CHN) of these newly synthesized compounds was performed by elemental analysis apparatus.
Synthesis of Blue Pigment from Kaolin

Amin Ur Rahman*, Faridullah Khan, Muhammad Riaz and Atif Latif
Materials Science Center, PCSIR Laboratories Complex, Peshawar-25120, Pakistan

(received December 18, 2007; revised January 14, 2009; accepted January 19, 2009)

Abstract: Kaolin of Swat NWFP, Pakistan was analyzed and its suitability was tested for utilizing the raw material for the synthesis of blue pigment. It was successfully utilized for the preparation of ultramarine blue pigment by subsequent reductive and oxidative heating with other ingredients. The pigment was characterized by UV-Vis, IR spectrophotometry and XRD.

Keywords: kaolin, ultramarine blue, pigment, Swat, Pakistan

Introduction

Ultramarines family of pigments are derived from sodalite (6NaAlSiO₄·2NaCl) doped with sulphur and are used in the manufacture of textiles, synthetic fibers, detergents, soaps, plastics, toys, ropes and mats, cosmetics etc. The catalytic activity of ultramarine is also reported and is thus used for dehydrogenation, dehydro-sulphurization, cracking and isomerization purposes (Kowalak et al., 2004).

Natural ultramarines i.e., lazurite and lazuli are known. Ultramarine is available in different colours and shades i.e., blue, reddish blue, greenish blue, red, pink and violet. Ultramarine blue consists of alumino-silicate framework, containing sodium cations and poly-sulphide anions (S₂⁻, S³⁻) (Tarling, et al., 1988) in which the S³⁻ species are dominant over S²⁻. The S³⁻ is responsible for the intense blue colour of the pigment.

Basic raw material for ultramarine is kaolin (Booth et al., 2003; Cork, 1993). Kaolin is largely used in ceramics and as filler in paper, plastics and rubbers. Synthesis of ultramarine is still based on J. B. Guimet method (Kowalak et al., 2004). The aim of the present research was production of ultramarine blue for industrial use utilizing kaolin (Al₂Si₂O₅(OH)) of Swat, NWFP, Pakistan. Kaolin deposits of Swat lie 34° 53′ 30″ N, 72° 53′ 30″ E and are among the oldest known kaolin deposits of Pakistan (Siddiqui et al., 2005). The reported deposits of Swat kaolin are 2.5 million tons (Yotoni et al., 1967).

Materials and Methods

Kaolin sample was collected from Shah Dehri, Swat, NWFP, Pakistan. The sample was analyzed gravimetrically (Furman, 1962) and trace metals were determined using atomic absorption spectrophotometer (Hitachi Z8000, Japan) (Table 1). Moisture content, water-soluble content and pH of the sample were also determined (Table 2).

Steps of pigment production are given in the flow diagramme (Fig. 1). Kaolin sample was activated/dehydrated at 700 °C in a muffle furnace for 2 h and afterwards mixed with sodium carbonate and charcoal in optimized ratio. The mixture was then finely grinded and blended with fine sulphur. All the chemicals were of commercial grade. The blend was packed in ceramic vessel, covered with mud, kept in muffle furnace and heated to 800 °C for 5 h. After cooling the reduced greenish product was grinded and heated in open air in a china dish, till the colour changed to blue. The blue pigment was washed with hot water several times and then with 10% sodium hydroxide solution to remove soluble matter i.e., sulphates. The product was then dried in air.

Fig. 1. Flow diagram for the production of blue pigment from kaolin

* Author for correspondence; E-mail: aminpcsir@yahoo.com
Introduction

Insects constitute 85% of all the known animal species (Richards and Davies, 1977), nearly one thousand species of which are associated with stored products (Banks, 1999); majority of them belong to Coleoptera (beetles) and Lepidoptera (moths) (Rees, 2004).

Production of cowpea, *Vigna unguiculata*, the most widely consumed and affordable source of protein in the tropics, is plagued by the field and storage insect pest infestation; some of them include *Aphis cracivora* (K), *Mealurothrips sjostedti* (T), *Maruca virata* (testulalis) (Fab), *Clavigralla tormentosicolis*, *Riptortus dentipes* and *Ootheca mutabilis* (Singh et al., 1990; Booker, 1965).

Dry cowpea seeds are infested by field-to-storage insect pests; damage by one of them i.e., *Callosobruchus maculatus* often leads to deterioration both in the quantity and quality of the produce. Caswell (1981) reported an annual cowpea damage of 24,000 tonnes due to infestation by *C. maculatus*. One hundred percent damage can be recorded within six months of the storage (Seek, 1993).

