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Effect of Thermal Shocking and Quenching on the Degradation Behaviour of a Thin PZT Disc

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Abstract. Thin lead zirconate titanate discs were subjected to thirty five thermal shocks from two different temperatures in deionized water and their relative dielectric constant, coupling factor and impedance values were measured with a view to investigating the behaviour of thin piezoelectric (PZT) discs at frequency of maximum and minimum impedance. Noticeable differences were observed in the electrical properties of the material, probably due to the change in dipole lengths and their orientations during thermal shocking. The results can be useful in modeling and designing of smart components for predicting their behaviour during such expected shocking conditions prior to fabrication.

Keywords: piezoelectric material, thermal shock, deionized water, dielectric constant, impedance, PZT

Introduction

Piezoelectric materials are used in various electromechanical applications where they are influenced by various cyclic loadings. Thermal cycling or thermal fatigue in most electronics materials may cause degradation in their internal characteristics. Thermal fatigue test methods include quench method and repeated heating method for thermal shocks which have been earlier discussed (Lamon and Pherson, 1991; Lamon, 1981). Influence of temperature on the electromechanical and fatigue behaviour of piezoelectric ceramics has been studied by Wang et al. (1998). Temperature gradient is developed due to sudden change in temperature in the ceramic materials and therefore, thermal stress is generated. Effect of thermal shocks has been studied by developing newly designed equipment. There are various popular thermal shock methods available in ascending and descending orders. Some of them popular for ascending thermal shocks, include hot jet gas method, high power radiation, melt immersion test, ribbon test method and high power laser heating method. Similarly, various test methods for descending thermal shocks are quenching in water, fluidized bed or a cold air jet impinging on hot discs; quenching in contact with huge brass rods and indentation method have been mentioned by Panda et al. (2002). Earlier, thermal shocks in a plate of finite thickness had been attempted. Thermal shock and thermal fatigue of ferroelectric thin films were investigated by Zheng et al. (2005). In all of the above methods, the water quenching method is mostly used for thermal shock tests in which samples are heated to a particular temperature and then quenched in water bath. Fatigue studies show that material degradation of PZT ceramics are strongly influenced by temperature.

Lead zirconate titanate ceramics show decrease in the dielectric constant and the resonance frequency when subjected to thermal shocks. Importance of temperature stability for dielectric constants and resonance frequencies have been discussed by Lee and Kim (2005). Earlier thermal shock resistance of the materials was evaluated by water quenching. Degradation of various properties of the piezoelectric devices in the presence of water and AC voltage was investigated by Xiang et al. (2007). They concluded that water is an important cause of degradation of piezoelectric (PZT) ceramics. However, limited work has been published on the effect of thermal shocking, quenching and on the degradation behaviour of thin piezoelectric ceramic discs. In this study, the degradation phenomenon of thin PZT ceramic disc have been investigated when exposed to repeated heating and quenching cycles below its curie temperature.

Materials and Methods

Lead zirconate titanate piezoelectric discs, nickel electroded on major faces, 0.191 mm thick and 12.7 mm in diameter, were used for the experimentation. The thin piezoelectric ceramic discs were heated at the heating rate of 9 °C/sec up to 100 °C, and 150 °C, using a thermal chamber and then quenched in deionized water at a temperature of about 20 °C. For all thermal cycling and quenching experiments, 2 PZT test samples were used and subjected to identical conditions. The temperature of the PZT samples was recorded using a spring loaded thermocouple and data acquisition system attached directly to the samples. In order to observe degradation phenomenon of the PZT ceramic, the capacitance, dissipation factor and impedance were measured at a frequency of 1 kHz at the start and after every five heating and quenching
Comparison of Ion Chromatography with Ion Selective Electrodes for the Determination of Inorganic Anions in Drinking Water Samples

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Abstract. Fluoride, chloride and nitrate anions were determined in drinking water samples using techniques of ion selective electrodes (ISE) and non-suppressed/suppressed ion chromatography (IC). Detection limit, percentage recovery and run time were evaluated for the two methods. Detection limits for ISE [0.02, 0.20 and 1.7 ppm (μg/mL) for fluoride, chloride and nitrate, respectively] were better than those for non suppressed IC (2.0, 1.0 and 2.0 ppm for fluoride, chloride and nitrate, respectively). Suppressed IC was used to measure fluoride. Statistical analysis of the data revealed no evidence of systematic difference between ISE and non suppressed IC for chloride and nitrate. Fluoride concentrations in all water samples were lower, while chloride and nitrate concentrations in some samples were higher than the maximum contaminant levels established by the United States Environmental Protection Agency.

