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Perspective

Antimicrobial Activity and Selenium Nanoparticles Fabrication against Marine Pathogens

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ABOUT THE STUDY

The fastest-growing area of food production in the world, aquaculture, poses a significant productivity barrier due to diseases that require substantial attention. With an export value of around USD150 billion (FAO 2016), fish are the most traded food product in international trade and they support a large number of employment in the secondary sector, including those in the trade and marketing services, fish processing, and the fish feed industry. The cultivation of new aquatic species and the transportation of live species to new countries and continents have been linked to the globalisation of aquatic products and the rise of aquaculture as the primary source of the world's aquatic food supply, which has simultaneously facilitated the spread of the pathogens and diseases associated with those pathogens (FAO 2014) [1].

The increase of aquaculture production is reportedly being hampered by disease outbreaks, particularly those brought on by bacterial infections. *Vibrio* spp., which is regarded as the major pathogen in culture settings, has been linked to massive losses of larval and juvenile penaeids and finfish that total $9 billion annually in economic losses worldwide. Aquaculture production is protected against a variety of infections, including *Vibrio harveyi* (*V.harveyi*) and *Pseudomonas aeruginosa*, by marine polysaccharides from a number of macroalgal species. And among them, the red seaweed *Kappaphycus alvarezii* (*K. alvarezii*) is important for enhancing salinity-related stress tolerance and infection resistance in shrimp hatchery development [2]. A well-known tropical calcareous algae with vast distribution throughout the Indian coast, *Halimeda opuntia* (*H. opuntia*), is recognised to have various antibacterial activities.

Because of the unique properties of nanoparticles, which enable novel applications, nanotechnology has grown into a vast field of study. Nanoparticles have found use in a wide range of medical applications, including diagnostics, vaccination, drug and gene delivery. Nanoparticles have piqued the interest of researchers as a specific and sensitive diagnostic tool for a variety of bacterial, fungal, and viral diseases in aquaculture. Metal and metal oxide nanoparticles have been used in water decontamination and as antimicrobial agents in aquaculture due to their effective antimicrobial properties against fish pathogens. In its nanoscale form, selenium, an essential micronutrient, appears to be a potent antioxidant with low toxicity. The efficient operation of the immune system depends on selenium, a biocatalyst and functional component of many enzymes that also has anticarcinogenic properties.

The synthesis of stable selenium nanoparticles for benign biomedical applications is still a difficulty, but numerous efforts have been made to do so using various biological sources, such as bacteria and plant sources, which produce nanoparticles of various sizes and morphologies. UV-Vis spectral spectroscopy was used to validate the presence of produced selenium nanoparticles in the suspensions. Both samples displayed a distinct surface plasmon resonance band at 293 nm and 294 nm for *K. alvarezii* and *H. opuntia*, respectively, in the UV-Vis spectra taken at various time intervals, which showed increasing absorbance with increasing incubation time. According to Chen et al. (2008), who stated that the particle size could be correlated with the nature of the UV-visible spectra and that if the particle size below was 100 nm or less, it showed a clear absorption maximum in the UV range [3,4], this clearly demonstrated that all of the selenium nanoparticles had sizes below 100 nm.

UV-Vis spectroscopy, Scanning Electron Microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR), and X-ray Diffraction (XRD) were used to characterise these selenium nanoparticles. The FTIR spectrum confirms the presence of different functional groups in the plant extract, which may potentially affect the reduction process and stabilisation of nanoparticles. SeNPs' antibacterial efficacy was tested against aquatic Vibrio infections [5]. It was discovered that SeNPs had a dose-dependent ability to suppress cell proliferation. Along with ascorbic acid, vitamin A, and other phenolics, the cell wall of K. *alvarezii* is known to include carrageenan, a sulfated polysaccharide, which may contribute to its antioxidant capacity.

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