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Origin of Opal-CT in Lower Eocene Tallahatta Formation, Mississippi, USA and Pleistocene Barind Clay Formation in Bangladesh: A Comparative Study

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Abstract. Opal-CT mineral in the lower Eocene Tallahatta formation in Mississippi, USA and the Pleistocene Barind clay formation in Bangladesh is of volcanogenic origin. X-ray diffraction patterns of claystones in the former indicated more ordered condition of the older sediments than those of the latter, which may be due to higher burial temperatures and longer time interval for transformation from volcanic ash to opal-CT of the former. Glass shards, present in the latter sediments, were not identified in the former, which may be due to transformation of glass shards of volcanic ash to opal-CT over the time.

Keywords: opal-CT, glass shards, Tallahatta formation, Barind clay formation, Bangladesh

Introduction

Opal-CT mineral of the lower Eocene Tallahatta formation is present throughout the Gulf and Atlantic coastal plains from Mississippi to Georgia and South Carolina states of USA. Opal-CT in Mississippi is suggested to be of volcanogenic origin (Kabir and Panhorst, 2004). Very recently this mineral was identified in the Barind clay formation of Pleistocene age in Bangladesh (Kabir, 2001; Kabir et al., 2001). A volcanic ash bed within this formation, a precursor of opal-CT, is reported from other localities in Bangladesh (Islam and Parveen, 1997; Abdullah and Hasan, 1991) and in India, which has been identified as Toba ash (Acharyya and Basu, 1993; Rose and Chesner, 1987). Kabir (2003) reported the chemical and mineralogical similarities of opal-CT-rich sediment of Bangladesh with Toba ash (75,000 BP) in India.

The present paper describes the evolutionary development of opal-CT in response to the depth of burial and age of sediments of the Tallahatta formation in USA and the Barind clay formation in Bangladesh.

Opaline silica—a brief review. Opal-CT, natural hydrous silica, is rarely studied mineral in the subcontinent. Opal and opaline silica can be grouped as opal-A, opal-CT and opal-C (Jones and Segnit, 1971). Opal-A is a highly disordered, nearly amorphous silica phase precipitated from solution either organically or inorganically. Marine organisms such as diatoms, radiolarians and sponges can extract silica from seawater at concentrations well below saturation levels with respect to amorphous silica. The sequence of change from opal-A contained in diatoms to opal-CT found in diatomite is well established. According to Hein et al. (1978), in the first 300 to 400 metres of burial, diatom frustules are fragmented, which increase the surface area available for the associated mild dissolution. By 600 m, the dissolution of opal-A is advanced and opal-CT precipitates abundantly between 600 and 700 m depth. The temperature required for transformation of opal-A to opal-CT is 35 to 55 °C (Calvert, 1983). Because the temperature is relative to the depth of burial, Hein et al. (1978) suggested that 500 m of diatomaceous sediment might be required at the base of the siliceous section for conversion of opal-A to begin. Murata et al. (1977) estimated that complete transformation of opal-A to disordered opal-CT occurred at a temperature of about 55 °C and at a burial depth of 900 to 1000 m. Nähr et al. (1998) showed a transition from opal-A to opal-CT in deep-sea sediments at depth of 340 to 370 m. Issacs (1982) and Williams et al. (1985) indicated that several hundred metres of burial and mildly elevated temperatures were required for conversion of opal-A to opal-CT when deposited with other types of sediments containing detrital materials. Inorganically precipitated opal-A is formed when a solution becomes saturated with respect to silica, causing silicic acid polymer to precipitate. These polymers then grow by the Ostwald ripening process to form colloidal gels (Iler, 1979). Opal-CT can develop from opal-A as a solution-reprecipitation process (Williams and Crerar, 1985).

Studies on the Peroxo Complexes of Thorium (IV) Containing Organic Acids and Amine Bases

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Abstract. New peroxo complexes of Th(IV) have been synthesized and characterized by elemental analyses and various physicochemical techniques. The complexes were found to oxidize allyl alcohol and triphenylarsine as well as triphenylarsine to their respective oxides. The molar conductance values and six fold coordination indicate that all the complexes are 1:1 electrolytes in dimethylsulphoxide revealing their ionic characters. The complexes display \(v(C=O)\) bands at \(\sim 1625\) cm\(^{-1}\) and \(v(C-O)\) bands at \(\sim 1405\) cm\(^{-1}\), significantly lower than the values of amino acid (\(\sim 1630\) cm\(^{-1}\) and \(\sim 1412\) cm\(^{-1}\)) indicating the coordination of amino acids through their carboxylate anion. The Th(IV) complexes display \(v(M=O)\) modes in the region 910-999 cm\(^{-1}\). The broad band observed at about 3244-3386 cm\(^{-1}\) for \(v(N-H)\) modes indicates the coordination of amino group through nitrogen atom of amino acid. These are predominantly O-O stretching \(v_1\), the symmetric M-O stretch \(v_2\) and the antisymmetric M-O stretch \(v_3\). The characteristic \(v_1(O-O)\) modes of the complexes appear at 800-840 cm\(^{-1}\). It is observed that the \(v_1\) mode decreases with the increase of atomic number of the metal in a particular group. The magnetic moment values of dioxothorium (IV) complexes revealed them to be diamagnetic in nature, suggesting there were no changes in the oxidation states of the metal ions upon complexation. The electronic spectral data of the complexes showed bands at 260-350 nm region due to the charge transfer band only.

