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Antibacterial Activity of Crab Shell Extracts Against Human Pathogenic Bacteria and Usage of New Drugs

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Abstract

Fisheries are playing a key role in the changing profile of Indian economic growth. Export of processed and frozen crab products is the backbone of seafood export in India. The industrial processing of crab generates 1,354 tonnes of wastes every year and it largely exists in wastes from the processing of marine food products. The waste generated from the worldwide production and processing of shellfish is a serious problem of growing magnitude and is a threat to the environment. It is essential to convert crab shell waste into useful products such as chitin etc., by recycling and reducing the waste as well as contribute towards gainful employment and economic benefits. The active biomolecules such as chitin and its derivatives are undergoing a significant and very fast development in food application area. Due to recent outbreaks of contaminations associated with food products, there have been growing concerns regarding the negative environmental impact of packaging materials of antimicrobial biofilms. Chitin, since a high antimicrobial activity against a wide variety of pathogenic and spoilage microorganisms. In the present study is aimed at recycling crab shell waste by using it for investigating the antibacterial activity against medically important pathogens.

Keywords: *Scylla serrata*; Chitin; Crude extract; Penicillin; Antibacterial activity

Introduction

Chitin is a long, naturally abundant, non-toxic and biodegradable, polysaccharide and unbranched molecule consisting entirely of N-acetyl-D Glucosamine units linked by β-1,4 bonds. It forms the basis of the shells of arthropods, lobster, shrimp, crab, octopus, nematodes, fungi, squid, jellyfish, green algae and the exoskeletons of insects. The antimicrobial activity is well known and has been exploited in dentistry to prevent caries and as preservative applications in food packaging in several countries [1-4]. The polysaccharide chitin has a documented antibacterial activity varies according to the chemical composition of the chitin. In the present study demonstrates the antibacterial activity of chitin have revealed that chitin is effective in inhibiting growth of bacteria [5]. The antimicrobial properties of chitin depend on its molecular weight and also immune systems from chitin have little potential as bacteriostatic agents [1-3]. In the present study consider about to the drug resistance to human pathogenic bacteria have been commonly reported and the side effects and the resistance that pathogenic microorganisms build against antibiotics. The brachyuran crab, Staphylococcus serrata is a major aquaculture crustacean species and as a result is becoming an increasingly important subject for study, particularly its antimicrobial activities in crude extracts of chitin.

Materials and Methods

The brachyuran crab of *Staphylococcus serrata* was collected from Parangipettai coast, south east coast of India. After collection the exoskeletons divided into three regions (head, chelated legs & walking legs). They were dried, powdered and stored separately in containers until further use. Deproteinized the exoskeleton by treating with NaOH and boiling at 80-85°C, subsequently washed and dried. The minerals in the sample were dissolved in diluted hydrochloric acid and washed in water. The product obtained after deproteinization and demineralization is called chitin. During deacetylation, N-acetyl group was removed by heating the sample with 40% NaOH for 2-3 hrs at 90°C [6]. Penicillin was used as positive controls while DMSO (dimethyl sulphoxide) disc and sample disc were used as negative controls. A loop full of strain was inoculated with 25 ml of nutrient broth in a conical flask and incubated in a rotary shaker for 17 hrs to activate strain. The assays were performed using the disk diffusion method (Whatman No. 1 filter paper disc, 4.5 mm diameter) [6,7]. The human pathogens like *Staphylococcus aureus, S. epidermidis, Bacillus subtilis, Pseudomonas aeruginosa* and *Pseudomonas mirabilis* were used in the study. The antimicrobial activity of these microorganisms was studied against the exoskeleton homogenate crude extract obtained from different parts of the commercial crab.

