The antimicrobials are substances of natural, semi synthetic or synthetic origin and have ability to kill or inhibit the growth of bacteria, viruses, fungi and protozoa. The word antimicrobial was derived from the Greek words anti (against) mikros (little) and bios (life). Antimicrobials agents are classified functionally according to site where they adversely affects viz. biosynthesis of cell wall, synthesis of nucleic acid, affects on permeability of cell membrane, interfere with metabolic process and translation of protein by ribosome. The antimicrobial compound are also classified on the basis of spectrum of activity against susceptible microorganism as, broad spectrum, intermediate spectrum or narrow spectrum. They may be either nonselective antimicrobials or selective antimicrobials like disinfectant and antibiotics respectively.

The antimicrobial agents are used both for antimicrobial chemotherapy and antimicrobial prophylaxis. The characteristics features of ideal antimicrobial agent includes selective toxicity towards microbes but non toxic to host, the microbicidal antimicrobials are more preferred over microbiostatic, in addition to these, ideal antimicrobials are relatively soluble, potent and does not lead to the development of antimicrobial resistance and allergies in hosts.

The antimicrobials are secondary metabolites found in microorganism, plants and animals. Microorganism such as bacteria, actinobacteria, cynobacteria, fungi and algae attracted more attention in research that lead to the discovery of natural antimicrobial compounds. The exploration of natural and synthetic antimicrobial compounds subsequently led to the development of drug for the treatment of human microbial diseases. Microbial diseases are one of the main cause of morbidity and mortality word wide. Today, many of such diseases are often caused by multidrug resistant microorganism and are very difficult to treat by
using conventional antibiotics and consequently lead to substantial increase in health care costs.

Antimicrobials compounds produced by microorganism are secondary metabolites and are grouped according to the microorganism they act, as antibiotics and antifungal. Antibiotics are the most important antimicrobial metabolites (Basilo et. al. 2003). The use of antimicrobial products against microorganism, either by killing them or inhibiting their growth has been place for the past 2000 years. (Liras and Martin 2005). Microbial secondary metabolites have a great variety of chemical structure and are normally formed by microorganism after the growth phase is completed.

The role of secondary metabolites are reported to offer ecological advantage to the organism producing it in its natural habitat. The microbial metabolites produced by many microorganisms possess specific or broad spectrum activity against co-existing microorganism (Berleman and Kirby, 2009). The antibiotics confer advantage to the producing organism through direct suppression of other organisms in highly competitive and resource limited environments (Davies 1990).

Since the discovery of penicillin, thousands of compounds with antibiotic properties have been identified. Although a wide variety of microorganism synthesize antibiotics, the majority of the useful compounds are produced by actinomycetes many species of bacteria also produce secondary antagonestic metabolites.

Some of the bacteria are known to produce servral metabolites with different structure and biological activities and a single bacterial strain may produce more than one secondary metabolites. The compounds produced by one particular strain may have similar chemical structure or completely different structure. The bacteria contains cluster of genes for the formation of each secondary metabolites, each
cluster has genes encoding structural biosynthetic enzymes and regulatory proteins for the control of metabolite formation.

The bacteria producing the metabolite also contains genes for making the producing organisms resistant to the metabolite for those cases where the metabolites have lethal or deleterious biological activity (Liras and Martin 2005). Secondary metabolites serves as competitive weapons against other bacteria, fungi, amoebae, plants, insect and large animals, in addition to antimicrobial activity, secondary metabolites may also act as metal transporting agents, agents of symbiosis between microbes and plants, nematodes, insects and higher animals as a sexual harmones and differentiation effectors (Dermain and Fang 2000). However secondary metabolite producing ability, is very uneven in the species of living world. In the prokaryotes and plant kingdom these are distinct groups of organism, namely unicellular bacteria, eukaryotic fungi and all filamentous actinomycetes being the most frequent and most versatile producer. In the group of prokaryotes unicellular bacteria the Bacillus and Pseudomonas species are the most frequent producer. Among the group of unicellular bacteria the most frequent producer are the Bacillus.

The prominent species of Bacillus includes, *Bacillus subtilis*, *Bacillus circulans*, *Bacillus lichaniformis*, *Bacillus polymixa*, *Bacillus brevis*, *Bacillus cereus* and *Bacillus pumilus*.( Norimasa et al. 2002, Mannanov and Sattarova , 2001 and Ahlem et al. 2010). These organism commonly produce peptides or modified peptide, lipopeptides, polyketides, phospholipids, aminoglycoside, aminopolyol, phosphon oligopeptide, isocoumarins, terpenoids, (Renee et al. 2008, Elizabeth et al. 2004 and Butcher et al. 2007). The peptide, polyketides, phospholipids and coumarins antibiotics produced from Bacillus species are therapeutically important, hundreds of peptides antibiotics have been described in the past half century (Hancoch et.al.1998, and Kleinkaut et.al.1998). These fall into
two classes, non ribosomally synthesized peptides such as gramicidin, polymyxins bacitracin, glycopeptides etc. and ribosomally synthesized peptides. The pumilacidins, pumilin, pumivicitin and amicocoumacins produced by *Bacillus pumilus* strains is important therapeutic agent for treating infection caused by bacteria, fungi and viruses. The ability of *Bacillus pumilus* can be augmented by searching and isolating novel strains from extreme environment for production of potent broad spectrum antimicrobials of secondary metabolite nature.

Microorganism including Bacillus species that thrive in an unusual extreme habitats have exhibited capabilities of producing unique metabolites that enhances survival under stressful condition by acquisition of substrate (Romero et. al. 2011). The marine environment covers more than 70% the world surface and has proven to be a rich source of both biological and chemical diversity (Gochfeld et. al.2003. Marine microorganisms are often taxonomically unique which makes these interesting as potential source of new drug leads. The marine environment is extremely complex and contains a huge diversity of life form. The water column of the ocean contains approximately 10^6 bacterial cell per millimeter (Hagstromet et.al. 2002) Marine Bacillus species are of great interest as novel and rich source of biologically active product. They live in close association with soft bodies marine organism which lacks obvious structural defense mechanism and thus really on chemical defense by production of bioactive secondary metabolites, either by themselves or associated bacteria to survive in their extreme habitat (Jensen and Fenical 1994). In the year 2007 alone 961 new compounds were described from marine microorganism reflecting an increase of 24% compared with the number of compounds reported for 2006 (Blunt et. al. 2009).

Extremophilic Bacillus species are a rich source of structurally diverse class of secondary metabolites including peptide, lipopeptide, macrolactone ,fatty acid, polyketides, lipoamide, Isocoumarins. Some of these bioactive compounds might
have high potential for the development of effective pharmaceuticals and agricultures products (Muhammad et.al. 2013). *Bacillus pumilus* isolated from unique niches of environments may produce useful bioactive compound against multiple drug resistant, emerging and reemerging microbial pathogen and spoilage causing microorganism.

**Objectives:**

To meet the objectives of the research, the work is planned on the following points.

- Isolation of Bacillus sp. from high salts, high temperature high pH and low pH environments.
- Screening of Bacillus isolates for antimicrobial activity against various bacterial and fungal pathogens.
- Identification of efficient antibiotic producing *Bacillus sp.* by biochemical test and 16S rRNA sequencing techniques.
- Optimization of bioactive compound production.
- Extraction and purification of antimicrobial metabolites by thin layer chromatography, column chromatography, PAGE and IR, Mass, NMR spectroscopy
- Identification and characterization of potent new antimicrobial compounds from *Bacillus pumilus*. 