Keywords: peroxy complexes, thorium (IV), organic acids, amine bases

Introduction

Increasing interest in metal-amino acids (Alcock et al., 1985; Djordjevic et al., 1985) as well as peroxy-metal systems (Mimoun, 1983; Bortolini et al., 1981; Groves, 1980) mainly attributable to their potential as models for understanding biologically important molecules (Mimoun, 1987), lead to the present study to establish rational synthetic routes to peroxy-thorium(IV) complexes containing amino acid and organic bases as coligand. Thorium has been identified as a bioessential metal (Gresser et al., 1986; Chasteen et al., 1983; Ramasarma and Crane, 1981). However, its actual biological function still remains an enigma (Boer, 1986). The recent discovery of thorium containing enzymes, a bromoperoxidase and a nitrogenase are considered to be major steps towards understanding the biochemistry of the metal. Moreover, peroxy heteroligand thorium(IV) complexes, besides being found to be capable of oxidising organic substrates (Alcock et al., 1985; Djordjevic et al., 1985), have been implicated to be actively involved in some biochemical processes. We considered that the coordination of an aminoacid and a peroxide ligand at a thorium(IV) centre might lead to biochemically relevant systems, because all three constituents, viz. thorium(IV), peroxide and amino acid are of acknowledged biological significance. In addition, the possibility of such complexes possessing oxidising properties could not be ruled out.

Peroxo complexes of poly-valent transition metals are used as catalysts or stoichiometric reagents for the oxidation of organic and inorganic substrate. Oxygenation reaction by molecular oxygen is one of the fundamental conversion processes, which play important roles in various situations, not only in chemical but also in metabolic systems (Lippard and Berg, 1994; Sheldon and Kochi, 1981). Since many of such processes are mediated by transition metal species (catalysts), it is essential for understanding of the reaction mechanisms and improvement of the oxygenation processes to reveal chemical and structural properties of the metal-dioxygen adducts. Transition metal-dioxygen adducts are also the key intermediates for oxygen transport in the biological system.

In this article, the synthesis and structural assessment of peroxy complexes of Thorium (IV) containing organic acid and amine bases as coligand have been described.

Materials and Methods

General method was used for the preparation of the complexes of the type [Th(O2)(amH).L] NO3 [where amH = deprotonated glycine, alanine, phenylalanine and leucine; L = quinoline, isoquinoline, pyridine, 2-picoline or 4-picoline].
Quantization of Buspirone Hydrochloride in Pure and Pharmaceutical Formulations by Spectrophotometric Method

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Abstract. A simple and sensitive method is described for the determination of buspirone hydrochloride in bulk drug and in formulations employing spectrophotometric technique. The method is based on the interaction of buspirone hydrochloride with ammonium molybdate in acidic media and the absorbance is measured at 700 nm. Beer’s Law is obeyed in the range of 5 μg to 350 μg/ml and RSD is 0.96 % for buspirone hydrochloride. Analytical data for the determination of pure compound is presented along with the application of the proposed method for the analysis of pharmaceutical formulation.

Keywords: buspirone hydrochloride, ammonium molybdate, spectrophotometry.

Introduction

Buspirone hydrochloride is an anxiolytic azaspirodecane dione (Fig. 1). It is reported to be largely lacking in sedative, anticonvulsant and muscle relaxant actions. Adverse effects can include dizziness, nausea, headache, nervousness, light headedness, excitement, paraesthesias, sleep disturbances, chest pain, tinnitus, sore throat and congestion. Buspirone is reported to produce less sedation and to have a lower potential for dependence than the benzodiazepines (Sean, 2002).

The analytical techniques being employed for the determination of buspirone hydrochloride are reviewed hereunder. In reverse phase HPLC, the recovery of buspirone hydrochloride was not 100% (Franklin, 1990), while in HPLC procedure the RSD values were higher, < 7.6% (Pehourcq, 2004), > 8% (Foroutan et al., 2004) and < 9% (Du et al., 2003) for buspirone hydrochloride, whereas the eluent was monitored at 254 nm (Li et al., 2004) by using lidocaine as the internal standard with pH adjusted to 4 (Zaxariou and Panderi, 2004). In the spectrophotometric method, extraction in chloroform is carried out prior to the determination (Sane et al., 1993) and then molybdenum content of the complex was determined via atomic absorption spectrometry (Aboul-Kheir et al., 2002). Long and tedious methods are involved in LC-tandem mass spectrometry (Chew et al., 2006, Green et al., 2004), GC-MS (Qiao et al., 1996) and gas chromatography with nitrogen-phosphorus detection (Lai et al., 1997) in which either pretreatment of sample is required or have high relative standard deviation.

