# *Pseudomonas aeruginosa* in Industries

**Nida Tabassum Khan***

*Department of Biotechnology, Faculty of Life Sciences & Informatics, Baluchistan University of Information Technology, Engineering and Management Sciences, Takatu Campus, Airport Road, Quetta, Baluchistan, Pakistan*

*Corresponding Author**

*Nida Tabassum Khan*

*Department of Biotechnology,*

*Faculty of Life Sciences & Informatics,*

*Baluchistan University of Information*

*Technology, Engineering and Management*

*Sciences,*

*Takatu Campus, Airport Road,*

*Quetta, Baluchistan, Pakistan*

*E-mail: nidatabassumkhan@yahoo.com*



**Received:** 01-Aug-2022; Manuscript No. JPSDD-22-70865; **Editor assigned:** 03-Aug-2022, Pre QC No. JPSDD-22-70865 (PQ); **Reviewed:** 08-Aug-2022, QC No JPSDD-22-70865 (Q); **Revised:** 10-Aug-2022, Manuscript No. JPSDD-22-70865 (R); **Published:** 20-August-2022, doi: 10.37532/jpsdd.22.4.2.1-2

## Abstract

*Pseudomonas aeruginosa* is a Gram-negative is a bacterium of the *Pseudomonadaceae* family (an individual from the Gamma proteobacteria). It is ordinarily isolated from soil and water as well as in plants and humans. Pseudomonas microscopic organisms are accepted to be a very rare example of genuine microbes for plants. Critically, *Pseudomonas aeruginosa* are known as opportunistic human pathogens however numerous industrial products including Rhamnolipids, Vanillin etc. are also synthesize by these species.

**Keywords:** Rhamnolipids • Vanillin • Bioremediation • Opportunistic • Monoflagellated

## Introduction

A monoflagellated gram-negative rod-shaped bacterium that is known to human as an opportunistic pathogen [1]. *Pseudomonas aeruginosa* is of great clinical significance since it is a multidrug resistant microbe perceived for its presence in any sort of environment [2]. *Pseudomonas aeruginosa* rhamnolipids, glycolipidic surface-dynamic molecules which have potential biotechnological applications [3, 4]. Rhamnolipids are produced by *Pseudomonas aeruginosa* in biosynthetic pathway and exhibits metabolic connections with various bacterial secretes including alginate, lipopolysaccharide, polyhydroxyalkanoates, and 4-Hydroxy-2-Alkylquinolines (HAQs) [5,6]. *Pseudomonas aeruginosa* secretes an exopolysaccharide called alginate that provide protection to the microbes in difficult environmental conditions and furthermore improves its adhesion to strong surfaces [7,8]. Alginate biosynthetic gene is incited upon connection to the base surface and this prompt expanded alginate synthesis [9]. Subsequently, biofilms which are beneficial to the endurance and development of the microorganisms is formed [10, 11]. Moreover, versatile anti-toxin resistance of *Pseudomonas aeruginosa* incorporates biofilm-interceded resistance and development of multidrug-tolerant persistent cells for recalcitrance and relapse of infections [12, 13]. *Pseudomonas aeruginosa* plays an important in biotechnology-based applications some of which are as follows:

It is broadly utilized as a model organism because of its wide metabolic adaptability that it is generally used to study biotechnological applications [14].

*Pseudomonas aeruginosa* is utilized for the investigation of antibiotic resistance and pathogenesis [15]. It produces an enormous number of compounds with bacteriostatic or bacteriocidic properties, these compounds are significant in the control of various Multi Drug Resistance (MDR) [16, 17]. For example, carbapenems producing *Klebsiella pneumoniae* and methicillin resistant *Staphylococcus aureus* [18].

- *Pseudomonas aeruginosa* plays a significant role in the bioremediation of heavy metals like lead, copper, cadmium and chromium since metals are straightforwardly and by implication engaged with all parts of microbial development [19]. Different *Pseudomonas aeruginosa* strains can biodegrade countless toxic compounds that are recalcitrant to other bacterial species, subsequently delivering auxiliary metabolites and biopolymers, making these strains helpful in medication and industries [20, 21].
- *Pseudomonas aeruginosa* has valuable purposes in different modern applications and industrial sectors as these bacteria incorporates the ability to biodegrade waste, petroleum processing derived from plants, agribusiness, mash and paper, mining etc. [22, 23]. They can also be used in commercial and household drain cleaners and degreasers, septic tank additives, general cleaning products, and odour control products [24, 25].
- Various strain of *Pseudomonas aeruginosa* has been recognized as micro factories for the biosynthesis of useful substances [26]. Some of these products are given below:
- Vanillin: Recent studies reported that *Pseudomonas aeruginosa* ISPC2 strain produces vanillin through microbial biotransformation utilizing isoeugenol as a precursor molecule [27].
- Rhamnolipids: It has been shown that rhamnolipids can be investigated to control and disrupt the formation of bacterial biofilms mainly of food-borne microbes [28].
- Protease: Proteolytic enzymes are to a great extent tracked down in every single living creature and are vital for the development of cells [29]. *Pseudomonas aeruginosa* releases extracellular protease utilizing maltose as a significant carbon source [30].
- Lipase: *Pseudomonas aeruginosa* are one of the most amazing producers of lipase catalyst which have shown extraordinary potential concerning their application in various industrial enterprises [31].
- Biopigments: The different kinds of pigments produced by *Pseudomonas aeruginosa* are to a great extent classed under the synthetic name of phenazines [32]. Phenazine compounds are of good biotechnological value [33].

