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Wound Healing Activities of Green Synthesized Nanoparticles using Green Marine Algae

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Abstract: ***Marine algae have the potential for various biological activities, hence the focus is to make a comparative study of different marine algae having biomedical properties with green synthesized silver nanoparticles. In addition to various kinds of metallic nanoparticles applied to biological applications, Ag - NPs are essential and fascinating nanomaterials fundamental to nanoscience and technology, particularly for nanomedicine. For the synthesis of numerous nanomaterials, including metal oxides, hybrids, and materials inspired by biology, green synthesis has emerged as a dependable, environmentally friendly, and sustainable process in the field of materials research. Characterizations using techniques including TEM, EDS, DLS, and FT - IR were done to verify the characteristics and configurations of the silver nanoparticles. Along with - it various kinds of assays are used to find out the different working methods of the respective algae. DPPH and FRAP assays were performed to get insight about antioxidant activity of silver nanoparticles, to check for antimicrobial activity, MIC turbidity test was done. Cell migration in two - dimensional surfaces is measured using the scratch test over time and in response to various treatments. Various in vitro experiments are conducted to evaluate the anti - inflammatory properties of the algae. MTT is used to investigate the cytotoxic effects of marine algae. The biological applications of marine algae are explored, and the most efficient one is elucidated.***

Keywords: Green marine algae, green synthesized silver nanoparticles, Caulerpa racemosa, Caulerpa scalpelliformis, Caulerpa taxifolia, antioxidants, antimicrobial

1. Introduction

Marine algae, which resemble plants and are found on rocks in coastal regions, are an important source of bioactive substances such as carotenoids, omega - 3 fatty acids, dietary fiber, vitamins, and minerals. They differ from plants and animals due to their special cells and pigments used in photosynthetic processes. Algae are a valuable resource in marine environments because they have several medicinal uses, both inside and externally. Algae are classified into three main types: Chlorophyceae, Phaeophyceae, Rhodophyceae, and Blue - green Algae (BGA). Chlorophyceae are green algae with chlorophyll a and b pigments, Phaeophyceae are brown marine algae with chlorophyll A, C, carotenoids, and xanthophyll. Rhodophyceae are red algae with r - phycoerythrin pigment, and BGA is sometimes treated as seaweed. Green marine algae known as Chlorophyceae is further classified into green - micro algae and green - macro algae. Caulerpa is one of those green macro algae having wound healing, antimicrobial as well as antioxidant activities. Currently, 15 of the 97 species of Caulerpa that have been identified have been consumed worldwide and many of them have different biomedical applications as well.

Caulerpa racemosa is a species in the Caulerpaceae family, belonging to the Bryopsidales orderIts branchlets are spherical, club - shaped, mushroom - to - disc - shaped, with erect fronds and vesiculate ramuli distributed radially or distichously. The plant contains higher total sugars, sulfate groups, proteins, and uronic acid, indicating that all polysaccharides are proteoglycans rich in sulfate groups. The presence of these many bioactive compounds exhibits efficient wound healing, antimicrobial and wound healing activities (Dissanayake, Indeewarie H et al. “Integration of in vitro and in - silico analysis of Caulerpa racemosa against antioxidant, antidiabetic, and anticancer activities. ” *Scientific reports* vol.12, 1 20848.2 Dec.2022, doi: 10.1038/s41598 - 022 - 24021 - y).

The green algae species Caulerpa scalpelliformis is regarded as "razor algae" because of its thin, blade - like shape. By giving tiny fish and invertebrates a place to live, Caulerpa scalpelliformis contributes to the health of maritime environments. The phytochemical screening of C. scalpelliformis already revealed antibacterial and antifungal properties. This algae is claimed to be an effective antimicrobial agent, and the findings suggest it possesses good biomedical application (Manikandan, Ramar & Ravichandran, R. Anjali & Manikandan, Beulaja & Prabhu, Narayanan marimuthu & Koodalingam, Arunagirinathan & Prasad, Sai & Chitra, P & Munusami, Arumugam. (2019). Synthesis, characterization, anti - proliferative and wound healing activities of silver nanoparticles synthesized from Caulerpa scalpelliformis. Process Biochemistry.79.10.1016/j. procbio.2019.01.013.)

Caulerpa taxifolia is a marine green algae that is very effective and produces a wide range of bioactive chemicals with various biological properties. There are 29 phytochemical substances in C. taxifolia, which includes flavonoids, alkaloids, polyphenols, steroids and many more.

2. Methods

The purpose of this work is to find the recent studies on chronic wound healing with the help of green marine algae. Studies that discuss various healing effects based on three different species of marine algae, some of which contain growth factors and antimicrobial properties.

3. Results and Conclusion

The comparative studies were done using different nanoparticles synthesized process by using different algal extracts of different species of Caulerpa, the characterizations were performed to confirm production of silver nanoparticles.

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