The most effective means of controlling this notorious pest is the use of synthetic insecticides (Obeng-Ofori and Dankwah, 2004; Anyim, 2003), continuous usage of which has produced some undesirable effects through inhalation of insecticidal dusts and residues. Apart from the high cost, chemicals also have adverse effects on non-target micro- and macro-fauna components of both aquatic and terrestrial ecosystems (Elhag, 2000).

In a bid to curtail the adverse effects of these synthetic insecticides, the activities of some cheap and environmentally friendly botanicals have been evaluated and found effective (Ogunleye, 2004; Tapondjou, 2002; Keita et al., 2001; Ogunleye, 2000). Linalool is a natural occurring terpene alcohol found as a major constituent of the essential oils of *Citrus sinensis* (Rutaceae) and *Occimum basilicum* (Lamiaceae) among others. It is also used by professionals as a flea and cockroach insecticide (Wikipedia, 2008a).

Plant-derived-oils have been used as repellant and antifeedant on insect pests by Akou-Edi (1985). According to him, laboratory trials in Togo using red corn treated with neem oil at concentrations of 1, 2, 3, 4 and 5 ml/kg infested with confused flower beetles and corn weevils showed significant difference between the treated and untreated samples. Addition of a little vegetable oil to stored rice or legumes for protection against stored insect pests has been established by researchers. Modes of action, appropriate dosage and duration of efficacy of oils on storage insect pests have been investigated by various workers (Rahman and Talukder, 2006; Singh, 1993).

Mwaiko (1992) reported that *Citrus* peel oil extracts was successfully used as mosquito larvae insecticides. Present study was made of the oils of ripe and unripe fruits of three citrus species namely *Citrus sinensis*, *C. paradisi* and *C. aurantifolia* with reference to their effect on cowpea bruchid *Callosobruchus maculatus*.

Materials and Methods

Collection of samples. Seeds of ripe and unripe fruits of *C. sinensis*, *C. paradisi* and *C. aurantifolia* were collected from a farm land in Okitipupa local government area of Ondo State, in western Nigeria. The collected seeds were spread on the laboratory tables under ambient conditions of temperature 37 °C and humidity 51%, for a period of 3 months for complete air drying. They were then grinded with a Kenwood blender to

Abstract. On application of the seed oil of ripe and unripe fruits of *Citrus sinensis*, *C. paradisi* and *C. aurantifolia* to the cowpea bruchid, *Callosobruchus maculatus* (F) for three days, a dose of 0.5 ml of *C. sinensis* gave, significantly, high mortality rate upto 85%. In case of *C. aurantifolia*, mortality ranged from 75% to 100%. Same least dosage of seed oil of ripe *C. paradisi* produced 58.8% to 100% mortality, whereas, except the dose of 0.5 ml, all the other treatments of unripe *C. paradisi* resulted in 100% mortality after 24 h.

Keywords: pest control, *Citrus* seed oils, bean beetle, *Callosobruchus maculatus*
Growth Measurement of Some Amylolytic Bacillus Species in Three Media

Adedayo Olajide Ajayi
Department of Microbiology, Adekunle Ajasin University, P.M.B 001, Akungba-Akoko, Ondo State, Nigeria
(received August 8, 2007; revised January 13, 2009; accepted January 16, 2009)

Abstract. Study of the growth pattern of some Bacillus species on starchy substrates showed that the metabolic activity affected the enzymatic activity. B. subtilis (WBS), B. licheniformis (WBL) and B. coagulans (MBC) generally had higher growth rate. B. circulans (SBC) and B. coagulans (WBC) had higher growth on cornstarch medium with corresponding higher β-amylase production as compared to other strains such as B. polymyxa. Ten of the 13 Bacillus species studied had better performance on cornstarch than on soluble starch except B. macerans (MBM), B. macerans (SMB2) and B. subtilis (WBS). The enzyme production ranged from 0.022 unit/cfu x 10^2 to 0.912 unit/cfu x 10^2 on cornstarch and 0.01 unit/cfu x 10^2 to 0.693 unit/cfu x 10^2 on soluble starch. Relatively higher α-amylase activity was observed in B. subtilis, B. licheniformis, B. macerans and B. circulans (WBC1).

