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Abstract. Using two threshold solid state nuclear detectors, mica and CN-85, the reaction of (14.0 MeV/u) Pb + Pb was studied. Reaction cross-section was determined experimentally as well as theoretically. Both elastic and inelastic data were used to calculate the experimental reaction cross-section. Theoretical reaction cross-section for 14.0 MeV/u Pb + Pb is 3809 ± 428 mb. Reaction cross-sections from elastic data were 3830 ± 500 mb and 3875 ± 500 mb for mica and CN-85, respectively. While reaction cross-sections calculated from inelastic data for mica and CN-85 were 4081 ± 500 mb and 4092 ± 500 mb, respectively. The partial reaction cross-sections for mica and CN-85 detectors were also determined. It was observed that partial cross-section of inelastic binary events in mica was higher than that in CN-85, whereas, cross-section of 4 and 5-pronged events in mica were lower than those in CN-85. However, the number of three pronged events was identical in the two detectors. Using the difference in mass registration threshold of the two detectors, for fragment masses between 4 amu (registration threshold of CN-85) and 30 amu (registration threshold of mica) were searched, which were registered in CN-85 but not in mica.

Keywords: heavy ion interaction, solid state nuclear track detectors, total and partial reaction cross-sections, theoretical reaction cross-section, light particle emission.

Introduction
Understanding the properties of nuclear matter is the most important challenge in nuclear physics. To achieve this goal, first the nuclei have to be prepared in extreme conditions of excitation energy, temperature, pressure, spin and isospin. The tool used to obtain such extreme conditions is heavy ion induced reaction. Emission of light particles in heavy-ion-induced reactions contains important information about the reaction mechanism.

Solid state nuclear track detectors (SSNTD) yield useful results in the study of heavy ion interactions. Due to registration of all the heavy reaction products, moving in the forward hemisphere, the use of SSNTDs become unbiased and more versatile in giving information regarding the heavy ion interactions. Solid state nuclear track detectors have been extensively used to investigate the heavy ion (A>4) interactions (Nasir et al., 2009; 2008; Khan et al., 2001; 1998; Brandt, 1980). Each SSNTD has its own mass registration threshold and registers only that particle whose mass is greater than this threshold value (Khan et al., 1984). In the present research work, CN-85 and mica track detectors were used to study 14.0 MeV/u 208Pb + 208Pb reactions. CN-85 (cellulose nitrate) with chemical formula C₆H₈O₉N₂ is a sensitive plastic while mica with chemical formula KAl₃Si₃O₁₀(OH)₂ is a mineral crystal. Both are etchable solid state nuclear track detectors.

The data presented in this paper consists of 2-, 3-, 4-, and 5-pronged events studies with two detectors, mica and CN-85, having different mass registration thresholds. They registered the fragment masses greater than their mass registration thresholds. Using the inelastic binary and multi-pronged events, the partial and total experimental reaction cross-sections were determined. The experimental reaction cross-section was determined from the elastic binary events and theoretical reaction cross-section for the reaction was also calculated. Analysis of the observed partial cross-sections of various multiplicities and the indirect events have been reported as the signal for the emission of mass fragments having masses between 4 amu and 30 amu, registered by CN-85 (having low registration threshold) and not by mica (having high registration threshold = 30 u), along with the heavy fragment masses in the present reaction.

Materials and Methods
A thin layer of Pb was vacuum deposited on each of the three mica and the two CN-85 detector pieces. These target-detector assemblies were exposed, to a beam of (14.0 MeV/u) Pb
Synthesis and Reactivity of Some Peroxo Complexes of Zirconium(IV), Thorium(IV) and Uranium(VI) Ions Containing a Quadridentate, Quadrinegative Ligand and a Pentadentate Dinegative Schiff Base

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Abstract. Some new peroxo complexes of zirconium, thorium and uranium containing a quadridentate, quadrinegative organic ligand and a pentadentate dinegative Schiff base ligand have been synthesized and characterized by elemental analyses, magnetic measurements and various spectral studies. Oxygen transfer reactions of some complexes toward different substrates have been investigated. The Schiff base, LH₂, was derived from the condensation of 2,6-diaminopyridine with salicylaldehyde. The present ligands undergo deprotonation during complexation coordinating with (OOOO)⁴⁻ and ONNNO⁻ donor sequences, respectively. The complexes have the compositions, [M(O₂) (OOOO)].2H₃O⁺ [M = Zr(IV) and Th(IV), OOOO = DCTA], [UO(O₂) (OOOO)].2H₂O⁺; [M(O₂) (ONNNO)] [M = Zr(IV) and Th(IV), ONNNO⁻ = L] and [U(O) (O₂) (ONNNO)].H₂O. The chelate effect of the quadridentate and pentadentate ligands stabilizes the metal peroxide moieties precluding oxygen transfers to organic and inorganic substrates. The mode of coordination is also influenced by the σ-donor electronic nature of the multidentate ligands. The IR spectral data also indicate that the ν₁(O-O) stretching modes decrease with and increase in the atomic number of the metals in a group.

Keywords: peroxo complexes, quadridentate and pentadentate ligands, heavy metal ions

Introduction

The chemistry of peroxo complexes has received considerable attention in recent years. Metal peroxides incorporated with other co-ligands exhibit different reactivities. The metal peroxo complexes are potential sources of active oxygen atoms and can be employed as efficient stoichiometric as well as catalytic reagents for the oxidation of organic and inorganic substrates. Peroxo complexes containing monodentate and bidentate auxiliary ligands have been found to be the sources of active oxygen atoms for oxidation reactions. Complexes containing tridentate and quadridentate co-ligands were inert towards such oxidative processes (Sharma et al., 2009; Bonchio et al., 2001; Justino et al., 2000; Tarafder and Khan, 1991a, 1991b, 1987; Tarafder and Islam, 1989; Tarafder, 1987; Tarafder and Ahmed, 1986; Tarafder and Miah, 1986; Westland and Tarafder, 1982, 1981; Westland et al., 1980; Mimoun, 1980; Jacobson et al., 1978). The crystal structures of many of these complexes have also been reported (Ole et al., 2008; Kondo et al., 2008; Hou et al., 2006; Nica et al., 2005; Kaizer et al., 2004; Hinnerb et al., 2003; Chishiro et al., 2003; Deubel et al., 2001; Lewis and Wilson, 2001; Meyer and Pritzkow, 2000). However, there seems to be no reports on peroxo complexes containing some multidentate ligands with OOOO and ONNNO donor sequences.