During the studies, it was found that buspirone hydrochloride reacts with ammonium molybdate in acidic media to give greenish blue colour having maximum absorbance at 700 nm. The reaction obeys Beer’s Law from 5 μg to 350 μg/ml. The colour reaction has not been reported in the literature. The present method is simple, accurate, precise and sensitive. Contents of other drugs have also been determined by this method.

Materials and Methods

Apparatus and reagent. Cecil CE-2041 spectrophotometer with 1 cm quartz cell was used to measure the absorbance and graduated pipettes were employed. Analytical grade chemicals and doubly distilled water were used. Standard solution (w/v) (1.0 mg/ml) of buspirone hydrochloride was prepared by dissolving buspirone hydrochloride (100 mg) in distilled water and the volume was made up to 100 ml with distilled water and the volume was made up to 100 ml with distilled water to give a stock solution, which was diluted further as required. A 10% (w/v) ammonium molybdate (BDH) as well as 2N sulphuric acid were prepared in distilled water.

General procedure. To an aliquot containing 5 μg to 350 μg/ml of buspirone hydrochloride, 2 ml of 8N sulphuric acid and 0.7 ml of 10% ammonium molybdate were added. The con-
Introduction

A number of insects or their products are to a certain extent still eaten by some West African tribes, as tit-bits, or exclusively by children. Such insects are mostly those which can be collected in large numbers, e.g. locusts in the gregarious phase, emerging termites, caterpillars and the large African cricket *Brachytrypes*. Also eaten occasionally and sometimes regarded as delicacies, are fatty ‘grubs’ such as the enormously distended queen termite and the larvae and pupae of scarabaeid beetles, and of the silkworm *Anaphe* spp. (Ene, 1963). Such consumption, besides Africa, has been practised throughout the course of history and in all past cultures, including those of ancient China, Mexico, Egypt, Israel and Greece (Bodenheimer, 1951).

West African silk is made from the communal cocoons spun by the gregarious caterpillars of the moths *Anaphe infracta* (brown silk) and *A. imbrasia* (white silk). These caterpillars feed mainly on the leaves of *Bridelia micrantha* and *Albyzzia zygia*, respectively. The cocoon of *A. venata* is not used in making silk (African Encyclopaedia, 1974; Ene, 1963). The first two species of caterpillars are popular as food among the Yoruba (Nigeria), and are sometimes offered for sale in the open markets. Since the *Anaphe* spp. are normally consumed in their seasons in Nigeria the intention of this study is to report the proximate composition, nutritionally valuable minerals and the effects of five different salts on the functional properties of silkworm (*Anaphe infracta*) larvae, for the benefit of the consumers.

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Abstract. The investigations of the silkworm (*Anaphe infracta*) larvae on dry weight basis showed that total ash, crude fat and fibre values were low while crude protein and carbohydrate values were high. Fe, Zn, Mg and P were high while Na, Cu, Ni, K, Ca, Mn, Co, Cr were low. The lowest gelation concentration varied between 6.0 in 1.0% Na2SO3 and 14.0 in 20.0% NaCl, NaNO3 and Na2CO3 with low CV%. All the water absorption capacity values were generally high, the highest being in NaNO3. The oil emulsion capacities were generally low whereas the oil emulsion stability was good in all the salts. The isoelectric point under pH solubility depended on the type of salt solution under consideration. These results make *A. infracta* larvae useful in some food formulations.

Keywords: *Anaphe infracta*, chemical composition, salt effects, functional properties, nutritional value

Materials and Methods

The caterpillars of *Anaphe infracta* were collected in the month of September around many trees of *Bridelia micrantha* in a farm located in Odo Ayetun-Ekiti, Ekiti State, Nigeria. A traditional method was used for the processing of silkworm caterpillars. After collection (about 1 kg) they were roasted in a hot pot to remove the hair. They were then sun-dried for some days, screened and dry-milled to flour by using a Kenwood blending machine. The sample was preserved in a refrigerator until use for various analyses.

Sample analysis. The proximate analysis of the sample for moisture, crude fibre and total ash were carried out using the methods described by AOAC (1990). Nitrogen was determined by the micro-Kjeldahl method (Pearson, 1976) and the amount of crude protein was calculated (nitrogen content x 6.25). Carbohydrate was determined by the difference. Duplicate analysis were carried out.

