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Perspective

Importance of photosynthetic organisms in monoterpenes biotransformation

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DESCRIPTION

Monoterpenes are important substances for agriculture and are utilised extensively in the food, cosmetic, and pharmaceutical industries. It is known that a range of organisms, including bacteria, fungi, yeasts, plants, or isolated enzymes, can alter the chemicals in this class. One of the most crucial green chemistry techniques, biotransformations allowed for the creation of novel compounds employing complete cells of microorganisms or isolated enzymes under mild reaction conditions. The anticancer, antispasmodic, antihyperglycemic, antiallergenic, anti-inflammatory, immunomodulatory and organoleptic properties of monoterpenes make them interesting and sought-after molecules for the pharmaceutical, sanitary, cosmetic, agricultural, and food industries, in addition to their use as flavour and fragrance compounds.

A good source of physiologically active substances with antiviral, antibacterial, antifungal, and anticancer properties is cyanobacteria. In addition, cyanobacteria are used as a source of alternative energy, food, fertiliser, and wastewater treatment. These microbes are oxygenic photosynthetic bacteria that play important roles in the nitrogen cycle, oxygen synthesis, and worldwide biological carbon sequestration. There is little proof that any compounds can prevent cyanobacteria from growing, and it is well known that they can withstand a wide range of environmental conditions. Oceans, fresh water, and soil all contain cyanobacteria and microalgae, which require water to survive. Blue-green algae can survive in bare rock, hot springs, and even lakes in the Arctic and Antarctic because they are more resistant to environmental stress.

Biotransformation of monoterpenes by cyanobacteria

Cyanobacteria engage in a variety of chemical processes, such as reduction. Blue-green algae contain link of both stereo and regioselective reaction capabilities. A few instances of how monoterpenes are used to make alcohols, ketones, oxides, and dike tones. Monocyclic monoterpenes can be transformed biologically in a variety of ways, including reduction, oxidation, hydroxylation, and oxidation with various cyanobacteria.

Biotransformation of monoterpenes by microalgae

There isn't much evidence that microalgae can biotransform monoterpenes, although they can decrease ketones and aldehydes and also oxidise alcohols. As a result, the processes that microalgae are comparable to those microorganisms.

The use of phototrophic microorganisms for organic synthesis is widely accepted, especially given that this technique, known as biotransformation, has many advantages, such as mild environmental conditions for the process to occur in an aqueous environment and high substrate specificity, as well as Regio, Chemo, and stereo speciicity. However, numerous drawbacks stemming from the utilisation of complete living cells restrict the usage of such biocatalysts. These include issues with logical designing and process optimization, limited volumetric productivity, and the frequently arduous isolation of products. Given their capacity to alter organic molecules utilising energy from light, phototrophic microorganisms' capacity to carry out monoterpene biotransformations appears to be particularly intriguing. The fact that the total cost of the biotransformation processes is cheaper for autotrophs than for heterotrophs is an undeniable advantage.

Since it is well known that cyanobacteria have a high tolerance for numerous environmental conditions, there aren't many things that now prevent their growth. As a result, the biotransformations carried out by photoautotrophic microorganisms that are submitted can be used as novel instruments to obtain compounds that have the necessary activity against other microorganism species. Such methods may also be used to explore the specificity of cyanobacterial

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metabolism, particularly if they are connected to the debate over whether phototrophic bacteria and which microalgae should take precedence.

In-depth research on the biotransformation of monoterpenes and their oxygenated derivatives in entire cells demonstrates the versatility of photoautotrophic microorganisms. It is conceivable to induce similar activities if only the mechanism of their control is understood and unified because the biotransformations of autotrophic microorganisms do not differ noticeably between bacteria and algae, as well as between photoautotrophs and heterotrophic bacteria and fungi.