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In the present studies, synthesis of some novel peroxo complexes of Zr(IV), Th(IV) and U(VI) containing a quadridentate, quadrinegative and a pentadentate dinegative ligands and their potential as oxygen transfer reagents have been reported. An attempt is also made to correlate the effect of the size of the metal ions on the ν₁(O-O) stretching modes from the IR spectra of the complexes. The structures of the ligands are shown in Fig. 1 and 2.

Fig. 1. LH₂: Bis-N,N'-(2-hydroxyphenylmethylene)2,6-diaminopyridine.

Fig. 2. 1,2-Diaminocyclohexane NNN’N’tetraacetic acid.
Thermal Activation of Bagasse Ash in High Strength Portland Cement Mortar

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Abstract. The pozzolonic reactivity of bagasse ash was enhanced using thermal activation technique by curing mortar specimens containing bagasse ash, at 20, 40 and 60 °C and the samples were tested for compressive strength at the age of 3, 7 and 28 days. Results indicated that bagasse ash is very sensitive to temperature rise and thus the application of thermal activation is very useful when early age strength development is desired. Bagasse replacement by 30% at 40 °C and 60 °C increased the mortar strength at 7 days by 10 and 18% more than the control, respectively.

Keywords: bagasse ash, thermal activation, portland cement mortar

Introduction

Different types of pozzolanic material are widely used for cement replacement in high strength Portland cement mortars and concrete for improving mechanical properties and durability and bringing environmental and economic benefits. The reasons for partially replacing cement in mortar and concrete with pozzolanic materials are diverse, which include strength enhancement and improvement in durability (Coleman and Page, 1997; Wild et al., 1996; Caldarone et al., 1994). There are also clear environmental advantages in reducing the quantity of cement used in construction materials. Indeed, cement production is highly energy intensive process involving significant environmental damage with respect to CO₂ production and raw material acquisition (Schindler, 2004).

Various studies have investigated ways to enhance the reactivity of the pozzolanic material. The principal aim of these attempts was to enhance the reactivity of the pozzolan, so as to improve the mechanical and durability properties of the final product. Prolonged grinding curing at elevated temperatures, alkali-activation and chemical activation are some of the methods that have been used to achieve this target (Xie and Xi, 2001; Shi and Day, 2000; 1995; 1993; Palomo et al., 1999; Bouzoubaa et al., 1997). The efficiency, however of some of these methods is debatable being too energy demanding, while others fail simple cost-benefit analysis. For example Helmuth (1994) suggested the grinding of Portland cement to very high specific area for use with slag to overcome the problem of low early strength. Schroder (1968) showed that with slag contents up to about 50-60%, the early strength is mainly determined by the fineness of the clinker fraction and then by that of the slag fraction. With cements of higher slag content, the fineness of slag was found to be of major importance at all ages. Wainwright and Tollozcko (1986), using temperature matched curing, indicated that concretes containing 50 and 70% slag replacement were far more sensitive to increases in temperature, with respect to their strength development, than equivalent Portland cement concretes. Further, Brooks and Al-Kaisi (1990) were able to use the adiabatic temperature rise of mass concrete to estimate the strength of OPC and OPC/slag concretes. They observed that 28-day strength of OPC/slag clearly exceeded those of OPC concrete only. This difference in behaviour has been attributed to the reduction of the overall quantity of C₃S in blended cement, which results in some C₃S hydrates being replaced by slower forming slag hydrates.

The objective of the present work is to evaluate the bagasse ash as supplementary cementitious material and its activation by thermal method to enhance the reactivity of bagasse ash and to improve the mechanical properties and durability of the final mortar.

Materials and Methods

Chemical composition of high strength Portland cement and bagasse ash used are given in Table 1 and physical parameters of bagasse ash, in Table 2. High strength Portland cement was ground to a fineness of 310 m²/kg. The sand used in the mortar had a specific gravity of 2.5 and a fineness modulus of 2.65. Bagasse ash was obtained from the Premier Sugar Mill Mardan (PSM), Khazana Sugar Mill Peshawar (KSM) and Frontier Sugar Mill (FSM), Thakhtbhai, Mardan. The samples were collected randomly from the heaps present in the yard of...
Abstract. Physicochemical analysis of the oil of Dioclea reflexa Hook f. seeds revealed the acid value, saponification value, iodine value, ester value and iodine number of the seeds to be 8.69 mg KOH/g, 251 mg KOH/g, 72.8 mg I/g, 242 and 27.9, respectively. The fatty acid composition determined by gas chromatography (GC) showed individual unsaturated fatty acid to be oleic acid (18:1), 0.8%, while the saturated fatty acids were palmitic acid (16:0), 10.2% and stearic acid (18:0), 21.9%. The infrared spectroscopy (IR) of the oil was also undertaken. The high saponification and iodine values of D. reflexa oil suggest its possible utilization in allyld resin, shoe polish, liquid soap and shampoo production.