The minerals were analysed from solutions obtained by first dry-ashing the sample at 550 °C to constant weight. Sodium and potassium were determined using flame photometer (Model 405, Corning, UK) and phosphorus was determined colorimetrically using a Spectronic 20 (Gallenkamp, UK) as described by Pearson (1976). All other metals were determined by means of an atomic absorption spectrophotometer (Pye Unicam Sp 9, Cambridge, UK).

Determination of functional properties. The variations of protein solubility against pH and salt concentrations were determined by the methods described by Oshodi and Ekperigin.

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Assessment of Groundwater Recharge in Semi-Arid Region of Northern Nigeria

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Abstract. The average annual groundwater recharge value of three sites, representing the major geological basins of Northern Nigeria, ranged from 169 mm for Maiduguri to 837 mm in Kano area and the recharge coefficient for the zone ranged from 0.26 to 0.56. The month of August accounted for about 53% of the average annual estimate. About 69 mm (70%) of average annual potential natural groundwater recharge was lost, as a result.

Keywords: drought, groundwater recharge, semi-arid zones, Nigeria

The semi-arid zone of Northern Nigeria has great potential for large-scale economic development due to warm temperatures and bountiful resources including farmlands, minerals and thermal energy (Adelana et al., 2003; Schoneich and Askira, 1987). The entire region (Fig. 1) is primarily oriented towards extensive agriculture and animal husbandry and is rainfall dependent. However, the infrequent and short duration of rainfall, less than 60 days, in most places has made water availability, one of the primary restrictive factors to economic development of livestock, agriculture and land resources. (Mustafa and Babatola, 1989; Thambyahpillay, 1987).

There is insufficient information available on groundwater recharge of the arid and semi-arid regions of Nigeria (Olasehinde et al., 2001).

The present investigation estimates the amount of groundwater recharge and the generated data can be useful in future planning and management of the resources and thus reducing some of the worst impacts of drought in vulnerable areas. The soil moisture deficit (SMD) model in view of its reliability and cost effectiveness (Ndubuisi, 2007, 2005; Odijie and Anyaeche, 1991; Rushton and Ward, 1979), was used to estimate the incidence of groundwater recharge. The method uses daily time steps to compute recharge (RECH) from rainfall after satisfying the primary moisture deficit (SMD), evapotranspiration (PE) and surface runoff (RO) demands. The estimate is for rainfall only, not taking into account any seepage along stream channels, irrigated agricultural fields, lakes and ponds etc.

In the model, recharge \(\Delta S = P1 - PE - RO\),

where:

\(P1 = \text{precipitation (mm)}\)

\(PE = \text{potential evapo-transpiration (mm)}\),

\(RO = \text{runoff (mm)}\).

Negative value of \(\Delta S\) represents an increase in soil moisture deficit and positive value indicates potential recharge.

Basically the possibility of recharge depends on the SMD, which can assume four states, i.e. A: SMD = 0; B: 0 < SMD < RC; C: RC < SMD < D; Da: SMD > D, where RC = root constant and D = maximum soil moisture deficit.

Odigie and Anyaech (1991) have given details on the model and method for estimating its parameters. A computer programme presented by Ndubuisi (2005) was adopted and applied. Drought effect was estimated by comparison between the data for the years 2001 to 2003 and for 1974 to 1983. Validation was attempted by comparison with previous estimates in literature.

The study area covers three major geological basins namely, the Iullemmeden (Olasehinde et al., 2001; Oteze 1991, 1989 and 1975); weathered basement rocks (Jones and Benson, 1991) or the Hadejia-Jamare and the Chad basin (Ndubuisi, 2001; Bumba et al., 1985), using data for selected stations representing each of the three major catchments basins: Sokoto, Kano and Maiduguri (Fig. 1). (Odige and Anyaech, 1991; Odigie and Olu, 1985).

The average annual recharge is 764.9 mm for Sokoto, 837.2 mm for Kano and 169.1 mm for Maiduguri. The annual estimate is about 31.8% of the average annual rainfall for Sokoto area, 55.5% for Kano area, and 26.3% for Maiduguri and environs (Fig. 2a-c). Therefore, the ratio of recharge to rainfall, or recharge coefficient ranges from 26% to 56% for the study area. The higher coefficient for Kano may be attributed to relatively higher precipitation and lower actual evapotraspiration during the period of study.

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Transplacentally Transmitted Congenital Brucellosis due to *Brucella abortus* Biotype 1 in Sprague-Dawley Rats

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Abstract. In the investigation on the transplacentally transmitted congenital brucellosis due to *Brucella abortus* biotype 1 in Sprague-Dawley rats, neither any stillbirth, abortion or premature birth nor any abnormality of fetus was observed in the infected group or in the control group. *B. abortus* biotype 1 was isolated from the fetus of infected rats only. Only one band of 498 base pair DNA was obtained in polymerase chain reaction products from DNA of the fetuses of infected SD rats.

