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Review Article

Microbial Biotransformation

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Abstract

Natural products are metabolites with intriguing structural and biological properties, but they have only been isolated in trace quantities. The amalgamations of such normal items help in acquiring them in mass sums. The chemical and pharmaceutical industries have increased their recognition of microbial biotransformation as an important manufacturing tool. Microbial transformation has gone from being of little interest to being a very active area in green chemistry, including the preparation of pharmaceutical products, in recent years.

Keywords: Natural products, Pharmaceutical industries, Microbial transformation, Green chemistry

INTRODUCTION

Compounds from natural products are metabolites with interesting biological and structural properties. Small amounts of isolated compounds are frequently available. In recent years, the chemical and pharmaceutical industries have increased their recognition of biotransformation as an important manufacturing tool. Biocatalysts can rearrange, or in a few occurrences even empower, the creation cycle of complex synthetic substances and medication intermediates (Roussis V et al., 1999). They can simplify the separation and purification processes by adding stereospecificity to the process. The capacity of biocatalysts to specifically produce helpful items under moderately gentle conditions contrasted with its substance impetus partner make bioimpetuses an intriguing and strong expansion. Later propels in innovation have uniquely expanded the capacity of industry to find new biocatalysts and upgrade their performance. These developments occur at a time when the pharmaceutical and chemical industries are under increasing pressure to produce natural products with greater efficacy and efficiency (Lilies G et al., 1996) (Frydman A, 2005).

BIOTRANSFORMATION OF MICROBES

Biocatalysis scope of study involving microbial transformation is increasing significantly from limited interest into highly active area in chemistry today including preparation of pharmaceutical products. Biotransformation can be clarified as the specific modification of a definite compound to a distinct product with structural similarity, by the use of biological catalysts including microorganisms like fungi. The biological catalyst can be described as an enzyme, or a whole, inactivated microorganism that contains an enzyme or several enzymes produced in it. Bioconversion is another term related to microbial transformation for this study in particular. There is only slight difference between a biotransformation and a bioconversion. A bioconversion utilizes the catalytic activity of living organisms and hence can involve several chemical reaction steps (Lilly MD, 1994).

A living microorganism will be continuously producing enzymes and hence bioconversions often involve enzymes which are quite unstable for used substrates. The properties of biotransformation and bioconversions are very similar and in many cases the terms are cited as interchangeable. On the other hand, fermentation, science under zymology utilizes microorganisms; yeast was known to turn sugar into alcohol since 1857 by the French chemist, Louis Pasteur. The biotransformation processes have advantages overcome some of the inherent problems and examples of some commercially successful processes. To utilize from this processes, biocatalysis research have been suggested for the nation’s rich natural resources mainly with the endophytes available. Biotransformation processes are far more diverse than therapeutic protein production processes. There are many microorganism strains and enzymes required to exploit the selective biotransformation potential for the bioconversion of a myriad of different substances into the desired products especially new optically active main pharmaceutical ingredients (Collins AM, 1999).

INDUCING AGENTS FOR MICROBIAL BIOTRANSFORMATION

Steroids

Using the white-rot fungus *Coriolus versicolor*, diosgenin (3b-hydroxy-5-spiros-tene) was transformed by bacteria into four previously unreported polyhydroxylated steroids. 5(R)-spirost-5- en-3b,7b,12b,21-tetrol, (25R)-spirost-5-en-3b,7a,12b,21-tetraol,and (25R)-spirost-5-en-3b,7b,11a,21-tetraol, along with three known congeners, 25(R)-spirost-5-en-3b,7b-diol, 25(R)-spirost-5-en-3b,7b,21-triol,and 25(R)-spirost-5-en-3b,7b,12b-triol (Leresche JE, 2006).

Monoterpenes

It was investigated the microbial transformations of two saturated acyclic monoterpenoids, tetrahydrogeraniol and tetrahydrolavandulol by Glomerella cingulata. The isopropyl group of both substances was hydroxylated in a regioselective manner. Tetrahydrolavandulol was transformed into 5-hydroxytetrahydrolavandulol, and tetrahydrogeraniol was transformed into hydroxycitronellol. The cyclic monoterpene ketone (-) carvone was used by the plant pathogenic parasite *Absidia glauca*. Through (+)-trans-dihydrocarvone and (+)-neodihydrocarveol, the diol 10-hydroxy-(+)-neodihy-drocarveol was formed in just four days of incubation (Tang FH, 2005).

