



***PSEUDOMONAS PUTIDA*-A GLOBAL PRODUCER OF BIOSYNTHETIC
POLYMERS**

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ABSTRACT

Pseudomonas putida is a gram-negative microscopic bacterium formally found in the mid of 1900's. It assumes a vital part in the decay that drives the carbon cycle. *Pseudomonas putida* can breakdown every kind of aliphatic and aromatic hydrocarbons. It is also capable of changing over styrene oil into the biodegradable plastics such as PHA. In addition, alginates, terpenoids, polyketides and numerous intermediates can also be obtained from this bacterium.

Keywords: Biocontrol; Biodegradability; Intermediates; Copolymers; Cis cis-muconic acid

INTRODUCTION

The utilization of *Pseudomonas putida* has developed throughout the course of recent years and has demonstrated to be incredible bacterial host to deliver mass synthetic, polymers, high priced novel products and medications [1, 2]. This microorganism is likewise utilized in bioremediation as biocontrol agent [3].

Some novel products fabricated by *Pseudomonas putida* are given below:

POLYHYDROXYALKANOATES

Pseudomonas putida normally produce endopolymeric mcl-PHAs as a carbon containing energy rich molecule under controlled conditions during nutrient impediment as carbon overabundance [4]. This group of PHA polyesters is one of the most amazing products produces in *Pseudomonas* species [5]. PHAs offer an environmentally friendly alternative for fossil fuel-based plastics, because of their biodegradability and competitive material properties, like biocompatibility, non-toxicity, insolubility, and thermostability [6, 7]. The primary structural organization of PHAs can be changed by optimization reaction conditions, precursor concentration, and strain modification [8, 9]. *Pseudomonas putida* can deliver mcl-PHAs by utilizing different carbon sources, inexhaustible

feedstocks, similar to crude glycerol from biodiesel production, unsaturated fats from plants, food waste and, surprisingly, nondegradable plastic waste [10, 11]. This co-production of significant bioproducts from low-cost substrates alongside PHA addresses a decent chance to diminish the generally PHA production costs [12, 13]. Alongside downstream handling and product recuperation is a significant step for the modern synthesis of intracellular components, which should be addressed to make the modern application useful [14]. A portion of the standard strategies incorporate dissolvable extraction and substance processing [15]. Nonetheless, these techniques are additionally set apart with ecological disadvantages, significant expenses, or debasement of the polymer [16, 17].

ALGINATES

Pseudomonas putida can also produce exopolymeric alginates under dehydration conditions [18]. Alginate is a typical used as an additive in beauty care products and food varieties [19]. Up to now, alginate synthesis has been mostly studied in the pathogenic *Pseudomonas putida* and there has been no business application related to these endeavors [20].

CIS CIS-MUCONIC ACID

The variety of oxidoreductases, mono- and dioxygenases encoded in the genome of *Pseudomonas putida* empowers this bacterium to degrade different aromatic compounds found in sustainable lignin feedstock [21]. The aromatics are diverted through catabolic routes by means of β -keto adipate pathway connecting up in a couple of intermediates i.e., catechol, protocatechuate (PCA), which are cleaved and afterward transformed into TCA cycle intermediates [22, 23]. One intermediate of this pathway, cis cis-muconic acid (MA), is utilized as a beginning material for the synthesis of caprolactam, terephthalic and adipic acid, as well as a mass compound in polymer fabrication for the development of muconic homo- and copolymers [24]. Upon disturbance in the degradation route at muconate cycloisomerase level, a stoichiometric change of sweet-smelling substrates into MA is accomplished [25]. Accordingly, improvement of MA productivity from aromatics of the PCA branch was accomplished by expanding PCA decarboxylase activity by co-articulation of proteins ecdBD [26]. In addition, hydroxymethyl furfuraldehyde can be likewise obtained from mono- and polysaccharides and pre-treated biomass ,

further reactant oxidation of HMF yields the structure block 2,5-furandicarboxylic acid (FDCA), which has expected applications in the creation of plasticizers, polyamides, and polyesters [27, 28]. Another polymer of interest is polyethylene furanoate (PEF), a copolymer of ethylene glycol and FDCA, which addresses an ideal substituent for polyethylene terephthalate (PET) in bundling, because of its excellent warm and unrivalled resistance properties [29, 30]. It additionally acts as precursor for poly(1,4-cyclohexanedimethylene furandi carboxylate) (PCF) [31].

BIOSURFACTANTS

Rhamnolipids are biodegradable and less harmful biosurfactants [32]. Biosurfactants upgrades the solvency of hydrophobic atoms in water by diminishing its surface pressure [33]. Principal applications can be tracked down in food industry, beauty care products, cleaning additives, biocontrol, and soil remediation [34, 35]. *Pseudomonas putida* produces short-chain rhamnolipids after joining of the rhlAB(C) operon from *Pseudomonas aeruginosa* and long-chain rhamnolipids after articulation of rhl qualities from *Burkholderia glumae* [36]. The chain length relies upon rhl genes rather than availability of unsaturated fats, this

property can be utilized for the development of tailor-made rhamnolipids [37].

TERPENOIDS

High resilience of *Pseudomonas putida* against the toxicity of intermediates has shown to be profitable to synthesize terpenoids [38]. The effective synthesis of geranic acid, a monoterpenoid with anti-microbial characteristics is used as a flavouring agent [39]. Additionally, one more class of terpenoids, the carotenoids zeaxanthin and β -carotene, has been effectively produced in *Pseudomonas putida* [40].

POLYKETIDES AND NON-RIBOSOMAL PEPTIDES

The polyketides (PKs) and non-ribosomal peptides (NRPs) have medicinally applicable uses [41]. Both the products are gathered by build-up of straightforward carboxylic or amino acid structural blocks [42]. The PKs 2,4-diacetylphloroglucinol and the UV-defensive color flaviolin are effectively produced in *Pseudomonas putida* [43]. In addition, a fascinating PK/NRP half breed compound is the anti-microbial called prodigiosin, because of its anticancer and immunosuppressant properties [44].

CONCLUSION

Thus, *Pseudomonas putida* produces a number of distinct polymers, copolymers

and intermediates that offers vast industrial application

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