Keywords: drinking water, nitrate, chloride, fluoride, ion selective electrode, ion chromatography

Introduction
Due to increase in population, urbanization and continued industrial growth, per capita water availability in Pakistan has decreased from 5000 m³/annum in 1951 to 1100 m³/annum in 2007 (WWF, 2007). The increasing gap between water demand and supply has led to severe water shortage in almost all sectors and has adversely affected the quality of drinking water; consequently, water pollution has become a serious problem in the country and most of the reported health problems are directly or indirectly related to water (PCRWR, 2008).

There are various sources of contaminants in drinking water which, when exceeding certain levels, are harmful to man. These contaminants are microorganisms, inorganic and organic chemicals and certain radioisotopes. Inorganic anions may affect the quality of water. Fluoride, chloride and nitrate have considerable importance in the quality of drinking water. Specially, the excess of nitrate and fluoride in drinking water has intense effects on human health (Meenakshi and Maheshwari, 2006; Fraser and Chilvers, 1981). Excess nitrate in drinking water could cause serious illness in infants below the age of six months. Fluoride might be the reason for different bone diseases and tenderness of bones in children (US EPA, 2009).

Fluoride, chloride and nitrate in groundwater and surface water originate from natural sources, sewage, industrial effluents, different food additives and as a result of leaching or runoff from agricultural land (WHO, 2004).

Various analytical methods have been proposed for the determination of fluoride in aqueous solutions, such as colorimetric, conductometric, complexometric and potentiometric methods (APHA, 1985). Some methods are rapid, sensitive, precise and relatively free of interferences. Traditional methods used for determination of fluoride, chloride and nitrate anions are based on colorimetric method, which due to interference by various ions, require special treatment of the samples like distillation or reduction and special analytical skills. Ion chromatography is becoming more popular for the analysis of water samples and is also recognized by the US Environmental Protection Agency (US EPA, 2009) as a method of choice for the determination of anions in water samples (Bosch et al., 1995; Cheam, 1992; Pereira, 1992; Frankenberger et al., 1990). Potentiometry has been widely used for quite some time due to its simplicity and prompt results. However, the selectivity is rather limited, especially if chemically similar ions are present in the sample. Recent developments in separation techniques have led to an improvement especially in the determination of fluoride in terms of selectivity and sensitivity (Weiss et al., 1995; Vasconcelos et al., 1994). Results of determination of bromide, chloride, fluoride, nitrate and sulphate using ion chromatography (IC) had been compared with those obtained by colorimetry for rainfall, cloud water and stream waters. According to that, there was no significant difference in chloride and nitrate measurements between the
Physical and Chemical Evaluation of Oils of Two Varieties of *Carthamus tinctorius* Grown in Pakistan

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Abstract. On evaluation of oils of two spineless varieties of *Carthamus tinctorius*, Thori-78 and Pawari-95 growing in Sindh, Pakistan, the quality of the oil was found to be similar, only the oil content differed. The hexane-extracted oil content of Thori-78 and Pawari-95 was 28.33±1.15 and 33.07±1.12, respectively. The oils contained 90.97% and 89.55% unsaturated fatty acids and 8.44% and 9.69%, saturated fatty acids, respectively. Linoleic acid was 75.42±0.59% and 76.40±1.0% and oleic acid was 15.55±0.30% and 13.15±0.49% by weight, respectively, and were the predominant fatty acids present in the oil.

Keywords: safflower oil, Thori-78, Pawari-95, linoleic acid, oleic acid

Introduction

Safflower (*Carthamus tinctorius*) is an annual herb belonging to the family Compositae. It is widely distributed throughout the world such as in Pakistan, India, Bangladesh, Afghanistan, Middle East, Thailand, China, Japan, Ethiopia, Sudan, Tanzania, Kenya, Tunisia, Europe, Argintina, USA, Canada and Australia (Knights et al., 2001). *C. tinctorius* flowers, seeds and oil have wide range of medicinal uses in different countries. Flowers are used for the preparation of dyes and drugs which are used for treating a number of disorders such as for dilation of arteries, reduction of hypertension, increasing blood flow, decreasing blood cholesterol, in treatment of rheumatoid arthritis, menstrual problems, skin diseases, urinary problems and jaundice etc. (Kaffka et al., 2001; Sastri, 1950). Seed decoction is used as laxative in Pakistan. The oil is used in Iran to treat liver and heart ailments and in charred state, used in India in treatment of sores and rheumatism. In Northern America, it is cultivated for using as bird feed, animal meal and for industrial applications (Oyen et al., 2007; Mündel et al., 2004; Oplinger et al., 1992).