Keywords: Bacillus sp., starch, beta amylase production, enzymatic activity

Introduction

Many environmental factors and culture media components greatly affect the metabolic processes in microorganisms. Ajayi and Fagade (2006), Lin et al. (1997) and Amoa-Awua and Jakobsen (1995), in their study demonstrated the metabolic activity of some microbial strains and the corresponding enzymatic productivity. Previous researches have also shown that medium composition affects enzymatic activities as well as sporulation in some microorganisms including Bacillus sp., (Ajayi and Fagade, 2006; Ray et al., 1995). Starch induces amylase production but there are reports indicating that starch may not be required for amylase production probably in organisms having constitutive enzymes (Shittu et al., 2005; Srivastava and Baruah, 1986; Burbidge and Collier, 1958). Thus the nature of substrate, including the nitrogen source and mineral element components of culture medium, affects metabolic processes in the microorganisms.

Bacillus species and other forms of microorganisms grow at different rates with specificity to different substrates in culture medium (Tobey and Yosten, 1977). The growth conditions also influence their enzymatic activities (Nortermann, 1992). Generally, media composition, cultural conditions, microbial cell biochemistry and physiology play vital roles in amylase producing mechanisms of Bacillus species (Bezbaraus et al., 1994; 1987).

In the present work, study was made of the growth of 13 amylase producing Bacillus species on starch and their corresponding amylase production activity, also with reference to carbon source.

Materials and Methods

The Bacillus strains for this study were obtained from wastewater, soil and milk sources in Ibadan, Oyo State, Nigeria. A sporulating chemically defined medium was employed to aid the suitable growth and recovery of Bacillus species, as described by Leicth and Collier (1996). Amylolytic Bacillus sp., were identified by standard microbiological techniques (Kotzekidou, 1996) and selected for final study by using starch hydrolysis procedure (Cowan and Steel, 1985; Difco, 1984).

Each organism was sub-cultured in nutrient agar medium and incubated for 24 h at 35 °C. Loopful of each sample was transferred to test tube containing sterile distilled water, thoroughly mixed and serially diluted to provide a homogeneous liquid suspension to be used as inoculum containing an estimated 10^6/cfu/ml of broth. Pour plate count technique and microscopy was used for the estimate. Samples were plated out immediately.

The growth pattern of Bacillus strains were studied by culturing the samples in different media supplemented with cornstarch, soluble starch and compared with the nutrient broth medium that served as the base medium. One ml of the appropriate dilution with similar range of count was inoculated into nutrient broth base medium supplemented with different carbon sources specified above and the nutrient broth base without supplement. This was cultured for 24 h at 37 °C. Ten fold dilution was made for each sample and analyzed at 6
Endemicity of Urinary Schistosomiasis in Ogbese-Ekiti Community of Ise-Orun Local Government Area of Ekiti State, Nigeria

C. A. Ologunde
Department of Science Technology, The Federal Polytechnic, Ado-Ekiti, Ekiti State, Nigeria

(abstract March 28, 2006; revised July 7, 2008; accepted July 12, 2008)

Abstract. In random examination of 191 students of Ogbese-Ekiti community of Nigeria for urinary schistosomiasis, 170 (89%) were found positive for *Schistosoma haematobium* eggs in their urine. The prevalence in the secondary school was 97.4%, while the prevalence in the primary school was 87.5%. The overall mean intensity of *S. haematobium* eggs/10 ml of urine in this community was 339.4. Also, 5.9% of the infected pupils excreted above 1000 eggs/10 ml of urine, while 59.8% had moderate intensity (50-499 eggs/10 ml of urine). The percentage macrohymaturia was 84. Among five aquatic snails *Bulinus (B) forskali*, *Bulinus (B) globosus*, *Pila ovata*, *Potadoma moerchi* and *Melanoides tuberculata* of river Ogbese, only *B. (P) globosus* shed the characteristics cercariae of *S. haematobium*. A monthly mean of *B. globosus* in river Ogbese was 53.2 and an increase in the population density of the snail occurred between November and May, 2004. The highest infection rate of *B. (P) globosus* with *S. haematobium* occurred in the month of March.

Keywords: schistosomiasis, aquatic snail, *S. haematobium*, Ogbese-Ekiti

Introduction

Schistosomiasis is widespread in tropical Africa and considerable amount of work has been done on African schistosomiasis (Cowper and Woodword, 1961). The prevalence of the disease and the distribution of the snail intermediate hosts differ in different parts of the continent (WHO, 1980). Schistosomiasis endemic in Nigeria (Adewumi *et al.*, 1991; Ozumba *et al.*, 1989; Edungbola, *et al.*, 1988). Investigation carried out in Nigeria indicates a widespread and intensive transmission of schistosomiasis, with exceptionally high prevalence of the disease among children living where water based activities are very common (Akogun and Okin, 1993; Betterton, 1984). The status of urinary schistosomiasis in southwestern Nigeria has been the subject of many publications (Okoli and Odaibo, 1999; Mafiana and Adesanya, 1994; Cowper and Wood Ward, 1961). The status of urinary schistosomiasis in each of the Local Government Areas of Ekiti State has already been documented (Ologunde, 2004). Ogbese-Ekiti is located in Ise-Orun Local Government Area of Ekiti State and no published data is available on the status of urinary schistosomiasis in this community. This paper describes the status of urinary schistosomiasis in Ogbese community of Ise-Orun Local Government Area of Ekiti State, Nigeria.

