Smart bioactive compounds: Their synthesis and potential application in biodiesel oxidation stability enhancement

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Abstract

Renewable fuels are one of the technical concerns that has gained in popularity as a result of its environmental advantages. Biodiesel deserves special attention in this regard because of its biodegradability and reduced pollutant emissions as compared to petroleum diesel. The main issue with biodiesel is that it has a low oxidation stability, which makes it difficult to store and inappropriate for engines. The peroxide value of biodiesel increases initially, then decreases as main products breakdown to create secondary products during oxidation. Increases in peroxide value can lead to an increase in cetane number, which lowers ignition delay and can cause a variety of engine issues. Antioxidants are used to block or slow down the oxidation process by inhibiting the start and propagation of free radicals, which reduces the formation of secondary degradation chemicals. Because synthetic antioxidants include phenolic components, they are added to biodiesel to prevent the production of radicals. Synthetic antioxidants such as butylated hydroxytoluene (BHT), butylated hydroxyanisol (BHA), tert-butylhydroquinone (TBHQ), and propyl gallate (PG) are widely utilised in biodiesel. Because of these unfavourable qualities, renewable antioxidant sources containing phenolic compounds are preferable to synthetic antioxidants. Synthetic antioxidants are generated from non-renewable sources and have carcinogenic health constraints for live creatures immediately exposed to them. In this context, bioactive chemicals such as polyphenols, which are found in a variety of natural plant-based materials and play a critical role in lipid oxidation protection, are extremely essential components. Ginger extract includes phenolic chemicals such as gingerol and shoagol, both of which are potent anti-radical agents. During the Rancimat oxidation stability test, ginger extract provided more protection for biodiesel. Because more antioxidant components are present in a larger percentage of additional nature-based robust ginger extracts, the oxidation stability is improved.

Marine habitats provide a wide range of ecological services that benefit society. Supporting services (primary production and nutrient cycling), provisioning services (such as food), and cultural services, such as tourism, are the most common. Marine biotechnology, in which marine organisms and their compounds are identified, extracted, isolated, characterised, and used for applications in various sectors to benefit society, ranging from food/feed to pharmaceutical and biomedical industries, has been made possible by recent advances in science and technology. Temperature, light intensity, salinity, and pressure are only a few of the physical, chemical, and hydrological factors that affect life in marine settings. Marine creatures have adapted to these varying conditions by creating a wide range of shapes, functions, and tactics that are critical for survival, adaptation, and thriving in the various ecosystems.

The production of biomolecules (secondary metabolites, enzymes, and biopolymers) is one of the most stimulating evolutionary traits present in extant marine phyla for biotechnology. Biomolecules mediate chemical communication between organisms, serve as a protective barrier against adverse environmental conditions, serve as weapons for catching prey or protection against predators, pathogens, extreme temperatures, or harmful UV radiation, and are essential in a variety of other life-sustaining processes. Biomolecules have developed to help species survive in their aquatic environments, and they are generally capable of exerting biological activity even at low concentrations to offset dilution/dispersion effects. Many marine metabolites have unique and complicated structures that allow for the identification of novel and creative commercial uses. Natural chemicals account for more than half of all medications now in use, with the ratio for anticancer and antibacterial therapeutic agents being significantly higher. Other features and activities of marine creatures, aside from biomolecules, can be helpful and interesting to many businesses, such as the removal and degradation of specific chemical compounds or organic debris, as well as the formation of complex biochemical processes. Marine resources, on the other hand, are generally untapped and undervalued.

Joint investigations by field and experimental biologists, as well as chemists, drove the growth in knowledge levels from the mid-twentieth century forward, aided by current improvements in ocean access techniques By the turn of the century, marine natural products chemistry had matured into a well-established specialty of chemistry, with an emphasis on secondary metabolite separation and structural elucidation.

The following essay examines several key components of the marine biotechnology workflow. The section “Methodology for Exploration of Marine Bioresources” gives an overview of the basic marine biotechnology pipeline and its major components, which include organism separation, data analysis and storage, chemical techniques for isolation, and compound characterisation. The section "Production upscaling" discusses production

and scaling-up to ensure enough supply at the industrial level. The section "Use case scenarios" discusses how marine biotechnology may help solve societal problems in areas including energy generation, agronomy, bioremediation, food, feed, cosmetics, bio-inspired materials, and medicines. Furthermore, the legislative and ethical issues arising from the development of marine biotechnology should not be overlooked and they are presented in section “Legislation and funding.” Section “Communication and stakeholder engagement in development finalization” concludes with a discussion on the importance of science communication both to raise consumer awareness on new products and establish new collaborations on one hand and implement knowledge transfer channels with stakeholders from the industrial, governmental and public sectors, on the other hand. The establishment of efficient communication that enables productive collaboration efforts is essential for the market entry and successful commercialization of marine biotechnology products. We conclude with an overview of the marine biotechnology roadmap in Europe.

Biography

Anuchaya Devi has her expertise in biodiesel production from different non-edible oil sources. Her research is primarily focused on biodiesel fuel quality enhancement in terms of improving its oxidation stability by different methods. She has developed designer biodiesel by blending different non-edible oils in different volumetric ratios with improved fuel quality. In recent times she focused on searching some alternative natural antioxidant sources which can be applied to biodiesel in place of synthetic antioxidants for protecting biodiesel from oxidation. She has identified the application of Ginger extract in biodiesel as a novel additive antioxidant source which is tremendously capable in protecting biodiesel from oxidation.

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