Keywords: Dioclea reflexa, physicochemical analysis, Fabaceae, fatty acid, seed oil

Introduction

Dioclea reflexa Hook. f. belongs to the family, Fabaceae. It is a hairy woody climbing shrub. It is widely spread in tropical and subtropical areas and is often considered a food crop. The seeds are arranged in pods, which are very hard and brownish in colour. D. reflexa, the marble vine, is highly regarded in some parts of Africa. The spherical seeds are used in games; root decoctions used to alleviate coronary pain; seed and root extracts are said to have insecticidal properties (Allen and Allen, 1981). The seeds are used to kill head lice by milling the cotyledons and mixing it with hair cream while the roasted cotyledons, are used for curing piles (Gill, 1992). The anti-microbial activity and phytochemical analysis of crude ethanolic leaf extract of D. reflexa has been reported. The leaf extract was reported to show broad spectrum antibacterial activity against Staphylococcus aureus, Proteus mirabilis, Klebsiella pneumoniae, Salmonella typhi, Streptococcus pneumoniae, Escherichia coli, Candida albicans, Aspergillus flavus and Fusarium solani (Ogundare and Olorunfemi, 2007). The phytochemical analysis of the leaf extract showed the presence of alkaloids, tannins, phenols and glycosides (Ogundare and Olorunfemi, 2007).

In Nigeria, the seeds of Mucuna pruriens, another species, are used in popular medicine for prevention against the effects of snake (Echis carinatus, Naja naja) bite (Guerranti et al., 1999). Proteins inducing an immune response against the venom of Echis carinatus have been isolated from the cold water extract of the seeds of Mucuna pruriens (Guerranti et al., 2002). The present study was carried out to investigate the physicochemical properties and fatty acid compositions of the seed oil of D. reflexa Hook f.

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Materials and Methods

Plant material. Dioclea reflexa Hook. f. (Fabaceae) seeds were obtained from Iropora Ekiti in Ekiti State, Nigeria. They were authenticated by Mr. F. O. Omotayo of the Herbarium Section, Department of Botany, University of Ado-Ekiti, Ado-Ekiti, Ekiti State, Nigeria. The brown hard shells of the seeds were broken to remove the cotyledons.

Extraction. The cotyledons were further broken into small pieces to enhance quick extraction. The coarse powder of the seeds of D. reflexa was extracted with n-hexane for 72 h at room temperature. Extraction was further repeated with n-hexane. The combined extract was concentrated in vacuo at 40 °C to obtain the seed oil which was analyzed for iodine value, saponification value, acid value, ester value and iodine number by the methods described by British Pharmacopoeia (1988).

Acid value determination. The oil (10 g) was weighed in 250 mL conical flask. A mixture of 25 mL of 95% alcohol, 25 mL of ether and 1 mL of phenolphthalein solution was added to the conical flask containing the oil. The oil was allowed to dissolve in the solvent mixture and titrated against 0.1 M aqueous potassium hydroxide. It was shaken constantly until blue colour was observed. The process was repeated twice in exactly the same manner.

\[
\text{Acid value} = \frac{(a \times 5.61)}{W}
\]

where:

\[
W = \text{mass (g) of oil weighed}
\]

\[
a = \text{volume of 0.1 M KOH required}
\]

Saponification value. The oil (2 g) was weighed in 250 mL quick fit flask. 25 mL of 1 M alcoholic potassium hydroxide was added using burette. A reflux condenser was attached to
Antioxidant Properties of *Telfairia occidentalis* as Affected by the Market Storage Method in Nigeria

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**Abstract.** The effect of market storage methods in Nigeria on the antioxidant properties of *Telfairia occidentalis* was assessed over a period of 96 hours with respect to the vitamin C, total phenol and phytate contents, as typified by their reducing power and free scavenging ability. *T. occidentalis* had a phytate content of 28.83 mg/100 g and there was no significant (P>0.05) difference in the phytate content in the first 24 h of storage but significantly (P>0.05) reduced at the end of the storage period of 96 h (26.74 mg/100 g) with 7.24% loss. Vitamin C content reduced significantly (P>0.05) as the storage period increased with a very high percentage loss (81.58%) at the end of the storage period. The vegetable had 2.78 mg GAE/100 g total phenol and was slightly reduced but not significant (P>0.05) during the first 24 h of storage. *T. occidentalis* had scavenging ability > 90%, which significantly (P>0.05) decreased as the storage period increased (57.47% loss at 100% conc. and 56.28% loss at 50% conc.).

**Keywords:** *Telfairia occidentalis*, vitamin C, total phenol, phytate, storage reducing power, scavenging ability

Introduction

Free radicals are highly reactive chemical substances such as peroxide, hydroxyl radical, singlet oxygen etc. that travel around in the body and cause damage to the body cells (Alia *et al.*, 2003). Antioxidants are powerful free radical scavengers in the body. Antioxidants are believed to play a very important role in the body defence system against reactive oxygen species (ROS), which are the harmful by-products generated during normal cell aerobic respiration (Gutteridge and Halliwell, 2000). Antioxidant nutrients (found in foods) soak up all the excess energy that these free radicals have, turning them into harmless particles or waste products that can be removed (Oboh, 2005). Increasing intake of dietary antioxidants may help to maintain an adequate antioxidant status, therefore, the normal physiological function of a living system (Kaur and Kapoor, 2001; Record *et al.*, 2001). Regular consumption of fruits and vegetables has always been associated with health benefits. Fruits and vegetables contain a wide variety of biologically active, non-nutritive phytochemicals which impart health benefits beyond basic nutrition (Gupta and Prakash, 2009; Oomah and Mazza, 2000). Researchers have estimated that every serving increase in fruit and vegetable consumption reduces the risk of cancer by 15%, cardiovascular disease by 30% and mortality by any cause by 20% (Gupta and Prakash, 2009). This is often attributed to different antioxidant components in fruits and vegetables such as ascorbic acid, vitamin E, carotenoids, lycopenes, polyphenols and other phytochemicals (Prior and Cao, 2000). Vegetables play significant role in human nutrition, specially as a source of vitamins (A, B, C, E), minerals and dietary fibre (Aletor and Adeogun, 1995).

