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ANTIBIOFILM AND ANTICANCER POTENTIAL OF MARINE ORGANISMS: A MICROREVIEW

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Abstract

Marine organisms are shown to have multiple applications in medical, industrial and agricultural sectors. Studies across the globe have proved that these organisms because of their extreme biological diversity produce a diverse class of metabolites with interesting and novel bioactivities. This microreview article finds emphasis on the potential of marine organisms for the production of biologically active secondary metabolites with antibiofilm and anticancer potential. Biofilms occur everywhere. However, occurrence of biofilms in medical implants poses serious life threat and is need to be attended with most care. Similarly, cancer, becoming a serious medical problem all over the world, is to be controlled or managed in a better way with more potent drugs. In this context, marine organisms offer themselves a potential bioresources for the search of biologically active secondary metabolites with the promise to develop antibiofilm and anticancer drugs. Hence, this microreview highlights the prospects of marine organisms for their antibiofilm and anticancer potentials.

Keywords: Antibiofilm, Anticancer, Marine Organisms, Metabolites, Diversity

INTRODUCTION

Biofilms are usually made up of diverse microorganisms, which are attached to a surface. The layers of microbial cells are attached to a surface and embedded in a matrix of exopolysaccharide. Bacteria foul medical devices and implants, such as catheters, components of cardiac pacemakers, artificial heart valves and joints. These implant associated biofilms can be treated with antibiotics but in certain situations replacement surgeries, which of course come with risks, would be needed

(Donlan and Costerton, 2002). Therefore, it is important to search for alternative therapeutics to control biofilm-associated infections.

Cancer, one of the leading causes of death worldwide, is the most serious challenge encountered by biomedical scientists. The therapies and treatments vary with types of cancer. During the past few decades, the research on bioactive metabolites from marine biological resources has geared up and among the sources marine actinomycetes are proved to be best. However, antitumor compounds are always preferred molecules by cancer biologists for therapy (Jayaprakashvel, 2012). Thus, cancers have always been challenging and never ending research is always on for finding newer compounds for cancer treatment. Breast and liver cancers are most common cancers with high occurrence. Compounds derived from marine resources have successfully used in the treatment of cancers. However, due to the alternate pathways in oncogenesis and treatment associated side effects of drugs have always warrented new and safer anticancer molecules and thus search of anticancer molecules are always a central theme of research.

Antibiofilm Activity

Quorum-sensing regulates bacterial biofilm formation and virulence factors, thereby making it an interesting target for attenuating pathogens. And hence, the antibiofilm strategies aim to isolate metabolites with antibiotic, antiquorum sensing activities for establishing antibiofilm activity. Coral Associated Bacteria (CAB) were isolated and found exhibited stable antibiofilm activity even after exposure to higher temperatures which is promising for the development of novel antifouling agents for diverse industrial applications (Padmavathy and Pandiyan, 2014). Similarly, Nithya *et al.* (2010) have identified that marine bacterial isolates inhibit biofilm formation and disrupt mature biofilms of *Pseudomonas aeruginosa* PAO1. Kavita *et al.* (2014) have characterized anti-biofilm activity of extracellular polymeric substances from a marine bacterium *Oceanobacillus iheyensis*. Thus, research on antibiofilm activity from marine microorganisms is receiving considerable attention worldwide.

Currently, biofilm infections are usually treated with antibiotic combinations. However, in many cases, these antibiotics are not efficient. In this context, novel strategies in preventing and eradicating biofilm formation have been recently reported including inhibition of attachment, disruption of biofilm architecture, immunotherapy, quorum sensing inhibitors (QSI) ...etc. These strategies require the search of novel active molecules. The antibiofilm activity of marine bacteria has been previously reported. For example, the marine bacterium *Pseudoalteromonas* sp. 3J6 exhibited antibiofilm activity against *Vibrio tapetis* (Rodrigues et al., 2015). And hence it is evident that marine bioresources especially microorganisms would be a potent choice for the search of novel antibiofilm drugs.

Anticancer Activity

Metabolites with anticancer activity are long been researched. Anand *et al.* (2015) have reported the total synthesis and anticancer activity of a cyclic heptapeptide from marine sponge using water soluble peptide coupling agent EDC. Anticancer and Antimicrobial Activity was reported from *Aspergillus protuberus* SP1, a marine bacterium isolated from Marine Sediments of South Indian Coast (Mathan *et al.,* 2011). L-Glutaminase produced by *Alcaligenes faecalis* KLU102, isolated from the marine realm (Bay of Bengal), demonstrated to have potential anticancer activity against HeLa cells (Pandian et al., 2014). Marine actinobacteria are emerging as a valuable resource for bioactive substances encompassing a variety of unique structural classes. Sivakumar *et al.* (2015) have reported that marine sponge derived actinomycetes had anticancer compounds. A collaborative study between

China and India has proved the anticancer potential of bioactive 16-methylheptadecanoic acid methyl ester derived from marine *Trichoderma* (Saravanakumar et al., 2015). The ethyl acetate extracts of *B. subtilis* subsp. *subtilis* RG isolated from mangrove ecosystem has been demonstrated to have potent cytotoxic activity against human breast adenocarcinmoa cells (MCF-7) (Ramasubburayan et al., 2015). Many review articles have emphasized the voluminous works done on anticancer drugs from marine organisms and marine microorganisms (Sithranga Boopathy and Kathiresan, 2010.; Mayer and Gustafson, 2003; Malve, 2016).

Many compounds from marine have been launched commercially as anticancer drugs. US Food & Drug Administration (FDA) in 2004 has approved Prialt1 (ziconotide, v-conotoxin MVIIA) the synthetic equivalent of a conopeptide found in marine snails, used for the management of severe chronic pain. Furthermore Yondelis1 (trabectedin, ET-743) an antitumor agent discovered in a marine colonial tunicate, and now produced synthetically, receiving Orphan Drug designation from the European Commission (EC) and FDA for soft tissue sarcomas and ovarian cancer and its registration in 2007 in the EU for the treatment of soft tissue sarcoma (Mayar et al., 2016). A series of reviews by Mayer and his coworkers in recent years have provided comprehensive information about 1000s of bioactive metabolites with anticancer activity from marine organisms (Mayer et al., 2009; Mayer et al., 2010; Mayar et al., 2013). These voluminous studies and reports have convincingly proved that marine organisms are potential resources for the exploitation of bioactive molecules with anticancer potential.

Conclusion

The scope for the production of biologically active, chemically diverse and functionally unique metabolites from the marine organisms is quite high and hence the research on antibiofilm and anticancer activity from marine microorganisms needs much attention.

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