Keywords: *Brucella abortus* biotype 1, transplacental transmission, congenital brucellosis

Introduction

Brucellosis is one of the world’s major zoonoses, alongside bovine tuberculosis and rabies (Boschirol et al., 2001). Major reservoirs of diseases include goats and sheep (*Brucella melitensis*), swine (*Brucella suis*), cattle (*Brucella abortus*) and dog (*Brucella canis*). *Brucella abortus* has been isolated from various tissues of rats in various parts of the world and were associated with proximity to *Brucella* infected-cattle (Moore and Schnurrenberger, 1981). Transmission to humans occurs through direct contact with infected animals or consumption of infected animal products. Human to human transmission is rare and has been described only after blood transfusion (Wood, 1955) and bone marrow transplantation (Ertem et al., 2000; Naparstek et al., 1983) and possibly during sexual intercourse (Ruben et al., 1991). Furthermore, some evidences are available that brucellosis may be transmitted to the neonatal infant through breast milk (Palanduz et al., 2000). In cattle, brucellosis acquired through suckling infected dam has been suggested as one of the possible modes of transmission (Cheville et al., 1995). In this study, the transplacentally transmitted congenital brucellosis due to *Brucella abortus* biotype 1 in Sprague-Dawley (SD) rats has been reported through bacteriological examination and polymerase chain reaction (PCR).

Materials and Methods

Culture of *B. abortus* biotype 1 isolated from bovine supra mammary lymph node in South Korea (Rahman and Baek, 2007) was used in this study for the experimental infection. *B. abortus* biotype 1 was grown in Brucella broth (Difco, USA) for 48 h at 37 °C with 5% CO₂. The bacteria were washed with saline thrice and suspended in physiological saline solution before use.

Experimental rats and inoculation protocol. Healthy (disease free) 6 to 10 month old pregnant female SD rats (n=25) weighing 200 to 250 g with no history of exposure to *Brucella* species were used in this experiment. Before starting the experiment, the female rats were kept with male rats for mating (two females with one male) and to see the vaginal plug (on day 1 after gestation, the vaginal plug was observed). Rats were classified into infected group (n=15) and control group (n=10). A 500 μl containing 1.0 x 10⁹ colony forming units suspension of *B. abortus* biotype 1 in physiological saline solution was injected subcutaneously at shoulder region to each of the 15 rats of infected group at the 7th day of gestation. Ten rats injected with only 500 μl of physiological saline served as control. These were following the same procedure, housed separately and not exposed to *B. abortus* biotype 1 organisms. The rats were maintained under hygienic conditions and were provided with commercial feed and water *ad libitum*.

Clinical examination and collection of fetuses. All of the rats were examined to record the clinical signs and rectal temperature every day until completion of the experiment. All of the rats were sacrificed after 20 days of gestation (i.e. the day before parturition). The fetuses were collected directly from uterus without any contamination and were examined.

Bacteriological examination of fetuses. Fetuses for bacteriological examination were stored not longer than 48 h at 4 °C prior to culturing. For bacterial culture Brucella-selec-
Palm weevil (Rhynchophorus phoenicis) is one of the most notorious species of insect pests that attack all types of palms. Other species are R. palmarum, R. ferrugineus, and R. bilineatus (Grimaldi and Bikia, 1985). R. palmarum transmits red ring disease in palms (Morin et al., 1986; Hill, 1983). Apart from being pests, palm weevils and some other insects are attractive and are important natural sources of nutrients for humans in African, Asian and Latin American region (Chen and Akre, 1994; Fasoranti and Ajiboye, 1993; Sutton, 1988). Some examples of very important edible insects are grasshoppers, bees, ants and caterpillars of beetles (Adedire and Aiyesanmi, 1999; DeFoliart, 1992; Malaise and Parent, 1980). The quality of protein determines the functional capability of any food item (Kinsella, 1976). Insects are good sources of quality proteins that range between 60-70% (Stein, 1991).

Palm weevil (Rhynchophorus phoenicis) is one of the most notorious species of insect pests that attack all types of palms. Other species are R. palmarum, R. ferrugineus, and R. bilineatus (Grimaldi and Bikia, 1985). R. palmarum transmits red ring disease in palms (Morin et al., 1986; Hill, 1983). Apart from being pests, palm weevils and some other insects are attractive and are important natural sources of nutrients for humans in African, Asian and Latin American region (Chen and Akre, 1994; Fasoranti and Ajiboye, 1993; Sutton, 1988). Some examples of very important edible insects are grasshoppers, bees, ants and caterpillars of beetles (Adedire and Aiyesanmi, 1999; DeFoliart, 1992; Malaise and Parent, 1980). The quality of protein determines the functional capability of any food item (Kinsella, 1976). Insects are good sources of quality proteins that range between 60-70% (Stein, 1991).

