INTRODUCTION
Infectious diseases are rapidly developing resistance towards traditional antibiotics, perpetuating the need for safer, more potent and broader spectrum compounds (Demain, 2000). In recent findings researchers analyzed that more than half the percentage of Emerging Infectious Diseases are caused by bacteria and also that countries like India risks new epidemics as the human population expands into natural wilderness, coming into contact with a diverse range of lifestyles that harbour unusual diseases. The multi drug resistance organisms are highly infectious with high mortality rate and their severity of infection is very high in immunocompromised patients especially who are suffering with some chronic diseases like AIDS (Talbot et al., 2006). The emergence of drug resistant pathogens as well as the increase in diseases affecting the immune system greatly intensified the need to investigate new bioactive metabolites of natural origin for potential pharmaceutical and industrial applications.

Microorganisms are capable of carrying out a tremendous variety of reactions and can adapt to a range of environments allowing them to be transplanted from nature to the laboratory where they can be grown on inexpensive carbon and nitrogen sources to produce valuable compounds (Narayana and Vijayalakshmi, 2008). Because of their biological activity, secondary metabolites of microbial origin are extremely important to our health and nutrition and have a tremendous economic importance. The screening of microbial natural products continues to represent an important route to the discovery of novel chemicals, for development of new therapeutic agents and for evaluation of the potential of lesser-known or new bacterial taxa (Kurtboke and Wildman, 1998). Natural products or their derivatives remain the most significant source of novel medicines (Newman et al., 2003; Fenical 2006; Lam,
For thousands of years, natural products have played an important role throughout the world in treating and preventing human diseases.

The value of natural products in this regard can be assessed using the following criteria:

1) The rate of introduction of new chemical entities of wide structural diversity including those serving as templates for semisynthetic and total synthetic modification.

2) The number of diseases treated or prevented by these natural products.

3) Their frequency of use in the treatment of disease.

Scrutiny of medical indications by source of compounds has demonstrated that natural products are used to treat 79% of all categorized human diseases (Newman et al., 2003). Newman (2008) also estimated that about 60% of the drugs that are available now including artemisinin, camptothecin, lovastatin, maytansine, penicillin, reserpine and silibinin are either directly or indirectly derived from natural products. Moreover, natural products have also been an invaluable source of inspiration for organic chemists to synthesize novel drug candidates (Koehn and Carter, 2005; Beghyn et al., 2008; Hunter, 2008).

Among the potential sources of natural products, bacteria have proven to be a predominantly prolific resource with a surprisingly small group of taxa accounting for the vast majority of compounds discovered (Keller and Zengler, 2004). Among them, bacteria belonging to the Order Actinomycetales (commonly called actinobacteria) account for more than fifty percent of the compounds reported in the Dictionary of Natural Products. Actinomycetes are the dominant group of soil population together with bacteria and fungi. They are Gram-positive bacteria having high G+C (> 55 %).
content in their DNA and originally considered as an intermediate group between bacteria and fungi. They belong to the phylum Actinobacteria that represents one of the largest taxonomic units among the 18 major lineages currently recognized within the domain Bacteria (Ventura et al., 2007; Adegboye and Babalola, 2012). The current hierarchical classification of the phylum Actinobacteria consists of 5 subclasses, 9 orders, 55 families, 240 genera and 3000 species (Goodfellow and Fiedler, 2010).

Class Actinobacteria

- 5 Subclasses
- 9 Orders
- 55 Families
- 240 Genera
- 3000 Species

Actinomycetes are plentiful producers of antibiotics and majority of the antibiotics in clinical use today are produced by them. They also produce other bioactive secondary metabolites including anticancer (mitomycin and daunomycin) and immunosuppressive agents (Bérdy, 2005; Galm et al., 2005; Olano et al., 2009; Solecka et al., 2012) apart from their major role in recycling of organic matter.

Actinomycetes are generally considered to be indigenous to terrestrial habitats, although it is becoming increasingly apparent that they are also common in marine ecosystems (Moran et al., 1995; Bull et al., 2000; Mincer et al., 2002;
Maldonado et al., 2005), as exemplified by the isolation of Corynebacteria, Dietziae, Gordoniae, Mycobacteria and Rhodococci from deep-sea sediments (Colquhoun et al., 1998; Takami et al., 1999), and Micromonosporae and Streptomyces from bathyal and coastal sediments (Goodfellow and Haynes, 1984; Jensen et al., 1991; Takizawa et al., 1993). As several species have been isolated and screened from the soil in the past decades, the chance of isolating novel actinomycete strains from these habitats which would produce new biologically active metabolites has reduced.

