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Spatial variability of biochemical composition in coral reef sediments of Kavaratti and Pitti islands, Lakshadweep archipelago

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In this study, variability of biochemical composition in the surficial coral reef sediments of Kavaratti and Pitti islands in Lakshadweeep archipelago was investigated. Biochemical composition of sedimentary organic matter from the study area was characterized by the dominance of proteins in Pitti and carbohydrates in Kavaratti over lipids. The percentage ratio of the labile to total organic matter indicated that most of the deposited organic matter was refractory in both environments. The higher PRT:CHO ratios in Pitti sediments compared to that of Kavaratti indicated that in the former there was low dead organic matter accumulation. The lower LPD:CHO ratios estimated for sediments in both islands indicated low quality of labile organic matter to support benthic fauna.

[**Keywords**: Coral reef sediments, Kavaratti, Pitti, Organic matter, Biochemical composition, Labile organic matter]

Introduction

Marine sediment overlay two-thirds of the earth's surface representing one of the largest microbial habitats on the earth. It is complex in nature and acts as the major sites for mineralization and nutrient regeneration of organic matter derived from pelagic primary production and terrestrial input[1]. The surficial sediments can play an important regulatory function through the storage and transformation capacity of organic matter and nutrients and through the reactivity of biogeochemical buffers[2]. A fraction of 25–50% of the organic matter derived from coastal primary production is deposited to the sediments[3,4,5]. The oxic surface layer of marine sediments can account for more than half of the total organic carbon mineralization[6,7].

Coral reef ecosystems are widely recognized as among the most biologically diverse and complex ecosystems; they have been called the marine equivalent of tropical rain forests[8]. These are characterized by exceedingly high rates of productivity, yet are typically situated in nutrient poor waters[9]. Coral reef sediments are generally loose and unconsolidated in nature. Sediments are fundamental for the function of oligotrophic coral reef ecosystems because they are major places for organic matter recycling. This releases the nutrients to the surrounding environment and the dynamics of nutrients are linked to the ecological processes. The study of nutrients would help in understanding the potential availability of life supporting elements in the aquatic system[10]. Therefore, both qualitative and quantitative studies are important for understanding the basic processes governing the distribution and biogeochemical cycling of nutrients[11]. The best coral development is always found on the nutrient-depleted oligotrophic waters, as they are the least tolerant of nutrient enrichment. The biogeochemical processes in the oxic sediment layer play an important role for highly permeable, carbonate sediments in coral reefs[12,13,14,15].

Reef sediments are typically derived from the calcareous skeletons of corals processed by bio-eroding organisms, but also by other biological, chemical and physical processes[16,17]. Generally, permeable reef sediments function as biocatalytical filters that lead to a very effective processing and regeneration of organic matter[18,19,20,21]. Consequently, these sediments contribute to the release of the limiting nutrients N and P after remineralization of organic material[22]. Through their contribution to an efficient element cycling[18,22], reef sediments are crucial for the functioning of coral ecosystems and help to maintain typically high biomass and primary productivity in coral reefs[23,24], despite of the surrounding oligotrophic waters[25,26,27].

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Role of hydrographical parameters and total organic carbon on mercury allocation along the riverine transect of Beypore, south-west coast of India

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Distribution of total mercury (THg) was carried out in the sediments of Beypore estuary. The THg concentration in surface sediments varied from 0.03 ppm to 0.17 ppm. The pollution index approach using contamination factor (CF) revealed that the sampling stations are moderately contaminated with respect to mercury. Further, the effects of hydrographical parameters (pH, salinity, dissolved oxygen) and total organic carbon (TOC) of the sediment were studied over the spatial distribution of mercury (Hg). Correlation analysis unveiled THg exhibited significant positive correlations with TOC (R=0.91) and salinity (R=0.744). However significant inverse correlation was observed between pH and Hg (R =-0.93). The C: N ratios suggest that the organic matter is labile in nature. Total organic carbon was found to control the distribution of Hg. It is the first base line study in this estuary.

[Keywords: pH; Salinity; Dissolved oxygen; Total organic carbon; Mercury; Beypore estuary]

Introduction

Mercury (Hg) is regarded as a global pollutant and an extremely toxic metal occurring naturally in air, water and soil[1, 2]. The element Hg occurs naturally from countless sources[4,5,6] and its toxicity is well established[3]. Numerous studies pertaining to Hg in coastal and estuarine sediments have unveiled the fact that organic matter is a key variable which influences distribution of Hg in aquatic environments[7,8,9,10,11,12,13]. Total organic carbon (TOC) is found to exhibit excellent correlations with Hg circulation in sediments[8,9,10] . It is cited that primary driver of sediment diagenesis in freshwater and marine sediments is organic carbon (OC) flux[14]. The stability of Hg-OC complexes depends on several factors: 1) nature and composition of organic matter; 2) Hg concentrations; and 3) pH, ionic strength and redox condition of the medium[15,16,17].