Palm weevil (Rhynchophorus phoenicis) is a good source of protein, minerals and fat. Larde (1989) reported that palm worms ranked higher to winged termites being the richest source of animal fat – a frequently scarce and needed commodity among tropical rural population. The physicochemical properties and the levels of anti-nutritional contents play vital role in the application of fat and oil in industries (Kinsella, 1979).

The present research work was conducted to determine the functional and the physicochemical properties as well as the level of anti-nutrients in the developmental stages of palm weevil.

Keywords: Rhynchophorus phoenicis, functional properties, physicochemical properties, smoke point, anti-nutrients

Materials and Methods

Insect collection. Palm weevil (R. phoenicis) larvae and adults were purchased from the main jetty terminal market at Igbokoda, Ondo State, Nigeria. The larvae were classified into early and late larval stages based on head capsule measurement, weight, body length, body width and circumference (Table 1). The larvae and adults were killed by asphyxiating them in a deep freezer for 48 h. The samples were dried separately in a Gallenkamp oven at 60 °C to a constant weight according to the procedure described by Adedire and Aiyesanmi (1999). The oil extracted during drying was put in a bottle and kept in the laboratory for analysis. The dried samples were pulverized with the laboratory pestle and mortar and stored in containers until required.

Functional analysis. Water and oil absorption capacities of the samples were determined as described by Coffman and Garcia (1977). The emulsion capacity was determined by the method of Yasumatsu et al. (1972) as described by Ige et al. (1984). The procedure of Coffman and Garcia (1977) as modified by Adeyeye et al. (2002) was used to determine the gelation properties, foaming capacity and the foaming stability of samples. Each parameter was measured in triplicate.

Determinaton of physicochemical properties. The specific gravity, refractive index, peroxide value and the free fatty acid value of the oil of R. phoenicis were determined according to Pearson (1976). The iodine value, saponification value, unsaponifiable matter and the acid values of the oil were estimated as described by Pearson (1981). The method recommended by AOAC (1975) was adopted in determining the
Introduction

Sunflower (Helianthus annus L.) is the second important non-conventional source of vegetable oil in the world after soybean (Sackston, 1981). National average yield has increased from 750 to 1500 kg/ha but it is still quite low compared with other sunflower growing countries of the world (GOP, 2005). Sunflower is moderately salt tolerant crop therefore it has a wide margin to be grown successfully on most of the soils. It has 47.5% oil content and is ranked next to peanut (48.5) in terms of oil content among flax, soybean, safflower, cottonseed, mustard and rape (Teasar, 1984). The threshold for the sunflower, soybean and safflower is nearly identical; the rate of yield decline above the threshold is lesser for sunflower as compared to soybean and safflower (Francois, 1996).

Salinity has been recognized as a limiting factor for crop productivity. In the past two decades, intensive research has been conducted to improve seed germination and seedling emergence under saline conditions by pretreating seeds with solutions of different inorganic salts. Various studies indicate considerable improvement in seed germination, emergence, seedling establishment and final crop yield in salt-affected soils as a result of seed halopriming (Ashraf et al., 1987; Ayers, 1952). Although salinity effect involved various aspects of plant life, it was not easy to establish a chain of priorities (Flowers et al., 1977). It may not be simple to get a scale of salt tolerance for plants because some species are sensitive to salt conditions in certain periods of their growth and development while they become resistant in others (Sayed, 1985). In saline soils, salt concentration in soil solution creates high osmotic pressure reducing the availability of water to plant and specific ion effects such as toxicity of sodium and chloride. In order to meet the ever increasing vegetable oil demand, expansion of the area under sunflower cultivation is need of the day. The present laboratory investigation was planned to facilitate and enhance germination of sunflower seeds by priming with inorganic salts under NaCl salt stress.

Materials and Methods

The experiment was conducted to study the effect of halopriming on sunflower seed germination and establishment under saline conditions in Soil Salinity Laboratory at National Agricultural Research Centre (NARC), Park Road, Islamabad during the year 2007. Seeds of sunflower were obtained from Oilseed Programme, NARC. Before the start of experiment, the seeds were washed, air dried and haloprimed for 6 h with inorganic salts (1%, 2%, 3%, 4%, 5% KNO3 and K2SO4 + H2O each) separately, whereas the control was treated with distilled water.

