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# MICROBIAL SECONDARY METABOLITES

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## ABSTRACT

The short history, explicit highlights and future possibilities of examination of microbial metabolites, including anti-infection agents and other bioactive metabolites, are summed up. The microbial birthplace, variety of creating species, capacities and different bioactivities of metabolites, remarkable highlights of their compound designs are talked about, chiefly based on factual information. The potential quantities of metabolites might be found later on, the issues of dereplication of recently disconnected mixtures just as the recent fads and possibilities of the exploration are likewise talked about.Instances of auxiliary metabolites incorporate anti-toxins, colors and fragrances. Something contrary to auxiliary metabolites are essential metabolites, which are viewed as crucial for the ordinary development or improvement of a life form. Available evidences had shown that the major source of secondary metabolite is microbial source, among that Bacilli is one of the important sources of Secondary metabolites.

**Keyword: Secondary metabolite, source of secondary metabolites, secondary metabolite of plant, microbial metabolite, bacilli source of secondary metabolite**

## INTRODUCTION

It is possible to describe metabolism as the sum of all the biochemical reactions performed by an organism. The intermediates and products of metabolism are metabolites and are typically confined to small molecules. Introduced by The word "secondary" indicates that while primary metabolites are present in any living cell that can divide, secondary metabolites are only incidentally present and are not important for the survival of the organism**[1**]. While secondary metabolites are derived from primary metabolism, they do not shape the organism's fundamental molecular skeleton 2018 Its absence does not shorten the life of an organism immediately, a trait contrary to the primary metabolite, but the survival of the organism is to a greater degree compromised **[2**]. The distinction between essential and optional metabolites is uncertain since many of the primary metabolism intermediates overlap with secondary metabolite intermediates While considered a primary metabolite product, amino acids are certainly secondary metabolites as well. Contrary to the observation that sterols are secondary metabolites, which are an integral part of a cell's several structural structures. The mosaic nature of the intermediate suggests that the primary and secondary metabolism share a similar biochemical pathway. The secondary metabolites function as a buffer zone in which it is possible to shunt excess C and N into an inactive part of the primary metabolism **[3]**. By the metabolic disintegration of the secondary metabolite, the retained C and N will return to the primary metabolite when on demand. There is dynamism and a delicate balance between the primary and secondary metabolism activities that are affected by cell or body growth, tissue differentiation, and development, as well as external pressures [**4]**.

The main source of new compounds for drug discovery and production has been recognized as microbial secondary metabolites. Traditional microorganism chemical research focuses primarily on the extraction and isolation of structurally and highly active fermentation broth and mycelium compounds. However, due to the high rate of re-discovery of identified MSMs, these processes are becoming inefficient. A significant portion of microbial gene clusters are generally assumed to be silenced under normal fermentation conditions [**5]**. Researchers can exploit the ability of microbes in a more objective way by mining the microbial genome and targeting

biosynthetic gene clusters of MSM, such as knocking down, adding or heterologous expression of microbial genes, controlling promoters, inducing mutations, or modifying cultivation conditions to stimulate the expression of MSM genes.

**Classification of secondary metabolites:** In structure, function, and biosynthesis, over 2,140,000 secondary metabolites are identified and are generally categorized according to their vast diversity. There are five major groups of secondary metabolites, such as terpenoids and steroids, polyketides, alkaloids, nonribosomal polypeptides, and enzyme cofactors, derived from fatty acids and substances **[6]**.

Terpenoids and steroids These are big classes of isopentenyl diphosphate biosynthetically derived compounds. About 35,000 recognized terpenoid and steroid compounds are currently being identified. Terpenoids have various unrelated structures, while steroids have a similar skeleton of tetracyclic carbon and are modified terpenoids biosynthesized from triterpene lanosterol **[7]**.

There are more than 12,000 known alkaloid compounds, and their basic structures consist of a basic group of amines and are biosynthetically derived from amino acid **[8]**.