Safflower is used as a substitute for saffron; its flowers are commonly mixed with rice, pickles and other foods to give an attractive colour (Sastri, 1950). America, India and Africa are the main producers of safflower oil. Its seeds are edible and are eaten after roasting. The seed oil content varies from 24 to 36%, depending on the variety of safflower, soil texture, climate and other conditions (Pritchard, 1991; Swern, 1964a). There are two types of safflower oil: high oleic (high in mono-unsaturated fatty acids) and high linoleic (high in polyunsaturated fatty acids). Gas chromatography has been an indispensable analytical technique ever since its first use in the fatty acid determination of plant seed oil (Echard et al., 2007; Peris-Vicente et al., 2006; Seppänen-Laakso et al., 2002). High performance liquid chromatography (HPLC) with ultraviolet and fluorescence detectors are the alternative methods for separation of volatile short chain and long chain fatty acids (Peris-Vicente et al., 2005; 2004; Chen and Chuang, 2002).

Safflower oil can be used in cosmetics, foods, nutritional supplements, personal care products, soaps and shampoos. Cold press oil is golden yellow and is used for culinary purposes. The oil obtained by dry hot distillation is dark and sticky and is used only for greasing ropes and leather goods which are exposed to water. Developed countries have created the most significant market for safflower oil for use as salad oil and cooking oil and in making margarine; being non-allergenic, it is considered to be one of the healthiest oils for human consumption because it has a high ratio of polyunsaturated/saturated fatty acids.

Safflower was introduced as oilseed crop in Pakistan in 1960. It is mainly cultivated in Sindh and Baluchistan provinces. Being a drought-tolerant crop, it is recommended for planting in rainfed areas. In Sindh it is cultivated after the rice crop on residual moisture. Due to the increasing interest in the safflower oil for edible purposes based on its high content of linoleic acid, our studies are mainly focused on the content and physical and chemical evaluation of the oils of two spineless varieties of safflower, Thori-78 and Pawari-95, grown in

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Analysis of Caffeine and Heavy Metal Contents in Branded and Unbranded Tea Available in Pakistan

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Introduction

Tea (Camellia sinensis) is one of the most popular beverages all over the world. According to an estimate, 2.5 million metric tonnes of dried tea is manufactured annually, 75% of which is processed as black tea and consumed in different countries. In UK, on an average, one litre of tea is consumed per person per day (Al-Oud, 2003). Different brands of tea are manufactured to meet the increasing demands of consumers worldwide. Positive and negative effects of tea on the health have been investigated by many researchers, recently (Yao et al., 2006a).

Caffeine ascribes quality characteristics to tea, such as briskness, taste etc., and has been considered an important quality parameter in the evaluation of tea quality (Yao et al., 2006b). Caffeine is a pharmacologically active substance and, depending on the dose, can be a mild nervous system stimulant. Caffeine does not accumulate in the body and is normally excreted within several hours of consumption (Mumin et al., 2006; Obanda et al., 1999). Human body requires both metallic and non-metallic elements for healthy growth and development within certain permissible limits. The optimum concentration needed for this purpose varies widely from one element to another, from infant to childhood to adult and from male to female (Atta, 1995). Determination of these elements in beverages, water, food, plant and soil is thus of utmost important. Tremendous research has been rendered on finding tolerance limits for nearly all essential elements needed for healthy growth and physiological changes in human body. There is a fairly narrow gap between the essential and the toxic levels of metals and essential trace elements that can otherwise accumulate in bone, hair and soft tissues such as liver, kidney, brain or lungs (Tautkus et al., 2004).

Materials and Methods

Caffeine. Preparation of tea solution. Two grams of tea were added to boiling water, (200 mL) in a 250 mL conical flask placed on a hot plate at 90 °C while stirring for 10 min by a magnetic bar. Then the tea solution was filtered through cotton wool and the residue was washed thrice with distilled water (10 mL). The tea solution was cooled to room temperature and washings were diluted to 250 mL with distilled water. The sample was analyzed in duplicate.

Measurement. To 10 mL of tea solution, 5 mL HCl (0.9 mL of 36% HCl was diluted to 1000 mL with distilled water) and 1 mL lead acetate solution (100 g of lead acetate was dissolved in small quantity of water and diluted to 200 mL with distilled water) were added and diluted up to 100 mL with distilled water. The solution was then filtered through Whatman filter paper # 42. Filtrate 25 mL and 0.3 mL sulphuric acid (167 mL of 98% H2SO4 was diluted to 1000 mL with distilled water) were placed in a volumetric flask and diluted to 50 mL with distilled water. The solution was filtered using the same type of filter paper. Absorbance of the filtrate was measured using spectrophotometer (Spectronic Unicam) at 274 nm. Readings were taken in duplicate.

Standard curve. Caffeine stock solution (20 mg caffeine/10 mL, w/v distilled water) was diluted to 200 mL with distilled water. Next, 0, 10, 20, 30, 40 and 50 mL of the diluted caffeine solution were separately mixed, each with 4 mL HCl in a volumetric flask and diluted to 100 mL with distilled water. Thereafter, the
Measurement of Atmospheric Concentrations of CO, SO$_2$, NO and NOx in Urban Areas of Karachi City, Pakistan

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Abstract. In the assessment of variation trends in ambient air quality at five selected regions of Karachi city, four air pollutants namely carbon monoxide, sulphur dioxide, nitrogen oxide and nitrogen dioxide were monitored, along with metrological parameters, for eight consecutive days. The results suggested that all the pollutants were mainly due to the emissions from motor vehicles and industries, owing to the absence of regulatory laws/standards about ambient air quality in Pakistan. The results have been discussed with reference to recommendations of the World Health Organization for the same.