The study area – Ogbese-Ekiti. The study area, Ekiti-State of Nigeria is situated between latitudes 7°.15’N to 8°.10’N and longitudes 4°.45’E to 5°.45’E. Osun, Kwara, Kogi and Ondo States bound Ekiti-State. Ekiti-State lies in the southern climatic belt, which is characterized by the rainy season of about eight months (March-October) and the dry season of about four months (November-February) (Barbour *et al.*, 1982). Ogbese river which is the major source of water to all inhabitants of Ogbese-Ekiti is a stretch of several kilometers that runs through several communities in Ekiti, Ondo and Edo States. The river is rich in aquatic vegetation, particularly *Nymphaea lotus*, *Pistia stratiotes*, *Ludwigia octovalvi*, which alter in density from season to season. During the dry season, many pockets of water are found along the river course. Human activities in river Ogbese include swimming, fishing, washing of legs, clothes and vehicles, wading and using water for domestic purposes.

Materials and Methods

Collection and examination of urine. Three schools (two primary and one post primary) in Ogbese-Ekiti were surveyed for urinary schistosomiasis (Table 1). Total student population of these three schools was 602. School children were randomly selected from the names in class registers to participate in the survey. Urine samples were collected from 191 school children aided by their class teachers between 10.00 and 13.00 h and the samples were labelled appropriately. In the laboratory, each of the sample was thoroughly mixed to ensure even distribution of contents. An aliquot of 10 ml of each sample was centrifuged at 2000 rpm for 5 min. The supernatant (9 ml) was decanted and the sediment was pipetted on to microscopic slides and the number of eggs were counted using hand counter. The number of eggs in 10 ml of each urine sample was calculated from the mean of results of two counts...
Dynamics of Clay Mineralogy With Profile Depth in Relation to Long Term Potassium Fertilizer Application to Sugar Cane Crop

M. Yousaf*, S. Ali, M. Waheed and M. S. Akhtar

University of Arid Agriculture, Rawalpindi, Pakistan
National Agricultural Research Centre, Islamabad, Pakistan

(Received June 21, 2007; revised December 28, 2008; accepted January 1, 2009)

Introduction

Potassium requirements of plants are mostly met from soil K resources. With respect to availability to plants, soil K exists as structural, exchangeable and soluble potassium. Mineral K occurs as mica and feldspars and amounts to about 98% of all the soil K, while readily available form of K is only 1-2% and occurs as exchangeable and soluble potassium. Sugar cane takes up K from solution that is buffered with exchangeable and structural potassium of soil system. Therefore, solution K depletion due to plant growth enhances weathering of mica and K feldspars. Among the two types of mica, biotite weathers at a rate faster than muscovite. Hence, biotite in soil system maintains greatest solution K than muscovite. Potassium feldspars in fine silt and clay fraction serves as an important source of K, though usually less significant than mica. Bajwa (1989) and Al-Ravi and Al-Mohammadi (1979) inferred that amongst the feldspars, only orthoclase is important in releasing potassium.

Mica on weathering is transformed to vermiculite with concurrent release of interlayer K (Fanning et al., 1989). Mineral vermiculite entraps added K and renders it unavailable to plants. On K fixation, the expensive minerals, beidellite and vermiculite contract and revert to mica-like-structure (Alexiades and Jackson, 1965).

Mittal et al. (1989) observed that increasing cropping intensity resulted in depletion of soil K, yet the intensity of K depletion was associated with cropping and fertilizer scheme. Akhtar and Ali (1993) also reported K depletion with intensive cultivation of rice-wheat without fertilizer K in an alluvial camborthid soil. Tributh et al. (1987) observed that removal of K by plants results in depletion of interlayer K in illite followed by the degration of clay minerals. Cropping without K application enhanced the depletion of structure K from mica minerals leading to the transformation of mica to vermiculite and smectite. The removal of K by plants resulted in depletion of interlayer K from illite and an increase in smectite minerals. These phenomena induce changes in clay mineralogy in soil profile with depth.