Around 10,000 compounds are known and biosynthesized from simple acyl precursors such as propionyl CoA, acetyl CoA, and methylmalonyl CoA. Fatty acid-derived substances and polyketides **[9]**.

Nonribosomal polypeptides the amino acid dependent compounds are biologically synthesized without direct RNA transcription by a multifunctional enzyme complex **[10]**.

**Secondary metabolites of plants**

Extremely economically important items are plant secondary metabolites. These are used as chemicals of high value, such as medications, flavours, fragrances, insecticides, colorings, etc. Plants are abundant in a broad range of secondary metabolites which have been detected to have in vitro antimicrobial properties, such as tannins, terpenoids, alkaloids, and flavonoids **[11]**. The ability of plants to synthesize aromatic compounds is almost infinite, most of which are phenols or oxygen-substituted derivatives. Around 25,000 terpenoids are classified as secondary compounds and are derived from isopentenyl diphosphate, a five-carbon precursor (IPP). Overall, about 12,000 identified alkaloids are recognized and have one or more atoms of nitrogen that are biosynthesized from amino acids. The 8000 known phenolic compounds are either synthesized through the pathway of shikimic

acid or through the pathway of malonate/acetate **[12]**. Overall, about 12,000 identified alkaloids are recognized and have one or more atoms of nitrogen that are biosynthesized from amino acids. The 8000 known phenolic compounds are either synthesized through the pathway of shikimic acid or through the pathway of malonate/acetate Alkaloids are known to be protein synthesis reserve materials, to be defensive substances that deter animal or insect attacks, and to be plant stimulants or regulators or simply detoxification products **[13]**. Alkaloids currently in clinical use include morphine and codeine analgesics, vinblastine anticancer agent, colchicine gout suppressant, tubocurarine muscle relaxant, ajmalicine antiarrhythmic, sanguinarine antibiotic, and scopolamine sedative

**Microbial metabolites**

Low-molecular mass products with peculiar structures are microbial secondary metabolites. A variety of biological activities are seen in the structurally diverse metabolites, such as antimicrobial agents, enzyme and antitumor inhibitors, immune suppressants and antiparasitic agents, plant growth stimulators, herbicides, insecticides, antihelmintics, etc. They are manufactured during the microorganisms' late growth process **[14]**. Special regulatory mechanisms in microorganisms regulate the production of secondary metabolites, as their production is typically repressed in the logarithmic phase and depressed in the stationary phases of growth. There is a distinctive molecular skeleton in the microbial secondary metabolites that is not present in chemical libraries, and about 40 percent of the microbial metabolites cannot be chemically synthesized **[15]**. Metabolites are low molecular weight (<1000 Da) chemical compounds which play a critical role in microbial metabolism chemical conversion; All of the metabolites of a single micro-organism are collectively referred to as its metabolome the term 'metabolome' was first suggested, and it can be split into three different matrices: inside the cell, in the extracellular medium, and in the headspace of culture. The metabolome is representative of the biological function of an organism since it is most closely related to the phenotype. Metabolites are characterized by infinite half-lives and are therefore absorbed, produced, degraded or excreted **[16]**. However, metabolites are not only formed, but also converted into various compounds during metabolic activities. The sum of each metabolite present within a microbial cell is responsible for the difference between the rate of metabolite formation and conversion.