Keywords: air pollution, industrial emission, vehicular emission, atmosphere

Introduction

Karachi is the largest metropolitan city of Pakistan having an estimated population of above 10 million. Total amount and complexity of toxic pollutants in the environment of Karachi are increasing day by day with the rapid increase of population and proportional increase of industries, vehicular traffic and open air garbage burning. Rate of atmospheric pollution is 40 percent higher in Karachi than the other cities of Pakistan (Qureshi, 1997). Typical major ambient air pollutants in the urban environment include CO, SO$_2$, NO, NOx, HC and PM10. CO is formed during combustion of carbon containing compounds. It is a toxic gas and its prolonged exposure, even at very low levels, may adversely affect central nervous system. When inhaled, it reacts with the haemoglobin of the blood stream to form carboxy-haemoglobin. CO attaches to haemoglobin roughly about 210 times more than the oxygen (All Refer.com, 2005). SO$_2$ is also generated by the combustion of high sulphur fuels. SO$_2$ is toxic to human body especially for persons having previous history of respiratory diseases, such as emphysema; besides, it also causes pneumonia. Nitrogen oxides are generated at high temperatures during combustion. Their ultimate effect on human beings is still not clearly understood, but they act as irritants to breathing and create discomfort to eyes and also destroy the cilia in the respiratory system.

Present study was carried out in various industrial, residential/commercial and down-town regions of Karachi city to generate base-line data on these localities by air pollution monitoring analyzers, to identify major sources of air pollution and suggest their remedial measures. The data so generated may assist in the formulation of the country air quality standards. Information about the industries was obtained from different civic agencies and the Department of Industries.

Materials and Methods

The subtropical city of Karachi is located in a semi-arid zone. It is the largest industrial and commercial centre in Pakistan and declared as one of the twenty mega cities of the world (Mage et al., 1996). Growing urban population, industrialization and traffic congestion are the main causes of air pollution in Karachi city. In order to assess the load of air pollutants in the environments of the city, monitoring of different air pollutants was carried out at five different locations (as shown in location map) of the city, categorized as follows:

1- Region A: the site with urban background, moderately populated, having low vehicular traffic density. It is one km distant from the main super highway. The area around the sampling site is sparsely populated.

2- Region B: a commercial site, densely populated, having high vehicular traffic density. This site is the busiest intersection of Karachi, surrounded by multistoried commercial as well as residential buildings. The population around this site mostly belongs to high income group.

3- Region C: an industrial area in district South of Karachi, with nearly 2000 different types of industries, approximately 60 percent comprising of textile mills, while
Seasonal and Year Wise Variations of Water Quality Parameters in the Dhanmondi Lake, Dhaka, Bangladesh

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Abstract. The quality of the surface water through 16 physicochemical variables was monitored at three sites of Dhanmondi Lake of Dhaka, Bangladesh, over 5 years during 2002-2007. The concentration of heavy metals (Pb, Cd, Cr, Co, Ni, Cu) was below detection limits with few exceptions. No clear seasonal variation trend for Fe, Mn, Zn, PO₄³⁻, SO₄²⁻, Cl⁻ and F⁻ was observed which differed from year to year. Slight increasing tendency in case of sulphate, phosphate, chloride concentrations and electrical conductivity was observed but it was not clear in other parameters. The levels of all parameters were found well below the standards for drinking water.

Keywords: lake water, seasonal variability, pollution trend, water quality, heavy metals

Introduction
Over the past 25 years, the quality of water bodies around Dhaka city has deteriorated a lot due to unplanned discharge of untreated effluents from factories and sewage. Dhanmondi Lake is one of the biggest lake and a great recreation place for the people of Dhaka city. But, this Lake is being contaminated due to the increase in human activities during the last few years. Lot of construction work had also been done during 1980 to 2006 along the valley of this Lake, which had directly influenced the water quality of the Lake. In addition, frequent floods during recent years have also contributed in polluting the lake water. The number of tourists has also increased in recent years, directly affecting the quality of water. Fishing activities around the lake are another source of contamination. Thus, a constant and systematic monitoring is essential to study long term pollution in the Lake environment especially when it is impacted by the increasing tourist population which disturbs normal activities in the area. Some short-term research work had been carried out in the past on water quality parameters of the river, and lake water in our laboratory (Quraishi et al., 2006; Azim 2005; Chowdhury et al., 2005; Hossain, 2005; Hadi et al., 1996; 1991; Maroof et al., 1985). But long-term monitoring is necessary to evaluate the pollution sources and to get a clear trend of pollution. Therefore, a long-term monitoring program was initiated in 2002 spread over a period of 5 years during 2002-2007, for a wide range of water quality parameters. The main objectives of this work were (i) to establish background levels for Mn, Fe, Zn, Cr, Ni, Co, Cu, Cd, and Pb in the lake water of Dhaka City and (ii) to examine the seasonal and year-wise variability of trace metals in lake water on seasonal basis.