After halopriming, the seeds were taken out and air dried. Ten seeds per petri dish of each treatment were put for germination. Experiment was organized in two factor completely randomized design (CRD) using three replications of each treatment. Germination of controlled and treated seeds was evaluated between two layers of moist filter paper in covered petri dishes. NaCl solution was applied to develop 200 mM salinity except control. For control treatment, distilled water was used. The petri plates were kept covered for 20 h a day and were removed each day for four hours during germination period. After complete germination, the lids of petri plates were removed for seedling development. The germination percentage was recorded 2, 4, 6 and 9 days after the beginning of the experiment. After two weeks of germination, when the seedlings were fully established, root and shoot lengths were...
Performance of Maize Cultivars for Fodder Production under Rainfed Conditions of Pothohar Tract

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Abstract. For finding the forage yield potential of eight maize cultivars, the cultivars were sown in the month of July during both consecutive years 2001 and 2002 and harvested in the month of September in both the years. The cultivars differed significantly from one another with regard to plant height, number of leaves per tiller, number of plants per row, leaf area per plant, green fodder and dry matter yield. The cultivar ‘Akbar’ produced taller plants, with the largest leaf area and more number of leaves per tiller and consequently yielded highest amount of green as well as dry matter among all the varieties under the rainfed climatic conditions of Pothohar tract of Pakistan.

Keywords: Zea mays, maize cultivars, Pothohar, agronomic characters, Pakistan, fodder yield

Introduction

Maize (Zea mays L.) is one of the important cereals and is cultivated for consumption of human beings and livestock both. In Pakistan maize is an important fodder and feed crop grown during summer and spring seasons both. Besides, being succulent and palatable, it can be safely fed to all types of livestock at all stages of growth without any danger of oxalic and prussic acids as compared to other summer season fodder crops like sorghum and millet. It is also the most suitable fodder crop for making silage and hay. (Muhammad et al., 1990).

In rainfed ecology of Pothohar region, livestock is an integral component of farming; however low fodder yield is a major limiting factor for development of this sector. The improved varieties are key-contributors in enhancing fodder productivity (Ayub et al., 1998). In a cultivar evaluation study, Zia and Ashraf (1980) confirmed that improved maize varieties performed better than out-dated local land races giving 37.59% higher yield as compared to the local cultivars. However, genotype x environment interaction always remained a serious problem in crop production while recommending a variety for some regions (Chaudhry et al., 2002; Ghaffar et al., 2002; Ayub et al., 2001; Muhammad et al., 1990; Rehman 1990). Similarly varieties of the same genetic potential responded differently under the same set of different nutrient regimes (Muhammad et al., 2002). However, the ideal variety is the one, which has a wider adaptation with higher yield potential (Finlay and Wilkinson, 1963). During the last 50 years, major emphasis has been placed on research and development on grain production of maize in the irrigated areas. Due to the short duration of the fodder crop and being suitable for rainfed cropping system, little has been reported regarding fodder. Hence, suitable maize cultivars having higher fodder yield for rainfed tract are required to be identified. The present study was conducted to determine the potential of different maize cultivars on the basis of desirable agronomic traits and higher fodder yield for Pothohar and allied areas having similar environmental conditions.

Materials and Methods

The present study was carried out under Fodder Research Programme at the National Agricultural Research Centre, (NARC) Islamabad during 2001 and 2002. The experiment was laid-out in a randomized complete block design with three replications keeping a net plot size of 3m x 6m with row to row distance of 30 cm.

Eight maize cultivars were selected for the study which are mentioned in Table 1.

The crop was sown on a well-prepared seedbed with the help of a single row hand drill, using 100 kg/ha seed rate of each
Performance of Newly Released Dry Land Wheat Varieties under Barani and Minor Irrigated Conditions

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Abstract. Among the three newly released dry land wheat varieties viz; Marwat J-01, Lucky J-03 and Raj 2000 and the local race “Khattakwal wheat” sowed in district Karak during, November, 2004-05, significant difference was found between the grain yields both under barani and minor irrigated environment. Marwat J-01 out yielded significantly all the varieties with one irrigation (4120 kg/ha) followed by Raj-2000 (3993 kg/ha). Under barani conditions as well, the two varieties produced statistically equal but highest grain yield of 1718 and 1773 kg/ha, respectively.

Keywords. wheat, arid lands, grain yield, Pakistan, Triticum aestivum

Introduction

Being staple diet of the people, wheat occupies a central position in agricultural policies, of Pakistan. It is grown on 92 percent of the total cropped area in rabi (spring).

About 80 percent of the total land area of 79.61 million hectares (m. ha) or about 25 percent of the cultivated area of 20.43 m. ha in Pakistan is barani (rain fed), bulk of which consists of arid and semi arid lands. These lands contribute 12.5 percent of the national wheat produce. Wheat (Triticum aestivum) is the main rabi crop of barani areas of Pakistan (Hobbs et al., 1983). However, wheat yield is sharply low in our country as compared to that of France (6.23 tons/ha), Britain (7.78 tons/ha), Egypt (6.25 tons/ha) and East Punjab, India (4.5 tons/ha) (Aqil, 2006).

Wheat genotypes differ in yield in response to environment and yield is a highly variable trait. Hence, extensive research is required to find suitable wheat lines across different locations (Baisakh and Nayak, 1991; More et al., 1990).

