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A REVIEW ON ACTINOMYCETES

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ABSTRACT

Actinomycetes are Gram-positive microorganisms. Recent studies of actinomycetes have widely distributed into different ecology and soil is best source of actinomycetes were commonly found. Actinomycetes are classified based on their morphology. Actinomycetes have different characteristics. Actinomycetes produce different types of bioactive compounds. Total 22,500 secondary metabolites produced by actinomycetes species and this bioactive compound act as antibacterial therapeutic agent. Due to their therapeutic agent, they act as antimicrobial against various infection. Actinomycetes produces enzymes and these enzymes have many importance in different field.

Keywords: Actinomycetes, classification, Antimicrobial activity, Enzymes

INTRODUCTION:

The term actinomycetes derives from the ancient Greek word ἀκτίς (aktís, 'ray') and μύκης (múkēs, 'fungus') **[1]**. Actinomycetes fungi have filaments pattern structure, branchingpattern structure and conidia formation **[2]**. Actinomycetes are Gram-positive unicellular and free-living bacteria and commonly found in soil and water habitat**.** Total 22,500 bioactive compounds that have got from 45% microbesare produced by actinomycetes microorganisms, 17% by bacteria and38% by fungi **[3]**. Actinomycetes microorganisms are highly contain

Guanine+Cytosinein their DNA genome **[4]**. Actinomycetes microorganism produce different pigmentation on the media which are red, yellow, brown and black colour **[5]**. The critical genera of actinomycetes are *streptomyces, Nocardia, Micromonospora, Actinoplanes, Actunomadura, Rhodococcus, Actinomycetales* and *Streptomyces* suggested to supply some of broad- spectrum antibiotics **[6]**. Natural therapeutic agent product roduced by actinomycetes play main role in thefindingof new antibiotics. Actinomycetes servethe most well-known group of microorganisms, they produce new bioactive compounds. All naturally obtain antibiotics are widely used in medicinal field and agriculture field. These bioactive compounds were produced from most known *streptomyces* spp **[7]**.

As reportedby World Health Organisation [WHO] over-medication and the inappropriate use of antibiotics presented to the creation of antibiotic resistance in many bacterial pathogens. Currently, the drug resistant pathogens appear more immediately than the rate of analysis of new drugs and antibiotics. Many researchers and pharmaceutical industry have involved in the isolation and screening of actinomycetes from unmark habitats, for the production of newantibiotics. But Serious infection caused by microorganisms have become resistant against microorganisms to regularly takeantibiotics and become a crucial healthcare problem in the 21st century **[8]**. Screening of actinomycetes for the manufacture of antibiotics has been search formany years by researchers. Actinomycetes have the capacity of produces different bioactive compounds such as antibiotics, anti-parasitic and enzymes like cellulase and xylanase used in waste treatment **[9]**.

The resistance problem demands to discover new antibacterial agents very effective against resistant of pathogenic bacteria.

Occurrence of actinomycetes:

Actinomycetes are soil habitants and also very everywhere spread in nature. Actinomycetes are also well familiar as soil habitat. The most dominant actinomycetes species found in soil *Streptomyces, Norcardia, Microbispora, Micromonospora, Actinomyces, Actinoplanes* and these actinomycetes species have been also isolated from the soil and actinomycetes are especially rich in alkaline soils and rich in organic matters and manufacture several structurally diverse bioactive compounds of pharmaceutical and agricultural significance. Actinomycetes help to recycle nutrients by degrading vast numbers of organic matter in the soil and commonly found incompost **[10]**.

Characteristics of actinomycetes:

Actinomycetes are commonly heterotropic in nature. Actinomycetes are aerobic and some anaerobic. Many actinomycetes can growon the particular media were used in

the laboratories like NutrientAgar (NA), Trypticase Soy Agar (TSA), Blood Agar (BA), Glycerine Aspargine Agar (GAA) and Starch Casein Agar (SCA). Actinomycetes can grow Pale, shiny and whitish colonies of actinomycetes species grow on the particular media.But in nutrient agar colonies pigmentation converted into light yellowcolour colonies with a chalky powdery white aerial mycelium and spore of mycelium are grow into hyphae **[11].**

Life cycle of actinomycetes:

Life cycle occur in to two different phases occur in spore forming actinomycetes. First is substratum mycelium and second is aerial mycelium. The substratum mycelium mentioned as primary mycelium which are develops the spores.The secondary mycelium mentioned as 'initial cell'.When the secondarymycelium forming the spores than again involving in particular structural changes and take place.The life cycle of the actinomycetesis described under the subsequent headings:

a. The first mycelium

b. The origin of the initial cells

c. The secondary mycelium

d. The formation of the spores [12].