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Trace toxic metals and physicochemical parameters e.g., Pb, Cd, Cr, Ni, Co, Cu, Fe, Mn, Zn, EC, pH, Cl, F, SO₄²⁻, PO₄³⁻, CN, NO₃⁻ concentrations were monitored three times at three different locations over a period of five years between March 2002 and September 2007; data for the year 2003 is not available.

Materials and Methods
Reagents. All chemicals were of analytical reagent grade. HNO₃, HCl and H₂SO₄ were of analar grade from BDH Laboratories. Certified reference material was obtained from the National Institute of Standards and Technology, USA. Commercially available 1000 mg/L (ICP grade) single element standard solutions (Merck or SPEX Certiprep, Metuchen, NJ, USA) were used in preparation of the working standards. Standard solutions were freshly prepared from 1000 ppm stock by dilution with deionized water (DI).

Sample collection, preparation and analysis. Water samples were collected from three locations thrice in a year between March 2002 and September 2007. Sampling was done in March (pre-monsoon), July (monsoon) and September (post-monsoon). The locations of the three sampling sites are shown in Fig. 1.

Each sample was divided into two portions, one for the analysis of metals ions and another for that of anion. pH of the portion for the analysis of metals was adjusted below 1 by addition of nitric acid to prevent adsorption to the bottle and the portion of anions was filtered, using Whatman filter #41 to remove suspended matter and stored at 4 °C. Water sample (250 mL) was quantitatively transferred to 250 mL beaker and then heated on a hot plate with 2 mL of HNO₃ until the total volume was reduced to approximately 5 mL. The concentrate
Salt Tolerance Evaluation of Rice (Oryza sativa L.) Genotypes Based on Physiological Characters Contributing to Salinity Resistance

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Abstract. Seven newly developed rice cultivars i.e., KS-133, DR-83, DR-64, BR-601, Gomal, JP-5 and Gomal-6, were evaluated for salinity tolerance in a glasshouse along with three varieties of known salinity tolerance i.e., KS-282 (tolerant), IR-6 (medium tolerant) and Basmati-385 (susceptible). Based on the survival percentage at 50 mol/m³ sodium chloride salinity imposed at seedling stage, rice cultivars KS-133, Gomal, and DR-83 showed high survival comparable to that of salinity tolerant cultivars like KS-282, and were thus placed in tolerance range. Survival percentage of JP-5, Gomal-6 and DR-64 remained in medium tolerance range (35 to 38%) as that of IR-6. The rice cultivar BR-601 showed only 13% survival and was found to be as sensitive towards salinity as Basmati-385. The results of rice survival in saline medium showed good uniformity and the check varieties showed results corresponding to those found elsewhere. Sodium (Na⁺) and potassium (K⁺) concentrations in the third leaf showed variations among different rice cultivars under salinity. There was an inverse correlation between varietal leaf Na⁺ vs survival percentage (r = -0.808) and Na⁺ vs leaf chlorophyll (r = -0.857). The correlation between K⁺ and final survival percentage was direct (r = 0.744) and also leaf chlorophyll vs survival (r = 0.952). The shoot fresh and dry weights were greater in the rice genotypes having higher final survival percentage under saline conditions. Therefore, in addition to final survival percentage, the higher shoot fresh and dry weight under salinity could be also used as criterion for evaluation of salinity tolerance of rice.

Keywords: salinity, rice, chlorophyll, salinity tolerance

Introduction

Salinization of agricultural soils is one of the major abiotic stresses reducing crop productivity worldwide. Over 6% of the global land area and over 20% of the irrigated land are currently affected by salinity (Munns, 2005). As irrigated system supplies roughly one-third of the world food supply, therefore, addressing the problem of salinity is of great concern especially with an increasing global population. Rice is one of the most important food crops, but the yield of the grain is very susceptible to salinity (Akbar et al., 1985). In Pakistan out of 6.8 million hectares of salt-affected land, over 1.5 million hectares are under rice cultivation (Khan, 1998). Thus, selection of rice cultivar having salt tolerant potential that would grow over a range of soil salinity is a prerequisite for generating income for rice farmers having sizable salt-affected lands.