Leafy vegetables are important items of diet in many Nigerian homes (Mepba *et al.*, 2007). They are valuable sources of nutrients specially in rural areas where they contribute substantially to protein, mineral, vitamins, fiber and other nutrients which are usually in short supply in daily diets (Mosha and Gaga, 1999). They also add flavour, variety, taste, colour and aesthetic appeal to what would otherwise be a monotonous diet (Mepba *et al.*, 2007). Vegetables are in abundance shortly after the rainy season but become scarce during the dry season during which cultivated types are used. Some eventually find their way to urban markets (Mepba *et al.*, 2007). In Nigeria, during the season of abundance of vegetables, the market women do not always sell all their vegetables on the day of harvest; it has to be preserved for 24 h or more in order for them to break even financially. The modern preservation method of refrigeration and controlled/modified atmosphere are not available to these market women in Nigeria, so they have to design their own methods of preserving their produce. Much work has been done on the phytochemical content of vegetables but there is paucity of information on the effect of storage on the phytochemical content of vegetables. The aim of this study is, therefore, to determine the effect of market

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Colour Removal from Textile Dyeing Wastewater
Using Different Adsorbents

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Abstract. The ability of different adsorbents/coagulants, such as liquid and solid polymers, ferric chloride, calcium carbonate and coal ash, was investigated for uptake of (reactive dyes, Red - 120, Yellow - 14 and Blue - 4 from textile dyeing waste. Coal ash was used for the colour removal from the textile dyeing wastewater of reactive dyes. Different adsorbents removed the colour from the effluent in different degrees; in some cases the colour was removed 100%. White polymer was ineffective. Calcium carbonate gave excellent results. Liquid polymers were better effective than the solid ones. Coal ash yielded good results without any further treatment.

Keywords: industrial wastes, dyes, colour removal, adsorbents

Introduction

Textile industry requires large amounts of water and generates large quantities of wastewater from various steps of dyeing processes. Textile wastewater is characterized by high content of dyestuff, salts, high COD deriving from additives, suspended solid (SS) and fluctuating pH depending on the process (Balcoiglu and Arslan, 2001; Yeh and Thomas, 1995; Yeh et al., 1993). Large amounts of dye chemicals in textile industry effluents create severe water pollution. Dyes impart persistent colour with organic load to the receiving water streams leading to disruption of the total ecological balance impairing the visibility in the recipients. This may significantly affect photosynthetic activity in aquatic environment due to reduced light penetration and may also be toxic to aquatic lives due to metals, chlorides etc., associated with the dyes or the dyeing process. It is, therefore, important to reduce the dye concentration in the wastewater before discharging it into the water bodies. However, it is difficult to remove dyes from effluents since dyes are stable to light, heat and oxidizing agents and are non biodegradable (Hai et al., 2003).

Protection of the environment has become a challenge for the chemical industries worldwide and in particular, the water pollution caused by synthetic dyes and chemicals. All over the world, environmental regulations are becoming stricter and are forcing the shift of technology towards less polluting or practically non-polluting areas of technological development (Destaillets et al., 2000).

Several physicochemical decolourization techniques have been reported for effluent treatment e.g., adsorption, chemical transformation, incineration, photocatalysis, ozonation or membrane separation, however, few, have been accepted by the textile industries largely due to high cost, low efficiency and inapplicability of the processes to a wide variety of dyes.

The conventional process used to treat textile wastewater is chemical precipitation with alum or ferrous sulphate. Drawbacks of this process are the generation of a large volume of sludge leading to the contamination with the chemical substances of the treated wastewater and associated disposal problems etc. For a more practical application, different processes were developed to treat textile industry wastewater. Filtration process, biological process, adsorption process, electrochemical process (Xiong and Karlson, 2001; Barlas and Akgun, 2000; Sójka-L et al., 1998; Banat et al., 1996) and ozone process etc., have been investigated for many years in numerous research centres due to their high reactivity but have low selectivity.

In most situations, use of a combination of different methods of treatment is necessary for removal of all the contaminants present in the wastewater (Sójka-L et al., 1998). Therefore, adsorption became one of the most effective methods of decolourization of textile wastewater (Vendevivere et al., 1998; Naumczyk et al., 1996; Veniceelau et al., 1994). Activated carbon is, by and large, the most commonly used adsorbent although other materials such as activated clay, wood and different types of cellulose-based materials have also been recently investigated for chemical adsorption (Los and Perkowski, 2003; Ciardelli et al., 2001). One important point to be considered when choosing an adsorbent is the possibility of easy regeneration, easy availability of material and the running cost of the treatment.

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Studies on Antifungal Activity and Elemental Composition of the Medicinal Plant *Trianthema pentendra* Linn.

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**Introduction**

Plants are the best source of active secondary metabolites which are beneficial to mankind. Many plant origin drugs have been reported with biological properties like analgesic, anti-inflammatory, antioxidant, hypoglycemic and antifungal agents (Sindhu, 2009). Skin diseases, diarrhoea, diabetes, malaria, respiratory infection, fungal and bacterial infections are the common health problems in developing countries and numerous medicinal plants are used traditionally which are remedial against these diseases (Pinn, 2000).

*Trianthema pentendra* Linn., commonly known as waho, is a traditional medicinal plant which is utilized in many parts of Pakistan for the treatment of various fungal skin diseases like tinea capitis, tinea pedis, tinea manuum and tinea corporis etc. The root of plant is irritant and cathartic. Leaves of the plant are used as astringent and abortifacient and as remedy in abdominal diseases and bladder pain, for snake bite etc. (Baquar, 1989; Shahani and Memon, 1988; Kirtikar and Basu, 1935).

Elements play essential role in the maintenance of the skin health. Aluminum acetate solution, copper sulphate and zinc lotions are used as skin disinfectant, cleansing agents, antiseptic and soothing and cooling agents. Calcium, magnesium and manganese are used in the formation of the collagen and connective tissue. Phosphorus and sulphur are used for the treatment of scabies and leprosy. (Sahito *et al.*, 2003; Soderberge and Halimans, 1982; Underwood, 1981). Skin diseases are usually caused by fungi and are one of the main problems of Sindh province. The present paper describes the antifungal potential of different solvent extracts of *T. pentendra* and is also its elemental study.