The terrestrial habitat has been the most predominant and widely exploited source (Nithya and Ponmurugan, 2012). A very little is known about the microbial diversity of marine sediments which is an inexhaustible resource that has not been properly exploited. However, the full potential of this domain as the basis for biotechnology, particularly in India, remains largely unexplored. Oceans have borne most of the biological activities on our planet covering approximately 70% of the planet and contain organisms with broad biodiversity and complex ecology offering a remarkable opportunity as a source of novel compounds. The bactericidal properties of seawater began to be recognized in the early 1930s and attributed to antibiotic producing bacteria and planktonic algae (ZoBell, 1936). A number of biologically active compounds with varying degrees of action such as anti-tumor, anti-cancer, anti-microtubule, anti-proliferative, cytotoxic, photo protective as well as antibiotic and antifouling properties have been isolated to date from marine sources.

The marine environment represents a largely unexplored source for isolation of new microbial strains (bacteria, fungi, actinomycetes, microalgae, cyanobacteria and diatoms) that are potent producers of bioactive secondary metabolites. During early investigations, it has been proposed that actinomycetes isolated from marine
habitats are not indigenous marine bacteria, but instead originate from spores of terrestrial actinomycetes that have been washed to sea. However, recent studies have shown that the distribution of actinomycetes in marine sediments and the requirements of seawater for growth give conclusive evidence that those adapted to the marine environment represent a physiologically unique class of microorganisms (Goodfellow and Maldonado, 2006). Since marine organisms live in a significantly different environment from those of the terrestrial organisms, it is reasonable to expect that their secondary metabolites will differ considerably. Drug discovery research from marine organisms has been accelerating and now involves interdisciplinary research including biochemistry, biology, ecology, organic chemistry and pharmacology (Capon, 2001; Haefner, 2003; Penn et al., 2009). Blunt et al., (2004) listed that in marine environments sponges (37%), coelenterates (21%) and microorganisms (18%) are major sources of biomedical compounds followed by algae (9%), echinoderms (6%), tunicates (6%), molluscs (2%) and bryozoans (1%). However, marine microorganisms have not been given the attention they deserve and a very limited insight into the capabilities and bioactive potential of marine microorganisms is available in literature to date. There is still scope for a higher magnitude of research and investigation to explore the potential of marine microorganisms as producers of novel drugs. Major classes of microbes like bacteria and fungi are now the targets of biomedical study and intriguing novel metabolites. Coastal bacterial samples grown under saline conditions have been reported to yield new antibiotics, antitumor and anti-inflammatory compounds (Pathirana et al., 1992; Trischman et al., 1994).

The exploitation of marine actinomycetes as a source for the discovery of novel secondary metabolites is still at its infancy and several novel metabolites have
been isolated during the past few years including Abyssomicin C, a novel polycyclic polyketide antibiotic produced by marine *Verrucosispora* (Reigdlinger *et al*., 2004), Diazepinomicin, a unique farnesylated dibenzodiazepinone produced by *Micromonospora* possessing antibacterial, anti-inflammatory and antitumor activities (Charan *et al*., 2004) and Salinosporamide A, a novel β-lactone-γ-lactam isolated from obligate marine actinomycete, *Salinispora tropica* (Maldonado *et al*., 2005).

Indian marine environment is believed to have rich microbial diversity. However, the wealth of indigenous Indian marine microflora has not been fully explored. Most of the studies on marine microorganisms have been limited to isolation, identification and maintenance of these organisms on different culture media. Their biotechnological potentials are yet to be fully explored (Sivakumar *et al*., 2007). East Coast of India is reported to be a major source of actinomycetes (Sambamurthy and Ellaiah, 1974; Balagurunathan, 1992; Dhanasekharan *et al*., 2005; Vijayakumar *et al*., 2007). Therefore, there is tremendous scope to identify new or rare marine microorganisms from this region and also to discover novel microbial metabolites with diverse biological activities (Dhanasekaran *et al*., 2005; Ramesh, 2009). The recent discovery of novel secondary metabolites from taxonomically unique populations of marine actinomycetes suggested that these bacteria add an important new dimension to microbial natural product research. Continued efforts to characterize marine actinomycete diversity and how adaptations to the marine environment affect secondary metabolite production will create a better understanding of the potential utility of these bacteria as a source of useful products for biotechnology. These findings will hopefully encourage additional studies addressing the ecological roles of actinomycetes in the marine environment, their diversity, distribution, culture requirements and evolutionary responses to life in the sea.
In view of the significance of marine actinomycetes as potential producers of bioactive compounds, the present study is mainly aimed to isolate and identify the actinomycetes from marine habitats and characterize the bioactive metabolites produced by the potent strain.

**The main objectives of the present investigation include:**

- Isolation of actinomycete strains from marine soil samples collected from Bheemili beach, Visakhapatnam, India.
- Screening the strains for antimicrobial activity to select the potent one.
- Cultural, morphological, physiological, biochemical and molecular studies of the selected strain.
- Optimization of nutritional and physiological parameters for improved production of secondary metabolites by the strain identified as *Rhodococcus* sp. VLD 10.
- Extraction, purification and structural confirmation of bioactive compounds produced by *Rhodococcus* sp. VLD 10.
- Minimum Inhibitory Concentration of the bioactive compounds produced by *Rhodococcus* sp. VLD 10 against Gram positive and Gram negative bacteria as well as fungi.