Organic carbon transported to the sediment can be of two types namely, autochthonous and allochthonous carbon[18]. Autochthonous carbon, which is typically considered the more labile of the two types of carbon, is produced at or near the site of consumption. Organic carbon produced outside the system of interest is considered allocthonous organic carbon[18]. Since organic carbon in fluvial systems can be degraded during transport by microbial and macrobiotic processes, allocthonous carbon (produced elsewhere) tends to be more refractory[19]. Both the magnitude and type of organic carbon play major roles in controlling the rates of sediment diagenesis. Carbon and nitrogen in aquatic ecosystems are governed by the amalgamation of terrestrial and autochthonous organic matter[20,21,22,23,24,25.]. It is found that freshly formed organic matter from mainly planktonic organisms has a C/N ratio of 6 to 9[26,27,28]. Salinity is regarded as a key factor in understanding speciation of Hg in estuarine sediments[16,29,30]. Earlier studies have observed that salinity intrusion brings high turbidity, which can also alter the Hg distribution[31]. Further increasing association of Hg with sediments has also been reported via "salt out" effects in estuary[16, 32, 33]. pH is also considered as an important factor in unveiling the mobility of Hg in sediments[34,35].

The present study encompasses the effect of physico-chemical parameters and total organic carbon on the spatial distribution of Hg concentration in Beypore estuary. The literature shows that very few data banks are available in this estuary. Studies regarding physico chemical parameters, tidal influence, nitrogen fluxes and trace metal chemistry have been undertaken in this estuary[36,37,38,39] . The potent pollution source identified was Gwalior rayon factory, a popular paper and pulp industry that changed the face of river Chaliyar. Paper pulp factory

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EC NUTRITION
Review Article

Fish Collagen and its Applications in Food and Pharmaceutical Industry: A Review

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Abstract

Marine collagen has gained immense attention in the recent past as an appropriate alternative to mammalian collagen. The marine collagen is extracted from various marine sources and their by-products including processing waste including fish skin, scales, bones, etc. The type and functional properties of these collagen vary with their molecular structure, extraction process, source, and so on. Marine collagen is usually extracted using mild acids such as acetic acid or enzymes, at low temperature, to prevent denaturation and changes in molecular properties. Collagen finds wide application in food, pharmaceutical and biomedical industries.

Keywords: *Marine Collagen; Denaturation; Food; Pharmaceutical; Biomedical*

Introduction

The marine ecosystem is known for their most valuable food resource as shell fish and fin fish. The remarkable evolution of the marine biodiversity has made the marine environment as the world's richest natural resource with wide diversity of specific and potent bioactive compounds. Marine food from very long time has been linked to beneficial health properties and in recent past innumerable research teams were actively engaged in exploring the health benefits of various marine bioactive components. These include polyunsaturated fatty acids (PUFA), collagen, gelatin, marine carbohydrates (polysaccharides/prebiotics), minerals, vitamins, antioxidants, enzymes and bioactive peptides with valuable nutraceutical, pharmaceutical and cosmeceutical potentials. These were reported to display huge nutritional and health benefits. Various marine sources such as fish skin, muscle, bone, intestine, etc. from pre-processing and processing centers are used to isolate many of these bioactive compounds. Fish peptides and algal polysaccharides have also attracted a significant attention due to their anticancer, antidiabetic, anticoagulant, antimicrobial and antihypercholesterolemic activities [1]. Omega 3-fatty acids from fish oils and marine bacteria, polyphenols and pigments from algae, are also currently studied for their potent antioxidant activities [2]. These researches have gained enormous interest in recent past due to the growing need for novel health substances with least side-effects that would not only aid in the prevention and treatment of several communicable and non-communicable diseases but also supplement the diet and are easily obtainable. In this context, marine bioactive compounds are viewed as significant for their noteworthy potentiality as therapeutic and nutraceutical compounds.

Collagen, the major structural connective tissue protein found in skin, tendon, ligaments, bones, is most prevalent in extracellular matrix (ECM). One fourth of the animal total protein is represented by collagen. These are chiefly of bovine and porcine origin (commercial collagens); and associated with these are the risk of transference of zoonotic diseases such as bovine spongiform encephalopathy

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Food Consumption Pattern among School Going Children in a Rural Area of Kerala

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ABSTRACT

A study was conducted to assess the socioeconomic details and food consumption pattern of school children in a rural community. A total of 100 children in the age group of 10-12 years in Ernakulam district of Kerala was selected using simple random sampling. Interview method with the help of structured and pretested schedule was used to collect the data. The frequency of consumption of different foods was assessed using a food frequency questionnaire. The findings revealed high consumption of rice, milk & milk products, sugar & jaggery, fats & edible oils, medium consumption of vegetables & non vegetarian items, and low consumption of pulses, nuts, oil seeds & fruits. This indicates the poor socioeconomic status prevailing in the area under study.

Keywords: *School children; Socioeconomic status; Food consumption; Food frequency; Kerala*

INTRODUCTION

School age is a dynamic period of growth and development forming a strong foundation for good health and productive adult life. School children grow significantly, but at slower rate. Their nutritional needs are high and critical and hence appropriate dietary intake is critical during this period as it provides the essential nutrients needed for growth as well as educational achievements. Though the Central and State Governments are trying to overcome malnutrition among children through various household oriented programmes, the problem is still existing to a large extent in the country. The data on the food consumption pattern of children in rural areas will be useful for the government to monitor the food distribution system and make sure that it reaches the targeted population. Hence, the present study was proposed in this direction with the following objectives.