**Materials and Methods**

**Plant material.** The leaves and shoots of *T. pentendra* were collected from different areas of Kohistan regions, District Dadu and reference sample was identified by referring to Flora of Pakistan (Nasir and Ali, 1990). The collected plant materials were washed with distilled water and placed in shade at room temperature for two weeks. One kg of dried plant material was dipped in five litre ethanol in a bottle for 20 days for cold percolation. The extract was filtered and concentrated under reduced pressure below 40 °C using rotary evaporator. The residue was completely dried and from it five different extracts viz., ethanol, ethyl acetate, chloroform, methanol and aqueous extracts were prepared using separating funnel. The extracts were evaporated until the solvents were completely evaporated and organic compounds remained in dry form. The extracts so obtained were mixed with the sterilize water (1 g, 5 ml) and each extract sample was applied for antifungal activity.

**Collection of dermatophytes.** The dermatophytic fungi namely: *Aspergillus niger*, *Aspergillus flavus*, *Paecilomyces variotii*, *Microsporum gypseum* and *Trichophyton rubrum* were scraped from the skin of different body parts at out patient departments of Liaquat University Hospital, Jamshoro and Hyderabad.

**Treatment of different solvent extracts.** The human skin pathogens were treated with different extracts and results were taken after 72 h at 30 °C. The percentage of mycelial...
Culture of *Ceriodaphnia cornuta*, Using Chicken Manure as Fertilizer: Conversion of Waste Product into Highly Nutritive Animal Protein

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Abstract. For finding a cheap and suitable feed for culture of *Ceriodaphnia cornuta* studies were carried out for 21 days using chicken manure as fertilizer whereupon *C. cornuta* population ranged between 50 ± 2 and 10,232 ± 202 Ind./L. (individuals/L). The culture peaked on the 17th day producing the maximum density of 10,232 ± 202 Ind./L. Thus chicken manure can be used as a fertilizer for mass culture of cladocerans, specially *C. cornuta*.

Keywords: culture, chicken manure, *Ceriodaphnia cornuta*, live feed

Introduction

The need for large quantities of live feed organisms in aquaculture and the increasing need for valorizing organic wastes, such as animal manure and agro-industrial residue, have been the major initiatives for research on the culture of live feed organisms (DePauw et al., 1980). Chicken manure is a waste produced in poultry farms in large quantities and is cheap. According to Banerjee et al. (1979) it is a complete fertilizer with both organic and inorganic fertilizer characteristics. Ray and David (1969) opined that chicken manure-fertilized medium produced a large population of cladocerans quicker than cattle manure and the plankton biomass increased with the increase of its dosage. The bacteria (gram positive and gram negative) and protozoans (*Paramaecium* sp.) produced in the fertilized medium form the suitable feed for mass production of this species. Different culture techniques are being developed to increase yield of cladocerans by employing different waste organic products as feed sources (Tay et al., 1991; Punia, 1988; Shim, 1988). Although *Artemia* nauplii (Versichele et al., 1986) and rotifers (Pourrito, 1986) are common live feed organisms which are mass cultured for hatchery use, there is growing interest for the production of Cladocera (Adeyemo et al., 1994). But availability of live feed is still a bottle neck in commercial seed production (Rao and Tripathi, 1993). A variety of artificial pelleted feed are available to rear the voracious larval stages of cultivable species which are not preferred as compared to live feed (Sumitra, 1987).

As the cladocerans are considered to be suitable live feed for fish larvae, they were mass cultured successfully by many investigators using different cheap organic waste products, (Golder et al., 2007; Shrivastava et al., 2006; Sivakumar, 2005; Suresh Kumar, 2000). Due to the smaller size and locomotive behaviour, *C. cornuta* has become the most preferable species of the fish larvae (Suresh Kumar, 2000).

The aim of this paper is to demonstrate the feasibility of maintaining culture for mass production of *Ceriodaphnia* solely on chicken manure and to provide practical guidelines to run such cultures.

Materials and Methods

Chicken manure was collected from a local broiler chicken shop and was dried for 2 days to remove the moisture and then in plastic jars for further use. Chicken manure suspension of 700 ppm concentration supported higher density of *C. cornuta* than other concentrations during preliminary trials carried out in 1 L beaker and was used to fertilize the medium. Chicken manure suspension of 700 ppm concentration supported higher density of *C. cornuta* than other concentrations during preliminary trials carried out in 1 L beaker and was used to fertilize the medium for mass culture in 50 L tanks. Zooplankton sample was collected from Chetpet Freshwater Pond, Chennai India and was brought to the laboratory with the least disturbance. The adult *C. cornuta* were separated using binocular dissection microscope based on the key characters outlined by Suresh Kumar and Sivakumar (2004).

The experimental aquarium tanks of 50 L capacity were filled with 40 L of filtered water and were fertilized with chicken manure at the rate of 700 ppm. The tanks were arranged in triplicate and after 4 days, *C. cornuta* were inoculated in each experimental tank at the rate of 50 Ind./L (individual per litre) containing both adults and neonates. The culture experiment
Contribution of Micronutrient Fertilization in Wheat Production and its Economic Repercussions


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Introduction

Wheat (Triticum aestivum) is an important rabi (winter) crop of Pakistan and is the most extensively cultivated crop in both the irrigated and the rainfed areas of the country. In Pakistan, during the year 2006-07, wheat was grown on an area of 8.58 million hectares with a total production of 23.30 million tones and average yield of 2716 kg/ha (GOP, 2008). To maintain the yield on a sustainable basis, proper amount of nutrients have to be added to each crop. Continuous cropping and contrasting edaphic requirement of crops have shown evidence of soil nutrient depletion and imbalances, low nutrient use efficiency, decline in organic matter and stagnant yield (Gupta et al., 2003). To get optimum yield, a balance dose of macronutrients as well as micronutrients are required. The soils of Pakistan, across much of the 22 m/ha cultivated area, have been formed from calcareous alluvium and loess, and are low in most of the essential plant nutrients. Loss of organic matter, whether by erosion or high temperature, in agro ecosystem adds to impoverishment of soil resources of several nutrient elements (Hadda and Arora, 2006).