Singh and Goulding (1997) observed no changes in mica and no K depletion in 153 years experiment on soil that was put under winter wheat cultivation at Rothamsted Experiment Station. However, contrary to this, Srivastava et al. (2002) observed depletion of non-exchangeable K in 27 years in NP treatment compared to NPK+FYM in alluvial mixed mineralogy in typic ustochrept soil under maize-wheat-cowpea cropping system.

Shaikh et al. (2007), in a five year study of mineral composition of Ustic Haplocamborthid soils of Sindh, under cotton-wheat system, observed that NPK treatment has more mica in coarse and fine clay fractions in AP (0-14 cm) horizon than control and NP treatments, indicating greater weathering of mica in NP than NPK treatment in surface horizon wherein K-less treatment increased weathering of sand and silt size mica. Dhaliwal et al. (2006) observed that soils containing sufficient quantity of K fix lower quantity of K.

Fertilizer application to sugar cane in Pakistan is primarily skewed towards nitrogen, followed by phosphorus and only nominal quantities of potassium are applied. The sugar cane crop of 125-Mg/ha removes about 168 kg K/ha per year.

Abstract. The experiment consisted of treatment of sugar cane crop with N, NP, NPK and farmyard manure and determination of its effect on soil mica, vermiculite and montmorillonite over a period of 18 years. The NPK treatment had greater mica in coarse clay, but less in fine clay than NP and control treatments. Vermiculite in coarse clay fraction, in NPK treatment, increased with the depth as compared to other treatments. The fertilizer treatment effect on smectite content was obvious only in AP horizon in fine clay fraction.

Keywords: clay mineralogy, potassium fertilizer, sugar cane
The Effects of Industrial Soil Pollution on *Prosopis juliflora* Swartz Growth Around Karachi

Syed Atiq-ur-Rehman* and Muhammad Zafar Iqbal
Department of Botany, University of Karachi, Karachi - 75270, Pakistan

*(received August 22, 2008; revised January 6, 2009; accepted January 10, 2009)*

**Abstract.** Study of the effect of soils of towel, garment, rubber and ply-wood factories of Korangi and Landhi industrial estates of Karachi and that of the University of Karachi on the growth of *Prosopis juliflora* Swartz plants growing in these areas demonstrated detrimental effect of industrial soils on the growth of plants of all the areas particularly on the plants growing at the University site.

**Keywords:** plant growth, *Prosopis juliflora*, soil pollutants, industrial pollution

**Introduction**

Rapid industrialization and phenomenal growth in population have created environmental pollution problem in Karachi city (Iqbal and Shafiq, 1999a). Major contributors to the environmental degradation include the industrial sector. Naqvi and Khattak (1995) reported increased amount of heavy metals, chromium, nickel, copper and lead in the waste effluents of Landhi Industrial Trading Estate of Karachi, Pakistan. Kullberg (1974) has described damages to vegetation caused by industrial effluents particularly to water plants. Iqbal and Qadir (1973) observed higher reduction in seed germination, root and shoot length in seeds collected from the industrial polluted areas as compared to other areas. Various kinds of industrial pollutants have adverse effects on *Triticum aestivum* var. UP-262 (Habib and Iqbal, 1996). Physical properties of soil, such as soil strength, bulk density, texture and structure, influences greatly the root penetration, growth and yield of various crops (Gerard *et al.*, 1982).

*Prosopis juliflora* (Family, Mimosaceae) is a perennial deciduous thorny shrub/small tree, used as forage for cattle. It provides fuel wood; its timber stabilizes sand dunes and it is used as shade plant and wind breake also (Khoshoo and Subramanyam, 1985). *P. juliflora*, *Abutilon indicum* and *S. holosericea* are distributed world-wide (Atiq-ur-Rehman and Iqbal, 2008). It is found in South Africa, India, West Indies and Mexico and has been recorded in Pakistan as well. *P. juliflora* is the most dominant species of plants growing in the Karachi University and is among the eight leading species of plants growing in the vicinity of Korangi and Landhi industrial areas (Atiq-ur-Rehman, 2007). In soil of Malir river, some heavy metals such as lead, copper and zinc were detected in large amounts, which influenced the composition of plant communities at this locality (Qamar-uz-Zaman and Iqbal, 1994).

In the present study, an effort has been made to study the destructive and hazardous role of towel, garment, rubber and ply board industries etc. in the proximity of Korangi and Landhi industrial places of Karachi, with reference to their effect on growth of *P. juliflora* in comparison to that of the Karachi University soil and plants.