- To study the socioeconomic details of school going children.
- To collect data on the food habits and preferences of the children 3.To assess the frequency of consumption of different foods

METHODOLOGY

The study was purposively conducted at Valakom village near Muvattupuzha in Ernakulam district of Kerala. The village population consisted mainly of daily wage workers in the agricultural sector which

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Research Article

Antioxidant Activitiy Guided Isolation of Chemical Constituents from Whole Plant of *Canscora Perfoliata*

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ABSTRACT

Canscora perfoliata is an important ethno medicine plant belonging to the family *Gentianaceae*. The plant is reported to have many important pharmacological activities even though the reports on the chemical constituents are few. The present study was designed for the bio assay guided identification of chemical constituents from most active extract of *C. perfoliata*. Various in vitro antioxidant assays like ABTS assay, NO quenching assay, Ferric reducing assay and DPPH scavenging assay were carried out on different extracts. Column chromatographic isolation for major chemical constituents was conducted on the most active extract. Hydroalchol extract showed predominant results in various antioxidant tests performed among the extracts. Column chromatographic isolation led to the identification of three compounds including a hydroxyl cinnamic acid, an alkaloid and a xanthanoid glycoside from the hydroalcohol extract. The identified compounds are the first report from this plant to the best of our knowledge. The plant extracts and identified compounds were active antioxidants and can be used a potentially as a bioactive source of natural antioxidants for contributing beneficial health effects.

Keywords: *Canscora perfoliata*, hydroalcohol, antioxidant activity.

INTRODUCTION

Canscora perfoliata is an important medicinal plant belonging to *Gentiananceae* family. *C. perfoliata* is distributed mainly in *Western Ghats*, India. *C. grandiflora* is the official synonym of this plant. The plant is being used by tribal people for various medicinal purposes. Various pharmacological activities of this plant were reported. The ethanolic extract of the plant showed significant hepatoprotective activity in CCl_4 induced hepatotoxic rats[1]. Ethanolic extract showed hypoglycemic and hypolipidemic activity in alloxan induced diabetic rats. In acute toxicity study, ethanolic extract of the whole plant was non-toxic up to 2000 mg/kg in rats[2]. It also showed antihyperlipidemic activity in Triton X-100 induced hyperlipidemia in male Wistar albino rats[3,4], immunomodulatory activity in swiss albino mice and significant anti-inflammatory activity in carrageean induced paw edema in wistar albino rats[5]. Yet now the reports on the main chemical constituents responsible for the medicinal activities of this plant were not available. So a detailed study was initiated for the identification of major chemical constituents. Various extracts of *C. perfoliata* were analysed for the different in vitro antioxidant assays including ABTS, NO quenching, ferric reducing and DPPH scavenging. The most antioxidant active extract was screened for the identification of active constituents using various chromatographic methods. The identified compounds were characterized using various spectrometric techniques like proton, carbon nuclear magnetic resonance and mass spectroscopy. The identification of chemical constituents in the plant extract will be useful for future pharmacological studies and also for checking the quality control of the plant.

MATERIALS AND METHODS

Collection of Plant material

Fresh material of whole plant was collected from Palakkad district Kerala. The materials were authenticated by Plant Systematic and Genetic Resources division, Centre for Medicinal Plants Research, Arya Vaidya Sala, and Kottakkal. A voucher specimen (9949) was deposited in CMPR herbarium.

Preparation of extract

10 gram each of the shade dried and powdered material was extracted with ethyl acetate, methanol, and methanol water (50:50) for 5 hours in soxhlet method. Filtered, solvents were removed by rotary evaporator under reduced pressure. 1 mg of all extracts was made up to 10 ml in respective solvents and these extracts were screened for various antioxidant activities and quantitative estimations.

Chemicals

Chemicals used in the study are quercetin, gallic acid, ascorbic acid, 2,2'azinobis (3-ethylbenzothiazoline-6-sulphonic acid), diphenyl picryl hydryzyl, Greiss reagent, ferric chloride, potassium persulfate, Folin-Ciocalteu reagent were procured from Sigma Chemicals Co.

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Dissipation Dynamics and Risk Assessment of Thiacloprid Residues in Chilli Pepper (*Capsicum annuum* L.) and Soil using Liquid Chromatography- Tandem Mass Spectrometry

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The dissipation of thiacloprid (Alanto 240 SC) in fresh, dry chilli pepper and soil is reported. The residues in fresh and dry chilli peppers reached below the quantitation limit of 0.01 mg kg^{-1} after 15th and 21st d respectively of application of thiacloprid at 63 and 126 g a.i. ha^{-1}. The residue magnified by 1.56 to 1.88 times on sun drying of fresh chilli peppers, necessitating study on its residue dynamics at different processing steps. Half-lives of thiacloprid at lower and higher doses of application were 3.4 and 4.3 d for fresh chilli peppers, and 2.7 and 3.8 d in the case of dry chilli peppers. The corresponding waiting periods were 10.3 and 16.0 d on fresh chilli peppers and 7.7 and 15.9 d in dry chilli peppers. The residue in soil reached below LOQ after 10th and 15th day, registering a half-life of 2.49 and 2.52 d respectively at the two doses. The risk assessment showed TMRC values on 0 d at 0.825 and 1.635 µg $person^{-1}$ d^{-1} at the lower and higher doses respectively on fresh chilli peppers, whereas dry chilli peppers showed 0.354 and 0.720 µg $person^{-1}$ d^{-1}. The thiacloprid applied at the lower and higher doses to chilli pepper did not pose any risk to humans, even on the day of application. It can thus be incorporated in integrated management of pest complex in chilli.