Various researchers have studied a number of varieties of wheat including Pirsaabak-85, Pak-81, Sarhad-82, Haider 2000, Saleem-2000 etc. in search of the best yielding variety for particular climatic conditions of specific areas of Pakistan.

Din (2004) reported no significant increase in the grain yield of any of the 19 selected wheat genotypes from CIMMYT/ICARDA which were evaluated for grain yield against Marwat J-01 in preliminary yield trials during 2002-03; however none of these genotypes exhibited significant increase in yield over Marwat J-01(Kissana, 2001).

Similarly under irrigated conditions, there was non-significant difference in the grain yield of Marwat J-10, Fakhre Sarhad, Inqiliab-91, Salim-2000, Raj, Bakhtawar-92, Dera-98, Nasir-2000 and Lakki J-03.

The variety complex undergoes changes in response to biotic and abiotic stresses as well. Wheat rust causes more variety changes than other factors (Khan et al., 2002). To this effect Agricultural Research Department in Pakistan is actively involved in developing varieties that are high yielding, resistant to rust(s) and have acceptable bread quality. Every year, hundreds of new lines are tested for all or either of these attributes so that country food and farm sector welfare needs are met with.

The total land area of the North West Frontier Province (NWFP) of Pakistan is 10.2 m. ha, of which nearly 19 percent or 1.93 m. ha is cultivated while 60 percent of the cultivated area is again rain fed (Khan, 1986).

In regard to the particular climatic conditions of NWFP, Jamal (2001) conducted multi location trials on wheat genotypes in district Lakki Marwat of NWFP and reported that the variety Marwat J-01 out yielded other varieties by 12-40%, producing the highest grain yield of 2183 kg/ha among the 14 dry land genotypes. Ilyas et al. (2006) tested seven wheat...
Introduction

Chemistry is a very general word covering many very large areas, organic chemistry, inorganic chemistry, biochemistry and also several scales from micrograms to many thousand tons.

Many chemistry laboratories try to connect chemistry and biology, mainly in pharmaceutical plants and laboratories. The purpose of this review is to describe some links between chemistry and biology. Starting from the synthesis and the structural characterisation of some furanic compounds, we describe some biological properties. There is an evidence for any chemist working in Pharmacy faculty to test new synthesised compounds for their biological properties.

Chemistry. Among furan compounds, derivatives of aldehydes or ketones were widely described. In this review, we point out some features with oximes, semicarbazones and thiosemicarbazones obtained with simple furan aldehydes: 2-furfural, 3-furfural, (furyl-2)-3 prop 2-enal (or furylacrolein). The synthesis of these compounds is very easy.

Only one molecule has been studied as a ligand: 2-furfuraldoxime (Bouet, 1986; Gupta and Bhat, 1979a & b, 1978, 1977; Sen and Pickerell, 1973). So, it was possible to prepare new oximes as well as semicarbazones and thiosemicarbazones. If we look at the furan cycle (Fig. 1), we note the presence of four hydrogen atoms, which could be readily substituted by various groups. It is well known that only the 2 and 5 positions are sufficiently reactive to accept substitution and attach alkyl or nitro groups for instance. Some derivatives with substituents in position 3 are known.

Synthesis and characterisation of the ligands. All compounds were characterised using usual structural techniques: infrared and UV-visible spectroscopies, NMR, X-ray diffractions.

Oximes. In the case of oximes the preparation was first described by Brady and Goldstein(1927): the aldehyde is allowed to stand with hydroxylammonium chloride (stoichiometric amounts) and sodium acetate in a mixture of ethanol and methanol (Scheme 1, Table 1).

![Fig. 1. Furan ring.](image)

**Table 1. Furanic oximes as ligands (Khan *et al.*, 1991; Bouet *et al.*, 1990; Bouet and Dugue, 1989; Bouet, 1986; Bouet and Jolivet, 1981)**

<table>
<thead>
<tr>
<th>$R_1$ $R_2$</th>
<th>Abbreviation</th>
</tr>
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<tbody>
<tr>
<td>H</td>
<td>CH=N-OH</td>
</tr>
<tr>
<td>CH$_3$</td>
<td>CH=N-OH</td>
</tr>
<tr>
<td>C$_2$H$_5$</td>
<td>CH=N-OH</td>
</tr>
<tr>
<td>NO$_2$</td>
<td>CH=N-OH</td>
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<tr>
<td>H</td>
<td>CH=CH=N-OH</td>
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<tr>
<td>CH$_3$</td>
<td>CH=CH=N-OH</td>
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**Abstract:** In order to demonstrate the links between chemistry and biology, some biological properties of a few furanic compounds have been described, starting from the synthesis and the structural characteristics. Also some features of the furan compounds with oximes; semicarbazones and thiosemicarbazones have been pointed out.

**Keywords:** furanic compounds, structure, biological properties.