Salinity resistance in rice is a complex character and many factors contribute to such resistance as occurs in species. Physiological studies suggest that in rice, restriction of sodium entry, higher potassium uptake, plant vigour, tissue tolerance to absorbed ions and water-use efficiency are the main factors contributing towards salinity resistance (Yeo et al., 1990). Reduction in shoot growth under salinity limits the volume of tissue for the uptake of newly arriving salt and once it starts, the situation worsens. Accumulation of Na⁺ and Cl⁻ in the leaves has been found to reduce photosynthetic activity, with ultra-structural and metabolic damage (Flowers et al., 1985). Salinity tolerance in rice can be enhanced by reducing the influx of excessive amounts of sodium chloride in the transpiration stream. The salt concentration in the shoot can be reduced by lowering sodium transport to the shoot and/or increasing plant vigour. Normally the more vigorous plants under non-saline conditions show greater resistance to salts (Yeo and Flowers, 1986). Some traditional cultivars and landraces are more tolerant to various abiotic stresses than elite cultivars. These cultivars are good source of tolerant traits; however, they generally have poor agronomic traits.

Maximizing the salt tolerance of crop species mainly depends on two factors: availability of genetic variation to tolerance and exploitation of the genetic variation by screening and selection of plants with superior performance under the applied stress (Yamaguchi and Blumwald, 2005; Shannon et al., 1994). Sensitivity of rice to salinity varies with the stage of growth. Generally, it is very sensitive to salinity stress at
Parasitic Contamination in the Table Vegetables Planted in Shiraz Plain, Iran

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Abstract. Contamination with parasites of the vegetables grown in Shiraz plains and irrigated by urban and industrial sewage-laden Shiraz Roodkhaneh Khoshk River and seasonal Soltanabad River was studied. It was found that 31.5% of the farms irrigated by the river water directly, 30.9% of the farms irrigated by water of nearby located shallow wells and 33.7% of the farms using water from the wells at a distance of one kilometer from the River were contaminated by Ascaris ova. 32.20% vegetables of farms irrigated by the wells located near Soltanabad river were contaminated with insects and larvae and 24.5% with Ascaris worm. After Ascaris ova, the larvae of different insects, Strongyloides parasite, Stercoralis and Trichostrongylus were the contaminants most present.

Keywords: parasites, irrigation, vegetables, Shiraz rivers, Ascaris

Introduction

Table vegetables, particularly those irrigated with raw sewage, play an effective role in the transfer of parasites specially the soil parasites and thus in spreading contagious and parasitic diseases to the consumers (Shariatpanahi, 2001; Fereydoun, 1987). The vegetables irrigated with Firoozabad-Tehran creek in 1989 and 1990 and table vegetables used in Yasooj in 1996, were found to be contaminated with parasitic worm eggs (Sarkari, 1997; Vosooghi, 1990). In south Louisiana in USA, where city and industrial sewage contaminated the agricultural lands, vegetables such as spinach, parsley, onion, asparagus, spearmint, tomato, pea, carrot and cabbage were found to be contaminated with heavy metals, the latter being 1.60% more than the permissible limit of the American National Health Society. Moreover 28.20% of the farms were contaminated with the parasitic eggs found in sewage (Ramelow et al., 1992).

In Japan, the researchers of Agriculture College, Tokyo University, in 1962 conducted necessary tests for finding the contamination of leek, parsley, sweet basil, spearmint and green pepper growing in the fields which were irrigated with city and industrial raw sewage and found these vegetables, heavily contaminated with parasites whereas the content of heavy metals was 2.13% more than the standards (Chino et al., 1991).

The researches conducted in Iran show that the vegetables may transfer eggs of worms such as Ascaris, Trichocephalus, Hymenolepis nana, Taenia, Fasciola hepatica, larvae of worms such as Trichostrongylus and hookworms, unicellular creatures such as Antamoeba histolytica, Giardia lamblia, Toxoplasma gondii which cause amoebiasis, giardiasis, (lambliasis) and toxoplasmosis and other diseases (Fereydoun, 1987).

Though irrigation method should be defined in relation to the amount of water used and the type of plants being irrigated, as each plant needs a different rate of water depending on the environment and geographical conditions such as temperature, raining rate, latitude etc., it was observed that these factors are ignored in Shiraz plain irrigation; here the irrigation system is deep water which is traditional and uses about 4,000-12,000 cubic meter water per hectare, yearly. This system causes problems relating to drainage of water, environmental contamination, agricultural damages and soil erosion etc. (Rastegar, 1992).

The present study was undertaken to find the extent of contamination of vegetables irrigated directly by Shiraz Roodkhanenh Khoshk River and Soltanabad River and by nearby lying well water. Taking into consideration the diseases, such as diarrhoea, resulting from the above mentioned practice, it is intended to propose safe means of growing vegetables and prevent regional contamination of vegetables with parasites and their transfer to the consumers.