Key words: Thiacloprid, chilli pepper, soil, LC-MS/MS, risk assessment, dissipation

Chilli pepper (*Capsicum annuum* L.) is a premium cash crop in India. It is grown in mainly tropical and sub-tropical regions for its fruits, which are consumed fresh as well as in dry and powdered form to impart pungency and taste to various food preparations. In the global scenario, chilli is produced to the tune of 122.34 million tonnes and India contributes about 1.4 million tonnes per annum (FAO, 2016). A major threat to chilli cultivation all over the world is its proneness to infestation by pest complex, especially mites, thrips, fruit borers, whiteflies etc. at different stages of crop growth. Thiacloprid ({(2Z)-3-[(6-chloropyridin-3-yl) methyl]-1, 3-thiazolidin-2-ylidene} cyanamide) (Fig. 1), a commercially available systemic neonicotinoid insecticide, is frequently used in chilli peppers against these pest complexes. Due to the characteristic physico-chemical properties of thiacloprid, the molecule is absorbed and translocated in plants, subsequently targeting the nicotinic acetylcholine receptors of insects and exhibiting an intensively selective toxic mode of action (Tomizawa and Casida, 2003). In India, thiacloprid 21.7 per cent SC has been recommended for thrips in chilli peppers by Central Insecticides Board and Registration Committee (CIBRC), Government of India (Anonymous, 2018). Its dissipation in chilli and risk assessment in humid climatic conditions as prevailing in Kerala is not much investigated. Hence, this study to generate relevant information on residue pattern and risk analysis.

MATERIALS AND METHODS

Chemicals and reagents

Analytical standard of thiacloprid (purity 99.9 %) was purchased from M/s Sigma-Aldrich (Steinheim, Germany). The formulation of thiacloprid (Alanto 240SC) was procured

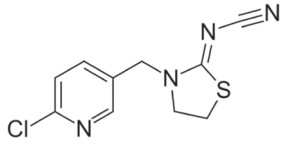

Figure 1. Molecular structure of thiacloprid

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DISSIPATION KINETICS AND RISK ASSESSMENT OF NOVALURON IN FRESH AND DRY CHILLI PEPPER UNDER HUMID CLIMATIC CONDITIONS

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ABSTRACT: Dissipation of novaluron applied as commercial formulation Rimon 10% EC to fresh and dry chilli pepper was studied using ultra performance liquid chromatography tandem mass spectrometer. The initial deposits of novaluron in fresh chilli peppers after second spraying at 37.5 and 75 gram active ingredient per hectare were 0.11 and 0.20 mg kg^{-1} which declined to below quantitation level within 10 days and in dry chilli peppers initial residues of 0.31 and 0.59 mg kg^{-1} reached below the level of quantitation within 15 days. The half-life of novaluron at the lower and higher doses in fresh chilli pepper was 2.1 and 2.3 days where as in dry chilli pepper was 2.4 and 2.3 days and the corresponding waiting periods; that is the minimum time must* wait *after applying the* pesticide, *calculated were 8.4 and 9.4 days in fresh and 11.3 and 13.0 days in dry chilli peppers. Processing of the chilli peppers by sun drying further reduced the contents of novaluron by a factor of about 3. Theoretical maximum residue contribution values were calculated from the residue data generated and were found to be below maximum permissible intake even on 0 day. Risk assessment studies indicated that the use of the insecticide at both doses did not pose any hazard to humans.

Keywords: novaluron, chilli pepper, dissipation, risk assessment, LC-MS/MS, residues.

INTRODUCTION

Chilli (*Capsicum annuum* L.) is one of the most important spice crops used due to its high nutritional and medicinal values. It is a rich source of capsaicin, dihydrocapsaicin, capsanthin, capsorubin, β-carotene, vitamin C and other compounds[1]. A major threat to chilli cultivation is its proneness to infestation at different stages of growth by sucking pests, especially mites, thrips, and fruit borers. Novaluron, N-[[3-chloro-4-[1,1,2-trifluoro-2-(trifluoromethoxy)ethoxy]phenyl]carbamoyl]-2,6-difluorobenzamide (Fig 1), an insect growth regulator[2] developed by Makhteshim-Agan Industries[3] is registered as insecticide[4] disrupting of normal growth and development of insects. It is used e.g., for protection of chilli pepper against fruit borers and tobacco caterpillar and deemed to be an eco-friendly pest controlling agent[5]. Dissipation studies of novaluron in agricultural crops are limited, and no investigation has been carried out on the risk assessment analysis of novaluron in chilli pepper. Therefore, such a study under humid conditions was conducted.

MATERIALS AND METHODS

Chemicals and reagents

Rimon 10 EC, a formulation of novaluron, was procured from Indofil Industries (Mumbai, India). As reference material, Novaluron (purity 99.9 %) was purchased from Sigma-Aldrich (St. Louis, MO, USA). Analytical grade sodium chloride, sodium sulphate, anhydrous magnesium sulphate, formic acid (Emparta ACS grade) and acetonitrile (Gradient Grade) were obtained from Merck (Mumbai, India). Methanol (LiChrosolv) and ammonium acetate (Emsure ACS grade) were purchased from Merck (Darmstadt, Germany). The solid reagents such as sodium chloride, sodium sulphate were activated at 450 ^{o}C for 4 hours before use. Ultrapure (18.2 MΩ) water was prepared by Elga Purelab water purifier (High Wycombe, UK). The sorbents primary secondary amine (PSA), graphitized carbon black (GCB) and octadecylsilane endcapped silica (C18) were obtained from Agilent (Santa Clara, CA, USA. Polyvinylidene fluoride (PVDF) syringe filters (17mm, 0.2 µm) (Thermo Scientific, Bartlesville, USA) were used to filter the final extracts. The suitability of solvents and chemicals was confirmed by running reagent blank samples.