Deficiency of various micronutrients is related to soil type, crop and to various cultivars. Introduction of new high yielding hybrids or cultivars, demanding a higher level of soil fertility, has further accentuated the incidence of micronutrient deficiencies.

Materials and Methods

Ten experiments were conducted in fields of two districts, viz. Mandi Bahauddin and Gujrat, in the Punjab province of Pakistan. Wheat response to the application of Zn, Fe and B in rice-wheat cropping pattern at ten locations in the fields in the Punjab, Pakistan was studied. The highest mean wheat grain yield (4707 kg/ha) was recorded with application of Zn:B @ 5:1 kg/ha, followed by 4678 kg/ha with Zn:Fe @ 5:10 kg/ha. The three micronutrients increased the grain yield from 1.8 to 11.8% over control, highest being recorded with the application of Zn:B @ 5:1 kg/ha. Combined application of all the three micronutrients reduced the grain yield by 1% compared to the highest yield attained by the combine application of Zn and B. However, the application of Zn @ 5 kg/ha proved to be the most economical micronutrient application with VCR of 4.80. None of the three nutrients increased the wheat grain yield in Gujrat, whereas Zn significantly increased the grain yield over control in Mandi Bahauddin. Straw to grain ratio of wheat was significantly decreased by the application of micronutrients over control mainly due to increase in grain weight.

Keywords: micronutrients, wheat, fertilizer, zinc, iron, boron

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Abstract. Wheat response to the application of Zn, Fe and B in rice-wheat cropping pattern at ten locations in the fields in the Punjab, Pakistan was studied. The highest mean wheat grain yield (4707 kg/ha) was recorded with application of Zn:B @ 5:1 kg/ha, followed by 4678 kg/ha with Zn:Fe @ 5:10 kg/ha. The three micronutrients increased the grain yield from 1.8 to 11.8% over control, highest being recorded with the application of Zn:B @ 5:1 kg/ha. Combined application of all the three micronutrients reduced the grain yield by 1% compared to the highest yield attained by the combine application of Zn and B. However, the application of Zn @ 5 kg/ha proved to be the most economical micronutrient application with VCR of 4.80. None of the three nutrients increased the wheat grain yield in Gujrat, whereas Zn significantly increased the grain yield over control in Mandi Bahauddin. Straw to grain ratio of wheat was significantly decreased by the application of micronutrients over control mainly due to increase in grain weight.

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The widespread deficiencies of Fe and Zn on the world scale are estimated to be 30-50% of the cultivated area (Cakmak, 2002). Soil and plant analyses show that >50% of the cultivated soils of the country are unable to provide sufficient Zn and B to meet the need of many crops (Khattak, 1995). The information obtained from 329 soil samples collected from various depths during the period of seven months revealed widespread deficiency of Zn and B followed by Fe (Zia et al., 2004). The widespread Zn and B deficiencies and micronutrient disorders have been reported for different field crops in all the four provinces of the country. More than 60% of soil in Punjab, 21% in NWF, 6-94% in Sindh and 90% in Baluchistan, are reported to be Zn deficient; Fe and B deficiency has been reported by Aziz et al. (2004) in citrus, deciduous fruits, groundnut and many other crops, who also found that make-up dose of nutrients improved the crop quality and increased resistance in plants against biotic and abiotic stresses. Chaudhry et al. (2001) reported that 5 kg/ha Zn appeared to be the optimum dose for wheat crop. Rashid (2006) reported that wheat responded to B. Pervaiz et al. (2003) found that straw grain ratio (SGR) decreased with the subsequent increase in Zn application. The present study was, therefore, under taken to identify the wheat response to micronutrients and their economic contribution towards wheat production.
Grain Yield Losses in Wheat by Russian Wheat Aphid

Diuraphis noxia (Mordvilko)

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Introduction

Pakistan, with a population of 160.9 million by mid-2008 is the sixth most populous country in the world. The country’s population is estimated to double by the year 2045 if population growth continues at 1.8% per annum (Economic Survey of Pakistan, 2008). Wheat is the most widely grown crop in the world. In Pakistan, wheat is a staple crop and is cultivated on some 8.459 million hectares giving production of 22.5 million tons during 2006-2007. It shares 13.7% of the value of Pakistan agricultural produce and 3.0% to GDP (Economic Survey of Pakistan, 2008).

Wheat crop suffers from a number of biotic and abiotic stresses from sowing to harvesting, including heat, drought, diseases and insect damage. One of the most recent and important pests of small grains is the Russian wheat aphid (RWA) Diuraphis noxia (Mordvilko). It spends its entire life cycle on the grains and grasses and is a serious pest of wheat. Russian wheat aphid prefers to live in leaf whorls and emerging tightly rolled leaves feeding on them. Infestation on leaves, stems, awns and heads result in necrosis and blackening of these plant parts, affecting grain yield. Aphid attack results in curling of leaves, delayed head emergence causing improper maturity of grains. Therefore, the early detection of pest infestation is important for its timely and proper control. Each 1% infestation level results in 0.5% yield loss at harvest (Karren and Reeve, 1989). Aphid attack starts from emergence and continues until maturity (Shea et al., 2000; Karren and Reeve, 1989).