Diterpenes

Candidiol (15a,18-dihydroxy-ent-kaur-16-ene) was transformed microbiologically by Mucor plumbeus into 3b,15a,18-trihydroxy-ent-kaur-16-ene,6a,15a,18-trihydroxy-ent-kaur-16-ene,3b,15a,18-trihydroxy-ent-kaur-16-ene, 3a,15a,18-trihydroxy-ent-ka 9b,15a,19-trihy-droxy-ent-kaur-16-ene undergoes an intriguing rearrangement in dilute acid medium into 16-oxo-19-hydroxy-ent-abiet,15-diene (Rozenbaum HF, 2006).

SIGNIFICANCE OF BIOTRANSFORMATION

Mucor plumbeus microbiologically transformed candidiol (15a,18-dihydroxy-ent-kaur-16-ene) into 3b,15a,18-trihydroxy-ent-kaur-16-ene, 6a,15a,18-trihydroxy-ent-kaur-16-ene, 3b,15a,18-trihydroxy-ent-kaur-16-ene, 3a,15a,18-trihydroxy-ent-ka 9b. This 8, 15-seco-entkaurene diterpene's possible formation is shown in the figure. 7b, a similar compound known as hebeiabinin A (7A and B). Acetylated substances were added to the following mixtures: 60, 63, 66-68, 71, 73, 75, 77, 79, and 81 to lessen the unique mixtures' extremes. Compound 65 prescribed to be an antique outlined during the partition philosophy from the legitimate biotransformed metabolite. When compared to other kinds of living things, their small size results in a surface-to-volume ratio that is by far the highest. Hence, this permits them to expand their metabolic rates in light of a high trade of particles and metabolites through their surface. Microorganisms multiply exponentially under the right conditions. Microorganisms are proficient to create extraordinary assortment of proteins in a brief timeframe because of its regular burn acteristic to increase. It is additionally conceivable to get and develop microorganisms that can make due under outrageous conditions like low or high temperatures or potentially acidic or salt conditions. Microbial change can make practical responses that are not liable to be completed by conventional manufactured methodology. Additionally, endophytes may produce biodegradable natural compounds (Rozenbaum HF, 2006).

BIOTRANSFORMATION OF SUBSTANCES

Opiate alkaloid

The biotransformation of alkaloids by organisms and plants was as of late looked into by Rathbone et al., in which they summarize the development of alkaloid bio transformations from the middle of the 1980s to 2002. In addition to conventional chemical approaches, biotransformation provides a versatile instrument for the structural modification of alkaloids. Evodiamine is one of the significant dynamic alkaloids in *Evodia rutaecarpa*, a customary chinese medication, which has been generally utilized in China for north of 2,000years. *Penicillium janthinellum* AS 3.510 biotransformed evodiamine into two metabolites: 10-hydroxyevodiamine and 11-hydroxyevodiamine. Evodiamine metabolism was similar in rats and microorganisms. Enzymes that catalyze the N- and O-demethylation of alkaloids have been found to be present in a lot of fungi. *Mucor piriformis*, *Streptomyces sp.*, and *C. echinulata* strains all N-demethylated lergotrile, an indole alkaloid, and various Cunninghamella and Fusarium strains all N-demethylated codeine .In addition, the use of the filamentous fungus *C. echinulata* NRRL1384 in the biotransformation of a thebaine derivative was reported. The thebaine simple was changed over completely to a combination of N-demethylated and N, O-demethylated items (Gershwin L, 2006).

Biotransformation of bufalin

Fernandes reviewed the biotransformation of steroid compounds by microbes in 2003, but significant progress has been made since then. Natural steroids like bufadienolides, for example, have significant anticancer properties. As a result, new derivatives that are more active have been produced as a result of biotransformation. Microbial hydrolysis can accomplish extremely high return. For example, cinobufagin and resibufogenin could be totally utilized by Alternaria modify nata AS 3.4578 to create their 12b-hydroxylated items in more prominent than 90% yield inside 8h. Additionally, *A. alternata* is capable of transforming 3-epi-desacetylcinobufagin into the principal product, 3-epi-12b-hydroxyl desacetylcinobufagin. In addition, the biotransformation of resibufogenin and cinobufagin by *Pseudomonas aeruginosa*. AS 1.860 yielded four dehydrogenated products: 3-keto-resibufogenin, 3-keto-cinobufagin, 3-ketodeacetylcinobufagin, and deacetylcinobufagin. However, *Mucor polymorphosporus* AS 3.3443's biotransformation of resibufogenin resulted in the production of 22 distinct metabolic products, though in low quantities (Bae EA, 2002).

CONCLUSION

For centuries, researchers have studied how bacteria change. A compound can be modified in a way that is good for the environment thanks to this phenomenon. Due to their rapid cell proliferation, microorganisms are able to produce a wide range of enzymes in a short amount of time. In this sense, a sensible number of mixtures of different organic interests can be gotten by microorganisms-driven changes of regular items.

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