Preparation of standard solution

A standard stock solution of novaluron (400 mg L^{-1}) was prepared in CH_3OH and serially diluted (1, 0.5, 0.25, 0.1, 0.05, 0.025, 0.01, 0.005 mg L^{-1}) for studying the linear dynamic range of the analytical method, for preparation of matrix matched calibration standards, and for spiking for recovery studies. The calibration solutions were stored at 4 ^{o}C. Matrix-matched calibration standards prepared with extracts of blank samples were in the range of 0.01–1 mg L^{-1}. The analytical method was validated through recovery studies as per EU guidelines[6]. The concentration with a S/N ratio 10:1 was considered as limit of quantification, with linearity from 0.005 to 1 mg L^{-1}. The recovery study of the untreated chilli peppers was carried out at 0.01, 0.05 and 0.1 mg kg^{-1} levels.

Instrumentation

Analysis was conducted on a UPLC system (ACQUITY, Waters. Milford, MA, USA) equipped with reversed phase column (2.1 mm x 100 mm, 5 µm particle size) (Waters Atlantis dC18). The auto sampler temperature was 5 °C, column temperature 40 ^{o}C. The mobile phase consisted of [A] 0.1 vol- % formic acid + 5 mmol L^{-1} ammonium acetate in 10 vol- % methanol in water and [B] 0.1 vol- % formic acid + 5 mmol L^{-1} ammonium acetate in 10 vol-% water in methanol. The gradient elution program was as follows: 20 % B (0.0 - 0.5 min), increased to 50 % B (0.5 - 1.0 min), increased to 70 % B (1.0 - 2.0 min), raised to 90 % B (2.0 - 4.0 min), increased to 100 % B (4.0 - 6.0

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Biodegradability of Synthetic Plastics – A Review

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Abstract : Plastics are chemically synthesized polymers made up of two sets of plastics - thermosetting and thermoplastics. There different properties have made it to enter in different sectors and replaced the conventional materials. There durability has made it non biodegradable and has also affected the environment due to its large production according to the need of the growing population. The use of biological means to degrade these plastics has been extensively studied by using different microorganisms collected from mainly contaminated sites. This paper discuss about the different screening methods for the detection of plastic degrading microorganisms. The different enzymes synthesized by microorganisms degrade different types of plastics.

Keywords : Plastic degradation, Biodegradable, Enzymes, Environment.

Introduction

Plastics are synthetic carbon polymers from petrochemical industries. These are synthesized by mixing two different polymers, resulting in improved properties of both the parent polymers(1). They are made up of eight fundamental elements i.e. hydrogen, silicon, oxygen, carbon, fluorine, silicon, sulphur and nitrogen. The different properties of plastics such as being light, resistant, different shapes and sizes, corrosion free, insulators, colourful and inexpensive has increased its industrial application. Plastic serves as the mother to thousands of industrial products manufactured for our daily use. It is mixed in our life in such a way that it cannot be separated in any manner. More than 30% of plastic are used for packaging due to their physical resistance and water impermeability. Each plastic gives a specific property that makes it to serve in different range of sectors (2). With the increase in population, the necessity of durable things have also increased, which have paved way to the increase in the synthesis of materials from plastics.

The application of plastics ranges from tooth brush to drinking water bottles, car batteries to irrigation and drainage pipes and straws to helmets (3). Plastics being unavoidable, utilization of synthetic plastics made from petroleum has adversely affected the environment since the majority of these synthetic plastics do not degrade and their physical way of degradation generates polycyclic aromatic hydrocarbons, polychlorinated

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Disease Management Options in Captive Reared Clownfish, *Amphiprion sebae* Bleeker 1853: Application of Chemotherapy, Marine Natural Products and Autogenous Vaccines

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Abstract

Disease conditions in aquarium captive-reared clownfish, *Amphiprion sebae* Bleeker 1853, were caused by bacterial pathogens belonging to *Vibrio* sp., *Alacaligenes* sp., *Serratia marcescens* and *Flavobacterium* sp. An emerging pathogen, *Serratia marcescens* was noted to cause severe ulcerations in the aquarium fish in a repetitive manner. Disease management studies conducted with antibiotics, extracts from marine macroalgae and sponges and immunoprophylaxis using formalin-killed *S. marcescens* cells gave promising results. Among the antibiotics, ciprofloxacin had a high inhibitory zone of 32 mm followed by oxytetracycline, trimethoprim and co-trimoxazole with 24 mm zones each. The methanol extract of the macroalga, *Gracilaria corticata* produced 36 mm inhibition zone, while the extracts of two sponge species, *Callyspongia diffusa* and *Sigmadocia carnosa* produced 26 mm and 24 mm zones respectively; suggesting scope for the use of extracts from maroalgae and sponges (marine natural products) for disease management in marine aquaria. The autogenous vaccine when administered in fish at 1×10^5 cells.g^{-1} resulted in increased relative percentage survival after the 15th day and continued with 100 % protection at 35 and 50 days, on challenge with *S. marcescens*. These studies suggest that proactive management strategies can be successfully adopted for managing *S. marcescens* infection in clownfish.