**Materials and Methods**

The experiment was conducted in greenhouse at the Department of Botany, University of Karachi under uniform natural environmental conditions. Healthy and uniform-sized seeds of *Prosopis juliflora* Swartz, were chosen from Korangi and Landhi industrial areas of Karachi and Karachi University Campus. Due to hard seed coat, the seeds were slightly cut at one end and sown in garden soil (loam soil) at 1 cm depth in large pots, and were irrigated daily. After 21 days, uniform-sized seedlings were transplanted to pots of 19.8 cm dia and 9.6 cm depth, in soils collected from a towel, a garment, a tech rubber and a tech ply board factories of the Korangi and Landhi industrial areas of Karachi at 0.30 cm depth. The soil of Karachi University was used as control. 50% Soil of the respective areas (including control) was mixed with 50% garden soil (one part manure + two parts fine sand), since, in the preliminary studies, pure soils of the industrial area hardly showed any response to seed germination and seedling growth. There were six replicates for each treatment and the experiment was completely randomized. Only one seedling was grown in each pot and plants were irrigated daily. Every week, pots were reshuffled to avoid light/shade or any other greenhouse effect. Seedling height, number of leaves and plant cover were recorded after every week for eight weeks.
Investigation of Starch Modification Potential of ‘Kanwa’ – an Alkaline Salt

A.K. Oladele*a, U.I. Ibanga*a and J.O. Aina*b

*aDepartment of Food Technology, FCFFT, New Bussa, Niger State, Nigeria
*bDepartment of Food Technology, University of Ibadan, Nigeria

(received May 14, 2008; revised January 23, 2009; accepted February 10, 2009)

Native starches are unsuitable for many industrial applications due to poor characteristics exhibited under processing conditions such as extreme temperature, high shear pressure and diverse pH (Wang et al., 1993). Modified starches in comparison have generally better paste clarity, gel stability, increased resistance to retrogradation, increased solubility and improved freeze-thaw stability which increase their application as stabilizer, filler, binder and adhesive. Starches are modified by physical, enzymatic, biological and chemical methods in order to reduce their limitations in industrial uses. Chemical modification of cassava and other plant starches with improved qualities and applications have been reported by several workers (Ahmed et al., 2005; Iyothi et al., 2005; Nurulislam and Azemi, 1997). Use of naturally occurring food products as starch modifying agents has been advocated. Some natural products such as alum and ginger have been reported to improve the functional properties of cassava starches (Daramola and Osanyinlusi, 2006; Lee et al., 1995). ‘Kanwa’ also known as ‘tronca’ or sodium sesquicarbonate is a naturally occurring alkaline rock salt with trace amounts of Ca, Mg, Fe, Zn, S, Cl, Si, P and K (Makanjuola and Beetlestone, 1975). It is used not only as a tenderizer but also as a flavouring agent, food preservative and as a prophylactic (Uzogara et al., 1988). It is relatively inexpensive, less hazardous and requires less safety precautions in use. Although its food uses have been established, information on its starch modification potential is not available in literature.

The present work aims at modifying cassava starch with low ‘kanwa’ concentrations and determines the pasting properties of the modified starches. For this purpose starch was extracted from an improved cassava variety 82/00058, aged 12 months at harvest, obtained from International Institute of Tropical Agriculture (IITA) Ibadan, Nigeria. Subsequently, cassava roots were grated, water was added and the slurry was sieved. The filtrate was allowed to settle for 24 h before decantation. The starch was drained, dried and milled into powder. ‘Kanwa’ was purchased from a retail market in Ibadan and used without further treatment while other chemicals used were of analytical grade.

The slurry method described by Agboola et al. (1991) was employed for the preparation of the modified cassava starches. Whereas unmodified (native) starch was used as control.

The yield of the substituted starch on a dry matter basis, solubility at 60 °C, swelling power, ash and moisture content of native and substituted starches were determined (AOAC, 1980; Smith, 1967; Leach et al., 1959).

Moreover, pH of the samples, paste clarity, pasting properties and freeze-thaw stability over four cycles were also determined. (Craig et al., 1989; Knight, 1974; Smith, 1967). Analysis was carried out in triplicate except pasting properties which were determined only twice.