Materials and Methods

City sewage is discharged into Shiraz Roodkhanenh Khoshk River passing through the city centre. Some districts of the city do not have proper sewage disposal means and the factories beside the river also dump their waste products...
Microbiological Quality of Drinking Water and Beverages in Karachi, Pakistan

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Introduction

Raw water itself does not contain large number of microorganisms. Drinking water contains assimilable organic compounds that allow a certain degree of bacterial growth (Exner et al., 2005). Improperly installed hand pumps permit infiltration of contaminated surface water, whereas unclean storage devices and other factors contribute to disease cycle, malnutrition and high mortality. Infectious diseases caused by pathogenic bacteria are the most common and widespread health risk associated with drinking water. Some of the pathogens, which are transmitted through contaminated drinking water, lead to severe and sometimes life threatening diseases particularly in children. The potential of drinking water to transport microbial pathogens to large number of population, causing subsequent illness, is well documented in different countries.

The most common and widespread risk associated with drinking water is its contamination by human or animal excreta. The potential consequences of microbial contamination necessitates that its control be of paramount importance. Pathogens in drinking water, presenting serious risk of diseases, include Salmonella sp., pathogenic Escherichia coli, Pseudomonas, Vibrio cholerae etc. Faecal specific bacteria such as coliforms, faecal coliforms and E. coli are the parameters of importance in monitoring faecal pollution.

The survival and growth of microorganisms in processing environments of foods, such as beverages, sherbets, ice creams, ice-lollies, etc. may lead to contamination of the finished products, resulting in reduction of microbiological safety and quality (Kohnen et al., 2005). However, several studies have demonstrated that the total counts and number of pathogens may get reduced due to the acidity and the effect of CO₂ during storage. (Mugochi et al., 1999; Simango and Rukure, 1992; Sheth et al., 1988; Zschaler, 1979; King and Nagel, 1975; 1967).

In Pakistan people lack access to adequate supply of safe water for daily use. The basic sanitary facilities are very poor and are not available for half of the population. Sources of microbial contamination of water and beverages include raw materials, processing equipment or utensils, human activities, sanitation practices, workers or handlers, waste materials, animal and insect pests and microbial growth niches. Chemical composition of foods and beverages and the environmental factors, such as water activity, pH, temperature, etc., determine the types of organisms that can grow there.

The present study was undertaken keeping in view the hazards of polluted or contaminated drinking water and the effect of its use in beverages and ice lollies etc. The survey provides base line data for authorities to set the guidelines for microbiological quality of water and beverages within the country.

Materials and Methods

Sample collection. A total of 780 water samples and 1220 beverage samples (412 branded and 808 unbranded), collected from 490 different schools, both government (98 schools) and private (392 schools), situated in different areas of the city of Karachi, was conducted for bacterial heterotrophic plate count, total coliforms, faecal coliforms, E. coli, faecal streptococci, Pseudomonas and Salmonella species. The counts ranged from 0 to 2.5 × 10⁵ cfu/mL and from 0 to 10⁶ cfu/mL in water and beverage samples, respectively. About 36% of water samples and 48% of unbranded beverage samples were contaminated with the indicator and the pathogenic bacteria; all the branded beverage samples were found fit for human consumption from microbiological viewpoint.

Keywords: drinking water, beverages, microbiological quality

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Study of food and feeding habits of fish requires continuous research, since successful fishery management, aquaculture and capture fishery programmes are based on it (Oso et al., 2006). Caranx hippos, Chrysichthys nigrodigitatus, Ethmalosa fimbriata and Mugil cephalus are some of the fish species readily available in the Lagos Lagoon, Nigeria in West Africa, and make up an important part of artisanal fisheries. Several studies of the food and feeding habits of these four fish species have been made, some of which include the work of Oronsaye and Nakpodia, (2005) and Blay (1995). However, information on the feeding inter-relationship of these species is lacking. In this paper, a report on the feeding inter-relationship among the four fish species is presented.

Forty specimens of the above-mentioned four fish species were caught in the Lagos lagoon each month during February to May 2001. Body weights and lengths of fish were measured and the stomach contents were studied. The organisms found were identified to the species level and analyzed by numerical and frequency of occurrence method.

Analysis of the food of Caranx hippos revealed diatoms and algae to form the major food items. Other food items were molluscs (Aloidis trigona, bivalve shell and Tympanotonus fuscatus), crustaceans (Calanus finmarchicus, shrimp and shrimp parts), fish (eggs, bones, scales and flesh) and detritus and other unidentifiable matter (Fig. 1).

Diatoms formed the major food items of Chrysichthys nigrodigitatus. Other food items were molluscs (Aloidis trigona, bivalve shell and Tympanotonus fuscatus), crustaceans (shrimp parts, Calanus finmarchicus, cladocera and crab appendages), fish (fins, scales, eggs and bones), algae, plant material and unidentifiable matter (Fig. 2).