Keywords: marine ornamental fish, *Serratia marcescens*, marine natural products, bacterin, relative percentage survival

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Occurrence of *Vibrio mediterranei* Pujalte and Garay, 1986 in aquarium reared marine ornamental fish

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Short communication

Abstract

Vibrios are ubiquitous in the marine environment, some of which are opportunistic pathogens, while several others cause serious pathogenic conditions. They are among the bacterial pathogens that top the list of pathogens which lead to economic loss in aquaculture. Although the occurrence of bacterial diseases in marine aquaria is not well documented, disease conditions characteristic of bacterial pathogens were noticed in the captive fishes maintained in the marine aquarium functioning under Vizhinjam Research Centre of Central Marine Fisheries Research Institute (CMFRI). In view of the importance of supply of healthy organisms for commercial aquarium trade, attempts were made to isolate and identify bacterial pathogens from diseased and moribund fishes of the said aquarium. Three species of Vibrio such as *Vibrio furnissi, Vibrio fluvialis* and *Vibrio mediterranei* from the commercially important marine ornamental fishes–*Acanthurus* sp. (surgeon fish), *Amphiprion sebae* (sebae clown fish), *Heniochus acuminatus* (banner fish) and *Chaetodon auriga* (butterfly fish). Among these, *V. mediterranei* is a comparatively lesser demonstrated species. Biochemical characterization of these isolates was carried out for differentiation from other species of Vibrio. Previous reports of occurrence of the species are from corals and associated ecosystems. The usefulness of this species in marine culture systems as a potential probiont needs to be investigated.

Keywords: *Ornamental fish, Vibrio, bacterial isolate, coral, biochemical characterization, probiont*

Introduction

Culture and maintenance of marine ornamental fishes intensified consequent to their ever increasing demand in the international market. Domestic ornamental fish market in India is worth a billion dollars and the demand is on the rise (Kumar *et al.*, 2015). However, production failures in the culture systems often result from diseases due to various infectious agents, among which bacterial pathogens form a major component. Bacterial diseases due to Gramnegative organisms are the most common infectious problem of ornamental fishes (Lewbart, 2001). Of these, vibrios are particularly important as they are ubiquitous in the marine environment and are considered as opportunistic pathogens present as part of the normal microflora, occasionally capable of causing disease in wild and cultured fish (Hjeltnes and Roberts,

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Original Article

Sub-lethal effects of potassium dichromate on hematological and histological parameters in climbing perch, *Anabas testudineus* (Anabantidae)

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Abstract: Chromium, which enters the river through anthropogenic sources, is one of the potent heavy metals. The present study is an attempt to determine the LC_{50} of Potassium dichromate for the climbing perch, *Anabas testudineus* and to study the impact of two sub-lethal concentrations (6 and 12 mg/l) of Potassium dichromate the toxic hexavalent Cr(VI) form of Chromium on this fish through investigating hematological and histopathological parameters. Experimental set up included quadruplicate treatments for each dosage, and the results were compared with control treatments. The results showed that the LC_{50} value at 96 hr was 59.92 mg/l. The fishes exposed to sub-lethal concentrations showed severe abnormalities such as; degeneration of hepatocytes, necrosis of hepatic tissue and extensive haemorrhage in gills and renal tissue. The present study brings out the harmful impact of Cr(VI) in the aquatic environment and necessitates regulations of its inflow to natural water bodies as a management plan to curb its contamination.

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Introduction

Water pollution has been regarded as one of the most important threats globally impacting human health, environment and sustainable development (World Water Assessment Programme, 2018). Although there has been a much understanding on the impact of the addition of anthropogenic contaminants to the environment, the natural aquatic bodies have extensively been polluted with heavy metals released from domestic, industrial and other man-made activities (Conacher et al., 1993; Velez and Montoro, 1998). According to the United States Environmental Protection Agency (USEPA), and the International Agency for Research on Cancer (IARC), these metals are also classified as human carcinogens based on the epidemiological and experimental studies (Tchounwou et al., 2012). Among the various metals, Chromium (Cr) has turned out to be a vital pollutant, which has the potential to be toxic to living organisms due to their bioaccumulation and non-biodegradable properties (Velma, 2009). With increasing industrialization and fewer means for safe disposal, contaminations of Cr in the aquatic environment is often being regarded as a menace in India. The situation gets even worse since its availability in nature either as dichromate in acidic environments or as chromate in alkaline environments has rampantly infiltrated into the drinking water system (Risikesh et al., 2007). The permissible levels of Cr for drinking water recommended by the Indian Drinking Water Quality Standard (IS: 10500:2012) is 50 µg/l. Hexavalent Chromium, Cr(VI) is highly carcinogenic and may cause death to animals and humans if ingested in large doses (Zyed and Terry, 2003). This form of Chromium rarely occur naturally but is produced from anthropogenic sources and profoundly used in industry for metal planting, cooling tower, water treatment, tanning, and wood preservation (Palmer and Wittbrod, 1991). Among the various compounds, the dichromate compounds, especially $K_2Cr_2O_7$, is the most profoundly found form of Chromate in India, mainly due to its wide industrial application.

Fishes are more prone to such pollution due to their

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Marine Bioinvasion – An Introspective Commentary on the Trophic Level Modulations in Zooplankton Communities

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Abstract

Zooplankton occupy a prominent position in marine food webs,modulating energy availability to higher trophic levels, while themselves being affectedby environmental variations. This review succinctly portrays the diversity of zooplankton communities in marine ecosystem with emphasis on their role in trophic modulations. The commentary also brings out the significance of this group as potential bioinvaders of coastal community, owing to the influence of various biotic and abiotic parameters prevailing in the region. The review also brings out the various sources and modes of marine bioinvasion and also signifies their ecological and economic impact with a view to postulate effective management measures for curbing their distribution.