The aphid incidence level differs in different cultivars of wheat (Wratten and Redhead, 1976). Advanced lines of wheat differ significantly with respect to population of aphids and grain yield. The aphid population attains peak level in mid March (Chen et al., 1994; Aheer et al., 1993). Aphid population varies on test cultivars of wheat during February-April 2001 and peak level of aphids was noted during the third week of March (Parvez and Ali, 1999). Aheer et al. (2006) reported mean densities of wheat aphids to be 2.29, 2.07, 2.41, 2.23 and 2.22/tiller on wheat cultivars, Inqlab-91, Pasban-90, Pak-81, Uqab-2000 and Iqbal-2000, respectively, and found that infestation of aphids mainly concentrated on leaves, on heads (spikes) and stem of wheat plant. The present studies were aimed at determining the effect of aphid populations on different wheat cultivars under field conditions.

Materials and Methods

The field experiment, to evaluate the response of different wheat cultivars to Russian wheat aphid (RWA), was conducted at Regional Agricultural Research Institute, Bahawalpur, Pakistan. Bahawalpur is located at an altitude of 112 meters, latitude 29° 23’ 60 N and longitude of 71° 40’ 60 E. Eight wheat cultivars, including two checks (Inqlab-91, Punjab-96, V-2047, V-2236, V-2239, V-2251, V-2707 and V-7222), were sown in two
Short Communication

Staining Effect of Yellow Dye Extracted from Wood of *Berberis vulgaris* L. on Angiospermic Stem Tissues

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*Berberis vulgaris* L., belonging to family Berberidaceae, is a shrub commonly growing in the southern Europe, northwest Africa and western Asia. It bears great medicinal importance. It was formerly used as a source of yellow dye and contains an antibacterial compound berberine (Kong *et al*., 2004). Berberine can be used as staining agent when dissolved in lactic acid (Lux *et al*., 2005).

Staining anatomical sections of plant tissues provides an adequate method for rapid and inexpensive microscopic observation of their internal structure. For section staining both natural and synthetic dyes are used (Drury and Wallington, 1976). The commonly used natural dye is haematoxylin, obtained from wood of Mexican tree, *Haematoxylon campechianum* (Baker and Silverton, 1985). Although synthetic dyes are very effective but their utilization is limited due to their harmful effects on human and animals. Some synthetic dyes have been in disuse due to their recognized adverse effects (Bhuyan and Saikia, 2004).

Owing to the global demand for the use of environmental friendly and biodegradable materials, the use of natural dyes has once again gained interest (Garg *et al*., 1991). The aim of the present investigation was to explore the effectiveness of yellow dye extracted from the wood of *B. vulgaris* L. for staining stem tissues of angiospermic plants.

Air dried wood of *B. vulgaris* L. was extracted with petroleum ether and after evaporating the petroleum ether, solutions were made using crystals in water and ethanol and used for staining. Free hand stem sections of *Pennisetum typhoides* (Burm.f.) Stapf. and C.E.Habb. syn: *P. glaucum* (L) R.Br. and *Chenopodium murale*, were prepared in ethanol, water, acetic acid and formalin, and stained with Berberis wood extracts (water and ethanol) (Ruzin, 1999). Then they were observed under light microscope (Olympus BX51) and the intensity of staining was determined (Lux *et al*., 2005).

The solutions of dye made in water and ethanol were found to stain the lignified tissues of both monocotyledonous as well as dicotyledonous stem cross sections (Table 1 and 2). However, Ethanolic extract was more effective than aqueous extract. The colour of the dye extracted with water was light yellow while that extracted with ethanol was dark yellow. The ethanolic extract of dye imparted dark yellow colour to vascular tissues of the stem cross sections. The dye extract 10% (w/v) in ethanol was found to be more effective in staining vascular bundles of monocotyledonous as well as dicotyledonous stem cross sections; however, the staining effects were more pronounced on the latter. The results further revealed that the dye extract in ethanol could be used successfully to stain lignified plant tissue. Similar results were obtained by Avwioro *et al.* (2005) for dye extracted from wood of *Pterocarpus osun* and Faizanullah (2004) for dye extracted from leaves of Henna

**Table 1.** Staining effect of *Berberis vulgaris* L. wood dye on stem tissues of *Pennisetum typhoides*

<table>
<thead>
<tr>
<th>Berberis wood extract</th>
<th>Tissue stained</th>
<th>Intensity of staining</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. In ethanol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1%</td>
<td>Vascular</td>
<td>+</td>
</tr>
<tr>
<td>5%</td>
<td>Vascular</td>
<td>++</td>
</tr>
<tr>
<td>10</td>
<td>Vascular</td>
<td>+++</td>
</tr>
<tr>
<td>II. In water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1%</td>
<td>Vascular</td>
<td>Traces</td>
</tr>
<tr>
<td>5%</td>
<td>Vascular</td>
<td>Traces</td>
</tr>
<tr>
<td>10</td>
<td>Vascular</td>
<td>Traces</td>
</tr>
</tbody>
</table>

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**Abstract.** Yellow dye was chemically extracted from wood of *Berberis vulgaris* L. using water and ethanol and its effectiveness as staining agent for angiosperm stem tissues was studied. The dye stained the lignified tissues of both monocotyledonous as well as dicotyledonous stem cross sections. However, the dye extracted in ethanol (10% w/v) was found more effective to stain the lignified tissues of plants.

**Keywords:** yellow dye, *Berberis vulgaris* L., angiospermic stem tissues

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Abstract. Mixed Ni-Zn ferrites \((x = 0.66, 0.77, 0.88, 0.99)\) were prepared by double sintering ceramic method using locally available low cost \(\text{Fe}_2\text{O}_3\) with 0.5\% by wt of Si additive. The chemical phase analysis, carried out by X-ray powder diffraction method, confirms the major phase of Ni-Zn ferrite. Study of the effect of composition on structural properties of ferrite system revealed a decreasing trend of lattice parameters with increasing Ni content. X-ray density and mass density increase with increasing Ni content, which in turn decreases the porosity due to successive presence of Si in \(\text{Fe}_2\text{O}_3\). This decrease in porosity along with chemical homogeneities, distribution of phases and grain formation were also observed in scanning electron micrographs.