In biological samples, there are usually three types of metabolites that can be found both intracellularly and extracellularly: I soluble in water (polar), (ii) insoluble in water (nonpolar) and (iii) volatile **[17]**. Though metabolites are highly diverse, the variety is at the level of atoms and not molecules and metabolites can be categorized as either endogenous or exogenous based on their origin and as either primary or secondary based on their role. Inside a cell, endogenous metabolites originate, while exogenous metabolites originate from outside the cell **[18]**. Depending on which growth phase the microbial cells are in, either primary or secondary metabolites will be produced. The metabolic pathways of primary metabolites are associated with the production (anabolic activity) and breakdown (catabolic activity) of metabolites, while the metabolic pathways of secondary metabolites are associated with low growth rate and a response to stress Although the metabolite classifications mentioned above are used in the entire literature, the boundaries between them are not clearly defined and are therefore open to interpretation **[19]**. For the purpose of this study, the authors differentiated between primary and secondary function-based metabolites and between origin-based intracellular and extracellular metabolites. Primary metabolites are synthesized continuously during bacterial development. They are essential for survival and are critical for major cellular processes such as development, growth and reproduction. When these essential metabolites cannot be produced by microorganisms, auxotrophy will result and the organism will die unless the metabolite is supplied exogenously **[20**]. Across phyla and kingdoms, primary metabolites are retained, and as a consequence, primary metabolites formed by the majority of microbial species are comparable. Due to their high turnover rates, they are usually discovered in low amounts inside the cell. As a consequence, the primary metabolite levels within the cell are usually lower than the secondary metabolite levels within the cell; however, this is not always the case as microorganisms can produce intermediate metabolites from the primary metabolism in abundance and can then be excreted into the extracellular medium. Secondary metabolites are not essential for the survival of the producing organisms, as opposed to primary metabolites, and are not necessary for normal growth and development **[21]**. Rather, they provide a survival benefit to the producing organisms, such as improving the available nutrient for uptake or protection against

environmental stressors and are therefore considered indispensable

**Bacilli a Source of Secondary Metabolites:** The rhizosphere is considered to be a rich source of micro-organisms producing a multitude of bioactive molecules, and the concentration of rhizosphere bacteria is estimated to be 10-1000 times higher than that found in soil bacterial populations. Many rhizobacteria that are nematophagous, including *Pasteuria spp., Pseudomonas spp.* For the biological regulation of phytopathogens, *Bacillus spp*. has been used **[22]**. Provided the *Bacillus spp*. The inhibition of phytopathogens is a fundamental feature of the bioactive molecules they generate, which are directly associated with plants and the soil environment. These maticides also demonstrate rapid growth and productivity during cultivation, as they Bacillus spp. is of special concern. As some display the ability to monitor plant-parasitic nematodes. and more specifically the Meloidogyne genus, in agricultural applications in particular. *Bacillus subtilis and Bacillus amyloliquefaciens* are the majority of products currently available for the promotion of plant growth and biological control **[23]**.

Rhizobacteria that occupy the rhizosphere or the spaces between the root cortex cells are known as extracellular plant growth promoters. and most are considered healthy micro-organisms. This is shown by the award of B by the United States Food and Drug Administration. This appellation indicates that *B. Subtilis* is not capable of causing injury, illness or death to another (nonpathogenic) organism and is therefore healthy for both humans and the environment. As biopesticides, they have great potential. Due to the combination of beneficial characteristics, they exhibit. They are ubiquitous in agricultural land, have the potential to grow under diverse environmental conditions and can survive because of their ability to create an overabundance of antimicrobial compounds in different environment. They also develop remarkably resistant spores and easily colonize plant roots and are known to encourage plant growth. This combination of traits is desirable because micro-organisms can be used in the production of biological pesticides with a range of beneficial characteristics **[24]**.

**CONCLUSION**

This review highlights the importance of secondary metabolites, including bacteria, actinobacteria, and fungi, from various

sources such as plants, microorganisms, and their classification, manufacturing and application in different fields. As new pharmaceutical agents in the fight against cancers, cardiac disorders, pests, cytotoxic agents, mosquitoes, infectious diseases and autoimmune disorders of both animals and plants are constantly and crucially required, climate change provides conditions favorable to repeated outbreaks of these events. A vibrant symmetry between advances in chemotherapy and the natural choice of infectious or invasive agents is the battle against any disease. If this never-ending effort is to be given constant importance to the scientific community, then new sources of bioactive secondary metabolites with novel activities must be identified. One of their important means of growth and defence is secondary metabolites, and these metabolites are readily available for discovery. As an alternative to most synthetic drugs and other commercially useful compounds, secondary metabolites with notable biological activity are considered.

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