Keywords : Invasive Alien Species, Zooplankton, Ballast, Trophic dynamics

1. Introduction

Ecosystem is the complex of living organisms, their physical environment, and all their interrelationships in a particular unit of space. The ecosystem concept analyses organic networks that account both the positive and negative aspects and competitive aspects which involves ecosystem-level competition, predation, parasitism, and destruction of the whole system. The significance of ecosystem is immense in the services it provides to humans, directly or indirectly. The benefits humans derive directly or indirectly from ecosystem functions are called ecosystem services. Ecosystem services are often classified and the Millennium Ecosystem Assessment (MA) classification of ecosystem services is perhaps the most cited. It divided them into four ecosystem service categories: supporting, provisioning, regulating and cultural services [1] .Provisioning services include food, water, fuel, fibres, genetic resources, medicines, other biochemical resources, ornamental resources, etc. Regulatory services include maintenance of air and urban environmental quality, climate, moderation of extreme events, erosion prevention, maintenance of soil quality, pollination, biocontrol, etc. Cultural services include aesthetic values, spiritual values, recreation, tourism, etc.

Ecosystem indicators or ecological indicators are any species or group of species of organisms whose function, population, or status can reveal the qualitative status of the environment. Ecological indicators are widely used to characterize ecosystem health. Taxonomic diversity and spatiotemporal variations over different scales in relation to environmental or anthropogenic factors offer information on how modifications in biodiversity affect ecosystem function. This strategy of using indicator species is now becoming widespread for a variety of marine ecosystems. Zooplanktons are microscopic animals

Short Communication

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First record of the rare Furry Lobster *Palinurellus wieneckii* (De Man, 1881) (Decapoda: Palinuridae) from the Arabian Sea

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Abstract: Two female specimens of the Furry Lobster *Palinurellus wieneckii* (De Man, 1881) with a total length of 118mm and 114mm, respectively, were obtained from the coral reefs off Kavaratti Island, Laccadive Islands, west of India. Only two species are currently recognized in this genus, which were described from a small number of specimens. As *P. wieneckii* is very rare, the present report from the Lakshadweep Archipelago provides a valuable new distribution point, which is the first record for the Arabian Sea. Illustrations and photographs are provided for this rare lobster.

Keywords: Distribution, taxonomy, Indian Ocean, Lakshadweep, Laccadive Islands.

Furry Lobster or Coral Lobster of the genus *Palinurellus* Von Martens, 1878 belonging to the family Palinuridae Latreille, 1802 was recorded from the Indo-West Pacific and the western Atlantic. It is rare throughout its range and descriptions were typically based on only a few specimens. The numerous short setae covering its body give the animal its common name, Furry Lobster. It is comparatively smaller in size than other palinurids and its systematic placement was uncertain until recently. Due to its peculiar appearance, the genus *Palinurellus* was previously regarded as belonging to a separate family, the Synaxidae Bate, 1888. Recent phylogenetic analyses using molecular tools, however, showed Synaxidae to be an invalid family and, subsequently, the genus *Palinurellus* was placed in the family Palinuridae (Holthuis 1966; Palero et al. 2009; Tsang et al. 2009; Chan 2010; Chien et al. 2013).

Only two species are currently recognized in the genus *Palinurellus*, *P. gundlachi* (Von Martens, 1878) from the western Atlantic and *P. wieneckii* (De Man, 1881) from the Indo-West Pacific (Chan 2010). The definitions of these two species, however, remain somewhat unclear because of the limited number of specimens available (Holthuis 1966). We report *P. wieneckii* for the first time from the Arabian Sea and the entire Indian coastline, providing an intermediate report of the species in the wider Indo-West Pacific.

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To
Dr. S. Suresh Kumar
Professor
School of Ocean Science and Technology
KUFOS, Panangad, Cochin

Dear Dr Suresh Kumar:

Thank you for submitting the revised version of your paper "**Prevalence of Multiple Antibiotic Resistant and Extended Spectrum Beta Lactamase (ESBL) producing *Escherichia coli* in a traditional fishing harbour and surrounding water bodies in south-west coast of India**" (Zubair A. A., M. Razia Beevi1 and S. Sureshkumar). We are pleased to inform you that the paper has been accepted for publication in the Volume 6 (2018 December issue) of the Journal of Aquatic Biology and Fisheries (ISSN 2321 – 340X), University of Kerala.

Thanking you.

Yours faithfully,

A.**Biju Kumar**

Chief Editor
Journal of Aquatic Biology & Fisheries

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Review Article

Bacterial Pathogens in Seafood – Indian Scenario

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Abstract

Fish and fishery products are frequently contaminated with bacterial pathogens. Common pathogens that are found in Indian seafood are Salmonella, Vibrios, *Listeria monocytogenes*, *Escherichia coli*, *Staphylococcus aureus*. The consumption of these infected fish and their products can result in mild to chronic illnesses. In addition, the presence of these food borne pathogens causes huge monetary loses to fishermen and exporters. In India a proper system of documentation and reporting of food-borne illness is lacking. Indian seafood are often contaminated by human activities and sewage released into the water bodies. Poor sanitation in fish landing centre and open fish markets also exacerbates the situation. The quality of fish sold in domestic market in India is poor compared to that of export trade. The importance of proper handling and storage of seafood to control the growth of pathogenic bacteria need to be emphasized. Proper reporting and documentation system with strong public awareness programmes can be very effective in management of food safety issues in the future.