Keywords: Ni-Zn ferrites; Si additive; iron oxide; ceramics

Introduction

Ferrites, being ceramic materials formed by sintering, have mechanical properties similar to those of pottery. In particular the properties depend on the sintered density. It was reported by Costa et al. (2003) and Snelling (1988), that during sintering, oxides react to form crystallites or grains which, nucleating at discrete centres, grow outwards until the boundaries meet those of neighbouring crystallites. During this process, the density rises; if this process were to yield perfect crystals meeting at perfect boundaries, the density would rise to the theoretical maximum, i.e., the X-ray density.

In practice, imperfections occur and the sintered mass has microscopic voids, both within the grains and at the grain boundaries. The resulting density is referred to as the sintered density. In normal production, the sintered density for Ni-Zn ferrite, suggested by Snelling (1988), is 4600 kg/m\(^3\) (pressed), and porosity is 13.5\%. It is a well-known fact that the properties of ferrite materials are strongly influenced by the materials composition and microstructure. But according to He et al. (2003), Da silva and Mohallem (2001), Heck (1974) and Von Aulock (1965), properties can also be changed by the sintering conditions employed and the impurity levels present in or added to these materials. The density and porosity can be improved further by using different techniques, like special sintering conditions and selecting suitable composition with addition of small amount (a few mol\%s) of metal oxide to ferrites. Researchers like, He et al. (2008), Goldman (1990), Heck (1974) and Von Aulock (1965), indicated that optimum properties of Ni-Zn ferrites were obtained when sintered at 1200-1250 °C. The sintering temperature 1200-1250 °C proved to be the most appropriate condition to obtain Ni-Zn ferrites and gave satisfactory values of density and other parameters comparable with the theoretical values reported for ferromagnetic Ni-Zn ferrites. In addition to this, He et al. (2008), Wu et al. (2006; 2004) and Goldman (1990), investigated the effect of Si, which improved the properties of ferrite products.

The present work was aimed at sintering Ni-Zn ferrite using low cost iron oxide, having 0.5 wt \% of Si additive, and studying its effect on improvement of the properties of ferrite samples and overcoming the cost of finally achieved ferrite products. The presence of Si improves density, but the amount must be low enough to prevent growth of large grains, which is confirmed through scanning electron micrographs.

Materials and Methods

Ferrite samples with compositions \(\text{Ni}_x\text{Zn}_{1-x}\text{Fe}_2\text{O}_4\), (\(x = 0.66, 0.77, 0.88\) and 0.99) were prepared in polycrystalline form through high temperature solid-state reaction method. The compositions, \(\text{Ni}_x\text{Zn}_{1-x}\text{Fe}_2\text{O}_4\), were prepared from powder mixture of NiO, ZnO, of purity better than 99\% along with locally available low cost \(\text{Fe}_2\text{O}_3\) with 0.5 wt\% of Si as an additive. The powder mixture were pressed into pellets of 16 mm diameter under a uni-axial pressure of 2.5 tons. Initially the samples were sintered in a muffle furnace at 1000 °C for prolonged period and finally heated for 6 h at 1200 °C for making a homogenous product. The samples were quenched in air and X-ray diffraction (XRD) patterns were taken by Rigaku XRD D/MAXIIA diffractometer using CuK\(\alpha\) radiations with

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A Review of Σ Hypernuclear Physics

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Abstract. A concise overview of fundamental Σ hypernuclei physics and the mechanisms of hypernucleus formation and interactions are presented. Σ−Λ interaction and strong force-mediated hyperon-nucleon interaction are introduced to give an epigrammatic background and current perspective of the subject. A model phenomenological elementary Σ-Nucleus (Σ-N) potential has been constructed and reported here as an instance of ΣN interaction. The potential incorporates both spin and isospin dependence and may be useful in calculating Hamiltonians, cross sections and decay widths in Σ hypernuclear reactions.

Keywords: ΣN potential; Σ−Λ conversion; woods-saxon potential; lane potential

PACS numbers: 21.80.+a, 24.50.+g; 25.80.Nv

Introduction

A hypernucleus is an unstable nucleus formed in situ with a constituent hyperon, a baryon comprising at least one strange quark, such as a Λ, Σ or Ξ hyperon, in a nucleus, such as Helium. Since the discovery of the first hypernucleus event in 1952 at Warsaw University with the detection of a Λ-hyperon by Danysz and Pniewski, (1953a;1953b; Danysz et al., 1963a; 1963b; Mladjenovic, 1992), the area of hypernuclear physics has seen a steady growth (Fig. 1). A number of further findings were made in the following years, recording more instances of hypernuclear detection, which are summarized in a detailed survey (Danysz, 1956). Nishijima (1954) predicted the Σ and Ξ particles for the first time and not only gave valuable insight into these hyperons but defined strangeness as an empirical quantum number connected to hypercharge. On the basis of this he did a complete classification of strange particles. This became one of the inspiring milestones for Schwinger (1956) to formulate his dynamic theory of κ mesons, as cited in his paper on this topic.

Since the Danysz and Pniewski (1953a;1953b) discovery, hypernuclei have been abundantly produced and studied at various physics laboratories in the world, most notably at the CERN in 1960’s and 1970’s epoch, Brookhaven (BNL) AGS during 1970’s to 1990’s, KEK, 1980’s to 1990’s, and at the BNL, KEK and US Jefferson labs (JLab) in the contemporary years, using both kaon and pion beams.

In addition to the terrestrial efforts at various laboratories, physicists turned to astronomy in order to see the presence of hyperons and strange baryonic matter in celestial bodies. It

Fig. 1. The first observation of a hypernucleus. A cosmic ray coming in from the top right collides with a nucleus in the emulsion to create the star of tracks. One of the fragments from the collision disintegrates lower down the image to produce three new tracks. The faintest of these, traveling towards the lower left, is probably due to a pion. The total energy released in the disintegration is consistent with the decay of a lambda particle in the original nuclear fragment. (Courtesy and Copyrights CERN Courier, CERN, Geneva).