Diatoms were the major food items of Ethmalosa fimbriata as well. Other food items were crustaceans (Calanus finmarchicus, shrimp parts, isopods and cladocera), fish (bones, scales and eggs), algae, plant materials and unidentifiable matter (Fig. 3).

Major food items in the gut of Mugil cephalus were diatoms. Other food items were crustaceans (Calanus finmarchicus and shrimp parts), fish (scales and bones), algae, plant materials and unidentifiable matter (Fig. 4).

Analysis of the food items in the gut of four fish species revealed that Caranx hippos did not feed on fish in February and April, molluscs in April and did not feed on plant material at all. Chrysichthys nigrodigitatus fed on plant material in February and fish in May. Ethmalosa fimbriata did not feed on fish in February and April, on plant material in April and did not feed on molluscs at all throughout the months studied. Mugil cephalus did not feed on fish in April and May and did not feed on molluscs at all.

The study reveals the food and feeding habits of the four fish species. Mugil cephalus is a plankton feeder, feeding mainly on algae and diatoms (Ramirez-Luna et al., 2008). In this study the important food item of Mugil cephalus comprised of diatoms, while other food items were algae, crustaceans, plant material and detritus. The food items of Chrysichthys nigrodigitatus included plant materials, molluscs, crustaceans, fish and detritus. Dada and Araoye (2008) also discovered similar food items in the stomach of Chrysichthys nigrodigitatus. Ajah et al. (2006) reported
Production and Characterization of Chitosan from Shrimp (*Penaeus semisulcatus*) Shell Waste of UAE

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Abstract. Chitosan was prepared from shrimp (*Penaeus semisulcatus*) shell waste by a chemical process involving demineralization, deproteinization and deacetylation; conversion of chitin to chitosan (deacetylation) was achieved by treatment with concentrated sodium hydroxide solution (55%) at room temperature (25 ºC). The present study was undertaken to evaluate the influence of deacetylation process during chitosan production on the physicochemical and functional properties of shrimp shell chitosan. Four experimental chitosan samples were prepared with deacetylation for 40 h, for 50 h, with and without stirring as well as for 60 h and were subjected to physicochemical and functional characteristic analysis. Change in duration of deacetylation process yielded some differences in each characteristic; deacetylation for 40 h led to lower viscosity, solubility, water/fat binding capacity and degree of deacetylation and for 60 h resulted in increase in solubility but decrease in viscosity. Stirring during deacetylation process led to lower viscosity, higher degree of deacetylation and higher fat binding capacity of the product. In contrast non-stirred sample produced product with lower degree of deacetylation and higher viscosity. It was concluded that duration of deacetylation process should be monitored constantly for optimal chitosan production depending on its intended usages in food, pharmaceutical and biomedical industries.

Keywords: shrimp shell waste, deacetylation, chitosan, chitin

Introduction

Chitosan is a fiber-like substance derived from chitin, a homopolymer of β-(1→4)-linked N-acetyl-D-glucosamine. Chitin is widely distributed in marine invertebrates, insects, fungi, and yeast (Subasingle, 1995; Austin et al., 1981); however, it is not present in higher plants and higher animals. Generally, the shells of selected crustaceans consist of 30-40% protein, 30-50% calcium carbonate and calcium phosphate and 20-30% chitin (Acosta et al., 1993; Knorr, 1984). Chitin is widely available from a variety of sources among which, the principal source is shellfish waste such as that of shrimps, crabs and crawfish (Rinaudo, 2006; Allan and Hadwiger, 1979). It also exists naturally in a few species of fungi (Franco et al., 2004; Andrade et al., 2000; Chung et al., 1994). Chitin and chitosan have similar chemical structures (Fig. 1). Chitin is made up of a linear chain of acetylglucosamine groups while chitosan is obtained by removing enough acetyl groups (CH3-CO) from the molecule so that it becomes soluble in most diluted acids. This process is called deacetylation. The actual difference between chitin and chitosan is the acetyl content of the polymer. Chitosan having a free amino group is the most useful derivative of chitin (No and Meyers, 1992).

Chitosan is a non toxic, biodegradable polymer of high molecular weight (Zhang and Neau, 2001; Tomihata and Ikada, 1997). Over the last several years, chitinious polymers, especially chitosan, have received increased attention as one of the promising renewable polymeric materials for their extensive applications in the pharmaceutical and biomedical industries for enzyme immobilization and purification, in chemical plants for wastewater treatment and in food industries for use in food formulations as binding, gelling, thickening and stabilizing agent (Prashanth and Tharanathan, 2007; Franco et al., 2004; Knorr, 1984).

Traditional isolation of chitosan from crustacean shell waste consists of four basic steps: demineralization, deproteinization, decolourization and deacetylation (Galed et al., 2008; No and Meyers, 1995). Several procedures have been developed and proposed by many researchers over the years for preparation of chitosan from different crustacean shell wastes (Galed...