Classification of actinomycetes:

The classification of actinomycetes classified basedon their morphological characteristics such as aerial mycelium, substrate mycelium, spores and sporangium. Based on their morphology of actinomycetes grouped into: *Mycobacteriaceae, Micromonosporaceae, Actinomycetales, Actinomycetaceae, streptomyces, nocardia etc* **[13]**.

1. *Mycobacteriaceae*: This species forming mycelium and growth as rod shaped branching and species multiply by division and bud formation occurs **[14]**.

2. *Micromonosporaceae*: This species well develops and non-septated mycelium and 0.3-0.6in diameter and not forming aerial mycelium. Conidia produces singly at cease of conidiophores onthe floor of substrate mycelium. Conidiophores areforming in branching or produces inclusters **[13]**.

3. *Actinomycetales*. Organisms forming elongated and commonly filamentous cells with particular tendency to branching hyphae now no longer exceeding 1.5 in diameter.The spores fragmentation of the plasma withinside the spore-bearing hyphae, the latter being spiral-shaped **[13]**.

4. *Streptomyces:* This species is non fragmented hyphae, with aerial myceliumand their spores remains conidia as chain formation **[14]**.

5. *Nocardia*: This species is specifically aerobic and branched filamentous they are forming branching substrate and forming aerial mycelium **[13]**.

6. *Actinomycetaceae*: This species is non septate and well-developed mycelium with

branching hyphae. This species multiply by the spores developed **[14]**.

Antimicrobial activity of actinomycetes:

Recently studies are focusing on the response of antimicrobial activity against microorganisms. *streptomyces* and *Nocardia are*bestspecies which mayproduce different types of bioactive compounds with antioxidant, anti-tumour, anti-inflammatory and antioxidant properties. This Antioxidants play main role in microorganisms defenceagainsthuman body less or high infection **[15]**. Well known bioactive compounds inhibit the growth of microorganisms. Gram positive and Gram-negative microorganisms are considered as test microorganisms in the antimicrobial activity of screenings and widely used test microorganisms were *Bacillus subtilis, Bacillus cereus, Staphylococcus aureus, Micrococcus luteus, Escherichia coli, Pseudomonas aeruginosa and Saccharomyces cerevisiaeetc* **[16]**.

Enzymes present in actinomycetes spp:

1. Proteases: Proteases produces from the Actinomycetes species Streptomyces and Nocardia. Proteases enzyme commonly uses in industrial wastes like feathers, nails, hair and plant wastes. Actinomycetes are produces very important industrial proteases enzymes are used in leather, textile, detergent and brewery industry etc **[17]**.

2. Agarases: Agarase enzyme produces from the species *Streptomyces*. Agarase enzyme able to use for beverages, bread, and a few low-calorie meals production. Japanese use agar-oligosaccharide as a moisturizing beauty additive, and it additionally has true hair conditioning effects **[18]**.

3. Amylase: Amylases enzyme arevery important group of enzymesand amylasehydrolyse starch into fructose, glucose and maltose and amylase enzyme divided into endoamylases and exoamylases. These amylase enzymes mostly used in baking, medicinal pharmaceutical and paper-pulp industries. Amylase from some alkaliphilic actinomycetesalso used in detergent formulation to improve the detergency of the compounds. Amylases from *Streptomyces* spp. play major important role in biotechnological and industries **[17]**.

Antibiotic producers actinomycetes:

Actinomycetes are well knownspecies for producingnovel antibiotics.Bioactive compounds areisolated from the actinomycetes species. *Streptomyces* spp is *most* abundant group of actinomycetes producing novel antibiotics. Actinomycetes are produces bioactive compounds areused in the clinical ways and thatBioactive compounds are β-lactams, tetracyclines, aminoglycosides and glycopeptides **[19]**. Approximately 100 antibiotics have been

economically usedto cure human infection. streptomyces spp are most abundant group development more than 60% antibiotics, but 15% are made from the species Actinomycetes, Actinomadura, Micromonospora etc. After research first antibiotic streptomycin is used produced through *Streptomycin griseusb spp* **[20]**. Some antibiotics such as penicillin, erythromycin, and methicillin very effective against infections causes microorganisms **[21]**.

Importance of actinomycetes:

Actinomycetes importance in several field like agricultural field, pharmaceutical field and different industrial field. Actinomycetes are currently used in biopolymers, biodegradation and biosurfactants. Some valuable enzymes produced from the actinomycetes different species processing food and catalyst act as biosynthetic process **[22]**.

CONCLUSION

Actinomycetes plays role in cycling of organic matter. Actinomycetes are the potential sources of enzymes, therapeutic compounds and other chemicals. Recent findings actinomycetes aredevelop variousbioactive compounds those act as therapeutic agent against various human infection and these agents are used in antibiotics production. This study concluded that actinomycetes are good source of the production of various bioactive compounds and antibiotics which reacts against the various toxic molecules and pathogenic microorganisms.

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