Results and Discussion

The chitin extracted from *Scylla serrata* exhibited vital antibacterial activity against the pathogenic bacteria strain *Staphylococcus aureus*, it was the most effective extract with the maximum zone formation in carapace (10.4 ± 0.12), chelated legs (9.8 ± 0.21), walking legs (8.4 ± 0.15) and positive control formation of zone (10.9 ± 0.25) (Figure 1). The *Staphylococcus epidermidis*, it was the most effective extract with the maximum zone formation in carapace (9.7 ± 0.19), chelated legs (8.5 ± 0.10), walking legs (7.9 ± 0.25) and positive control zone of inhibition (10.1 ± 0.32) (Figure 2). The pathogenic bacteria strain *Bacillus subtilis*, it was the ordinary able extract with the maximum zone formation in carapace (9.1 ± 0.31), chelated legs (8.3 ± 0.41), walking legs (7.5 ± 0.34) and positive control formation of zone (9.8 ± 0.35) (Figure 3). The maximum zone formation against the pathogenic bacteria strain *Pseudomonas aeruginosa*, it was recorded in carapace (7.2 ± 0.15), chelated legs (6.3 ± 0.14), walking legs (5.6 ± 0.23) and positive control zone of inhibition (9.1 ± 0.20) (Figure 4). Similarly, *Pseudomonas mirabilis*, it was the most effective extract with the maximum zone formation in carapace (6.8 ± 0.26), chelated legs (5.7 ±

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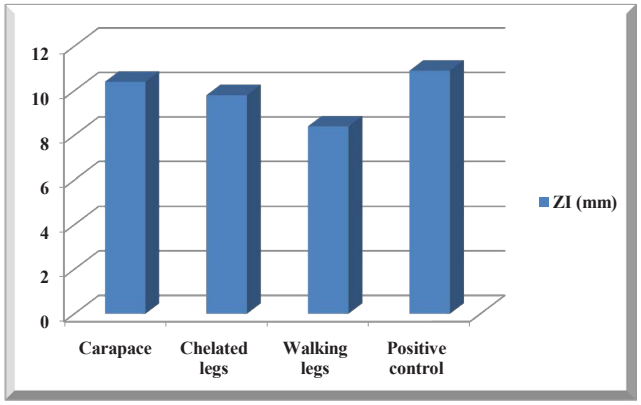

Figure 1: Zone of Inhibition (ZI-mm) in chitin of *Staphylococcus serrata* against *Staphylococcus aureus*.

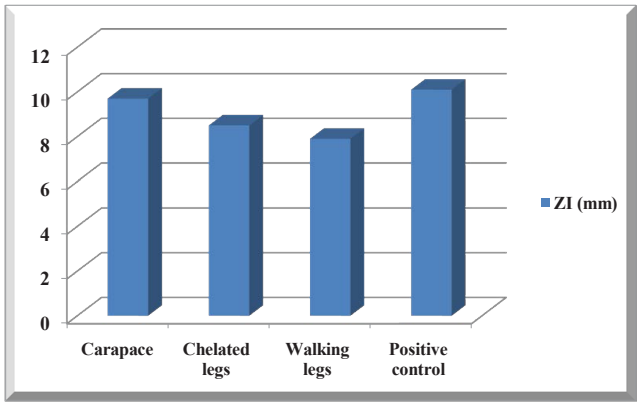

Figure 2: Zone of Inhibition (ZI-mm) in chitin of *Staphylococcus serrata* against *Staphylococcus epidermidis*.

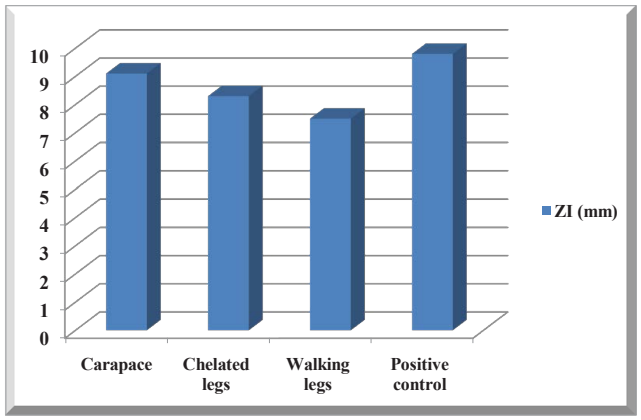

Figure 3: Zone of Inhibition (ZI-mm) in chitin of *Staphylococcus serrata* against *Bacillus subtilis*.