The values obtained for some of the physical and functional properties of ‘kanwa’-modified starches are shown in Table 1. Yield of the modified starches was high and varied with kanwa concentrations ranging between 90.5-95.7%. This shows that leaching of the starch constituents is reduced at alkaline conditions unlike acidic conditions which reduced yield through thinning of the starch (Ahmed et al., 2005; Lawal et al., 2004). Increase in ‘kanwa’ concentration from 0.1 to 1.0% increased the yield. The swelling power of the modified starches (4.9 - 5.3) was higher than that of the native (unmodified) starch (3.5). This could be attributed to weakening of the starch...
Bactericidal Efficacy of Silver Impregnated Activated Carbon for Disinfection of Water

Liaquat Sultana*, Ishratullah Siddiqui, Farooq Ahmed Khan and Tanzil Haider Usmani

*Food and Marine Resources Research Centre, PCSIR Laboratories Complex, Karachi-75280, Pakistan
bCentre for Environmental Studies, PCSIR Laboratories Complex, Karachi-75280, Pakistan

(Received April 4, 2008; revised January 4, 2009; accepted January 6, 2009)

Introduction
For provision of safe drinking water, the bacteriological quality of water is of paramount importance in addition to monitoring of indicator bacteria such as coliform and faecal coliforms, effective gadgetries and means and devices for providing safe drinking water, as per WHO standards (WHO, 1984).

The germicidal effect of silver was first explored by Carlon in 1893; since then several devices containing silver as water disinfectant have been proposed and their bactericidal efficacy has been investigated (Kim et al., 2008; Bell, 1991; Pierce et al., 1978; Berger et al., 1976; Barranco et al., 1974; Spadaro et al., 1974). In addition to being bactericidal, silver also increases the lability of viruses when used for disinfection of water (Mahnel and Schmidt, 1986). Some bacteria can develop resistance to silver (Russell et al., 1994) but other evidence suggests that no resistant strains have been encountered clinically (Lansdown, 2002). Activated carbon/coal-based sorbents have been observed to remove enteric viruses satisfactorily (Chaudhri and Sattar, 1989; 1986). Activated carbon is unique and versatile adsorbent because of its extensive surface area, microporous structure and high adsorption capacity; hence, it is widely used as filter medium in drinking water purification devices (Jayadev and Chaudhri, 1990; Osman and Chaudhri, 1990; Prasad and Chaudhuri, 1989; Protheroe et al., 1989; Tikhonova et al., 1989). Activated carbon is also assuming increasing importance in the control of air pollution, in purifying and controlling the general chemical environment, in certain biomedical applications and for removal of organic matter from water and wastewater (Usmani et al., 1994).

In the present work, samples of granular activated carbon, prepared locally from an indigenous raw material, and imported granular carbon were coated with silver and used for disinfecting water. The objective of the study is to assess and compare the disinfection efficacy and capability of the two types of silver coated products, separately as well as mixed with untreated graded sand.

Materials and Methods
The imported activated carbon used in this study was granular carbon of M/s. Norit, Holland. The locally produced granular activated carbon was prepared from coconut shells. The shells were first disintegrated in a pilot disintegrator followed by carbonization in an inert atmosphere of nitrogen void of air and then physically activated with a mixture of superheated steam and air in a fluidized bed reactor (Usmani et al., 1999). Both activated carbon samples i.e. imported (I) and locally produced (L), were broken in a rod mill, classified to a particle size of 1.00-2.00 mm on a sieve shaker and then utilized for impregnation of silver. The samples were initially washed thoroughly with water to get rid of any foreign material etc., and then dried at 120 °C to constant weight, prior to silver coating.

Silver was impregnated on both carbon samples by the method described by Beg et al. (1986) for the treatment of sand. Briefly, 500 g of graded, washed and dried sample of each activated carbon was treated with 0.1% A.R. grade silver nitrate solution, allowed a maturing time of one h and then treated with 10% sodium hydroxide solution. Carbons samples were then initially treated with 10 ml 1:1 NH4OH solution and afterwards with 15 ml of reducing sugar solution washed with distilled water to pH 7 and then finally dried at 120 °C.

Abstract. When highly contaminated water was passed through two types of silver coated activated carbon and their mixtures with sand, the former was found to be far better medium for disinfection of water, with bactericidal efficacy of about 2.5 times that of the latter.