Keywords: Seafood, Bacteria, Salmonella, Vibrios, *Listeria monocytogenes*, *Escherichia coli*, *Staphylococcus aureus*

Introduction

Seafood is a major vehicle for transmission of several bacterial diseases. Human infections due to many pathogenic bacteria are reported to have been transmitted through fin fish, shell fish and other sea food products (Okuda et al., 1997). Fishery products have been recognized as a major carrier of food-borne pathogens like *Salmonella* sp, *Staphylococcus aureus*, *Vibrio cholerae*, *Vibrio parahaemolyticus*, *Yersinia enterocilitica*, *Listeria monocytogenes*, *Campylobacter jejuni* and *Escherichia coli* (Venugopal et al., 1999). Estuaries and coastal water bodies are the major sources of seafood in India and are often contaminated by the activities of adjoining population and partially treated or untreated sewage released into these water bodies. Seafood harvested from such areas often contains pathogenic microorganisms (Kumar et al., 2005). In addition poor sanitation in landing centres and the open fish markets exacerbates the situation (Kumar et al., 2001). It has been reported that quality of fish sold in domestic market in India is poor compared to that of export trade and are mostly contaminated with pathogenic microorganisms (Nambiar & Iyer, 1990). The microbial quality and presence of food borne bacterial pathogens in fish and fishery products of the Cochin area has been investigated by many authors (Nambiar & Iyer, 1990; Nambiar & Iyer, 1991; Thampuran & Surendran, 1998; Surendran et al., 2002; Lalitha & Surendran, 2002).

In India, the role of seafood sector in providing economic and nutritional security is very large. The rising demand of seafood nationally and internationally further leads to production of unscrupulous, under-processed and unhygienic products that may harbor various species of bacterial and viral seafood-borne pathogens. The presence of these food borne pathogens causes huge monetary loses to the fishermen and the exporters. Often food borne outbreaks are not properly documented in developing countries, unlike the western counterparts; hence, less number of reports are available in these countries.

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DNA barcoding confirms species substitution of *Parastromateus niger* (black pomfret) using exotic species *Piaractus brachypomus* (Red Bellied Pacu)

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Abstract
Species substitution is a case of fraud practised by the fish dealers for acquiring additional profit. During a fishery survey in the local markets of Kerala state (South India), some 'alien' fishes were encountered which were traded along with *Parastromateus niger* as 'black pomfrets'. Samples of these two groups were collected for morphological and molecular characterization (viz. COI gene). COI sequences of *P. niger* corroborated with the same in NCBI while morphological and molecular characters of 'alien' fishes corroborated with an exotic fish *Piaractus brachypomus*. Molecular analysis carried out using additional COI sequences of 'pomfret' and 'piranha' fishes acquired from NCBI confirmed the speciation of 'alien fishes' as *P. brachypomus*. This study reports the illegal trade of *P. brachypomus* as a species substituent for *P. niger* in Kerala and recommends the enforcement of strict laws for preventing food frauds as it could bring up serious economic breakdowns in fisheries sector.

Keywords: *Parastromateus niger,* COI, *Piaractus brachypomus,* species substitution

1. Introduction
Parastromateus niger (Class Actinopterygii, Order Perciformes, Family Carangidae) or black pomfret is a high valued marine fish inhabiting the shallow inshore waters of the Indian Ocean [1, 2]. Increasing demand for this species has resulted in the reduction of its stock to a larger extent due to over exploitation and lack of proper fishing management programs [3]. Recently its landings in Indian coastal areas declined drastically to the tune of 13924 tonnes in 2016 being only 52.36% of its previous year catch [4]. Higher availability of this species is needed to satisfy its increased demand since other sources of supply like aqua farming has not been in vogue for this species. This indicates possibilities of species substitution and misrepresentation using morphologically similar exotic, non-invasive, protected and low valued species, since seafood mislabelling is a global and significant issue in the present scenario [5-10].

In Kerala (S. India), *P. niger* is having higher market acceptance and is traded in fresh, processed (fillets, brined), sun dried and frozen conditions [11]. During a fishery survey conducted in local markets of Kochi (Kerala, S. India), certain 'alien' fishes were encountered which were traded along with *Parastromateus niger* (black pomfret) as black pomfrets. *P. niger* was identified on the basis of their morphological characters while the 'alien' ones showed a similarity in its body outline and pattern only. Even though, *P. niger* is reported to possess morphological similarity to the white pomfrets, *Pampus argenteus* and Chinese pomfrets, *P. chinensis* [12], little is known about a morphologically similar species substituent for black pomfrets. Hence, whole, fresh samples of these two different groups were collected from local markets of Kochi and a molecular approach was carried out to confirm the case of species misrepresentation. Since mitochondrial cytochrome c oxidase subunit I (COI) gene was used as a well-established molecular marker for identification of bio specimens including invasive and exotic species [13-15], the same were developed from the collected specimens and the results are presented here.

2 Materials and methods
2.1 Sample collection
Whole fish samples of *Parastromateus niger* (n=40) and 'alien' fishes (n=70) were collected from the local markets of Kochi (S. India) and transported to the laboratory in iced condition.