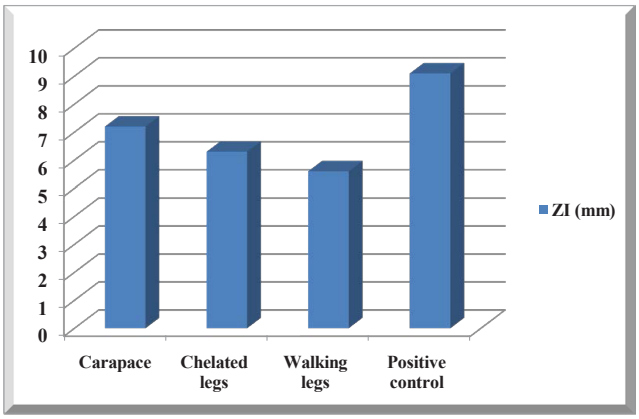

Figure 4: Zone of Inhibition (ZI-mm) in chitin of *Staphylococcus serrata* against *Pseudomonas aeruginosa*.

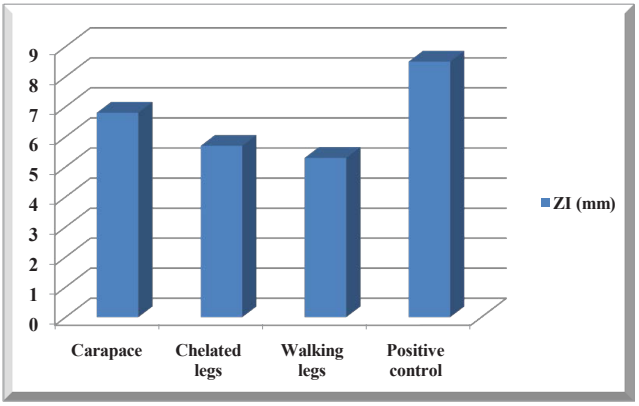

Figure 5: Zone of Inhibition (ZI-mm) in chitin of *Staphylococcus serrata* against *Pseudomonas mirabilis*.

0.30), walking legs (5.3 ± 0.24) and positive control formation of zone (8.5 ± 0.28) (Figure 5) [8].

In the present study the results indicated that, the maximum inhibition zone was recorded in gram positive *Staphylococcus aureus, S. epidermidis and Bacillus subtilis* and the minimum inhibition zone was recorded in gram negative *Pseudomonas aeruginosa, Pseudomonas mirabilis*, when crab shell extract was used for in vitro screening by disc diffusion method. The microbial associates of marine crustaceans have proven to be a rich source of biologically active substances with antimicrobial, cytotoxic and antineoplastic activities that can be useful for biotechnological and pharmaceutical application. Despite tremendous progress in human medicines today infectious diseases caused by bacteria, viruses, fungi and parasites are still a main threat to public health [9,10]. The impact is particularly large in developing countries due to relative unavailability of medicines and the emergence of widespread drug resistance [11-13]. Antibiotic resistance to man-made drugs is almost not possible to stop because it is the result of some easy rules of evolution. Penicillin, it's important to understand that antibiotics vary in the way they kill microbes and also specifically attack against bacterial pathogens, still one of the most widely used antibiotics and recently it can be shortage of day by day. In this result showing against pathogenic activity of chitin binding with penicillin, it can solves the shortage problems and also useful for inventing of new drugs. During the last two decades, the development of drug resistance as well as the appearance of undesirable side effects of certain antibiotics has led to the search of new antimicrobial agents mainly among chitin extracts with the goal to discover new chemical structures, which overcome the above disadvantages. Recent research on natural molecule and products primarily focuses on chitin since they can be sourced more easily and be selected based on their ethno medicinal uses. A holistic ecofriently crab shell waste management

strategy is outlined for preventing environmental pollution converting crab waste into used as a packaging material for the quality preservation of a variety of food products and its recycling. So searching of chitin which shows antimicrobial properties from crab is the right choice to solve many problems.

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