Keywords: bactericidal efficacy, activated carbon, water disinfection, silver impregnation
A $^{15}$N Tracer Study to Evaluate the Effects of Nitrogen and Copper Fertilization on Fertilizer Nitrogen Efficiency in Rice Production

Abu Turab Mohmmad Ali Choudhury** and Mohammad Khanif Yousop

**Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad 38040, Pakistan

†Department of Land Management, Faculty of Agriculture, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia

(received April 6, 2008; revised January 23, 2009; accepted January 26, 2009)

Abstract. In the study of the effects of nitrogen and copper fertilization on rice yield when four rates of N (0, 60, 120 and 180 kg N/ha) as $^{15}$N labelled urea and three rates of Cu (0, 5 and 10 kg Cu/ha) were applied, grain yield increased significantly with increasing N rates up to 120 kg N/ha. The recovery of fertilizer N was around 40% irrespective of N and Cu rates. Copper application at 10 kg/ha increased grain yield by 0.53 t/ha insignificantly. Cu content in the straw was below the critical deficiency level of 6 mg/kg. Thus higher rate of Cu fertilizer (above 10 kg/ha) in soil increase rice yield and fertilizer N efficiency if Cu is applied as basal. Alternately, Cu may be applied as foliar spray on standing crop to avoid Cu adsorption in the soil.

Keywords: $^{15}$N tracer study, copper, rice, fertilizer nitrogen efficiency

Introduction

Rice is the main food crop of an estimated 40 percent of the world’s population (Buresh and De Datta, 1990). The rice crop removes from 16 to 17 kg N and 8 g of Cu for the production of one ton of rough rice including straw (Choudhury and Kennedy, 2005; Sahrawat, 2000; Ponnamperuma and Deturck, 1993; De Datta, 1981). Most of the rice soils of the world are deficient in N and biological nitrogen fixation by cyanobacteria and diazotrophic bacteria meets only fraction of the N requirement (Sattar et al., 2008; Hashem, 2001; Baldani et al., 2000; Tran Van et al., 2000). Fertilizer N applications are thus necessary to meet the crops demand. In wetland rice soils, the availability of water soluble Cu decreases due to decrease in redox potential (Ponnamperuma, 1985, 1972). Cu deficiency in soil increases sterility in rice grain resulting in a decrease in the yield (Ambak and Tadano, 1991). This problem can be solved by applying proper amount of Cu fertilizer.

The largest rice growing area of Malaysia is located in the Muda Irrigation Scheme, Kedah that covers an area of about 95,000 ha. Recent investigations showed that there is a tendency of yield decline in many sites of this area due to Cu deficiency (Samy et al., 1992a). Investigations showed that soils of some locations of this irrigation scheme are deficient in Cu (Choudhury and Khanif, 2000a). Farmers are applying a single fertilizer dose of 80 kg N/ha, 30 kg P$_2$O$_5$/ha and 20 kg K$_2$O/ha in rice fields throughout the Irrigation Scheme (Samy et al., 1992b). Indiscriminate application of fertilizers throughout the irrigation scheme caused low yield in many locations due to Cu deficiency. Cu fertilization may result in increased rice yield as well as fertilizer N efficiency. The $^{15}$N tracer technique is used as the precise method to estimate fertilizer N use efficiency (Cong et al., 2008; Fan et al., 2007; Kongchum et al., 2007; Nishida et al., 2007).

The present study was undertaken to evaluate the effects of N and Cu fertilization on rice yield and fertilizer N efficiency using the $^{15}$N tracer technique.

Materials and Methods

A greenhouse experiment was conducted at Universiti Putra Malaysia to evaluate the effects of N and Cu fertilization on rice yield and fertilizer N efficiency. The study was conducted in two soils (Idris and Tebengau series). In this paper the findings on one soil (Idris series) are discussed. The taxonomy of the soil is typic plinthaquept, very fine clayey, mixed, isohyperthermic, pallid (Paramananthan, 1998). The soil was collected from rice growing areas of the Muda Irrigation Scheme, Kedah, about 500 km north of Kuala Lumpur, Malaysia. Soil samples were collected from 0-15 cm depth, air dried, ground and sieved through 2 mm sieve. Soil was analysed for organic matter, pH, cation exchange capacity (CEC), total N and available Cu. Organic matter was analysed by potassium dichromate and sulphuric acid digestion method (Walkley and Black, 1934). Soil pH was measured by glass electrode (Peech, 1965). Total N was determined by sulphuric-salicylic acid digestion method (Walkley and Black, 1934). Soil pH was measured by glass electrode (Peech, 1965). Total N was determined by sulphuric-salicylic acid digestion method (Walkley and Black, 1934). Soil pH was measured by glass electrode (Peech, 1965). Total N was determined by sulphuric-salicylic acid digestion method (Walkley and Black, 1934). Soil pH was measured by glass electrode (Peech, 1965). Total N was determined by sulphuric-salicylic acid digestion method (Walkley and Black, 1934). Soil pH was measured by glass electrode (Peech, 1965). Total N was determined by sulphuric-salicylic acid digestion method (Walkley and Black, 1934).