## Conclusion

Thus, *Pseudomonas aeruginosa* have been widely implicated as clinical pathogens but it is also offering numerous biotechnological benefits.

## References

1. Wu, W., et al., "*Pseudomonas aeruginosa*." *In Mol. med. microbiol.* (2015): 753-767. Academic Press.
2. Strateva, T., & Yordanov, D., "*Pseudomonas aeruginosa*–a phenomenon of bacterial resistance." *J. med. microbiol.* 58.9(2009): 1133-1148.
3. Jarvis, F. G., & Johnson, M. J., "A glyco-lipide produced by *Pseudomonas aeruginosa*." *J. Am. Chem. Soc.* 71.12(1949): 4124-4126.
4. Kerr, K., & Snelling, A., "*Pseudomonas aeruginosa*: a formidable and ever-present adversary." *J. Hosp. Infect.*, 73.4(2009): 338-344.
5. Mata-Sandoval, J., et al., "High-performance liquid chromatography method for the characterization of rhamnolipid mixtures produced by *Pseudomonas aeruginosa* UG2 on corn oil." *J. Chromatogr. A.* 864.2(1999), 211-220.

6. Rahman, K., et al.,"Rhamnolipid biosurfactant production by strains of *Pseudomonas aeruginosa* using lowcost raw materials." *Biotechnol. Prog.* 18.6(2002): 1277-1281.

7. Stapper, A., et al., "Alginate production affects *Pseudomonas aeruginosa* biofilm development and architecture, but is not essential for biofilm formation." *J. med. microbiol.* 53.7(2004), 679-690.

8. Fyfe, J. A., & Govan, J. R. "Alginate synthesis in mucoid *Pseudomonas aeruginosa*: a chromosomal locus involved in control." *Microbiology* 119.2(1980): 443-450.

9. Boyd, A., & Chakrabarty, A. "*Pseudomonas aeruginosa* biofilms: role of the alginate exopolysaccharide." *J. ind. microbiol. biotechnol.* 15.3(1995), 162-168.

10. Nagino, K., & Kobayashi, H., "Influence of macrolides on mucoid alginate biosynthetic enzyme from *Pseudomonas aeruginosa*." *Clin. Microbiol. Infect.* 3.4(1997): 432-439.

11. Ghafoor, A., et al., "*Role of exopolysaccharides in Pseudomonas aeruginosa* biofilm formation and architecture." *Appl. environ. microbiol.* 77.15(2011): 5238-5246.

12. Valentine, M. et al., "Generation of a highly attenuated strain of *Pseudomonas aeruginosa* for commercial production of alginate." *Microb. biotechnol* 13.1(2020): 162-175.

13. Franklin, M., et al., "Biosynthesis of the Pseudomonas aeruginosa extracellular polysaccharides, alginate Pel, and Psl." *Front. microbiol.*2.167(2011)

14. Breidenstein, E., et al., "*Pseudomonas aeruginosa*: all roads lead to resistance." *Trends microbial*. 19.8(2011): 419-426.

15. Aloush, V., et al., "Multidrug-resistant *Pseudomonas aeruginosa:* risk factors and clinical impact." *Antimicrob. agents chemother.* 50.1(2006), 43-48.

16. Bonomo, R., & Szabo, D., "Mechanisms of multidrug resistance in Acinetobacter species and *Pseudomonas aeruginosa*." *Clin. infect. dis.* 43.Supplement_2 (2006): S49-S56.

17. Porras Gomez, M., et al., "Overview of multidrug-resistant *Pseudomonas aeruginosa* and novel therapeutic approaches." *J. Biomater. Nanobiotechnology* 3(2012): 519-527.

18. Lomovskaya, O., et al., "Identification and characterization of inhibitors of multidrug resistance efflux pumps in *Pseudomonas aeruginosa:* novel agents for combination therapy." *Antimicrob. agents chemother.* 45.1(2001), 105-116.

19. Chellaiah, E. R. "Cadmium (heavy metals) bioremediation by *Pseudomonas aeruginosa:* a minireview." *Appl. water sci.* 8.6 (2018), 1-10.

20. Karamalidis, A., et al., "Laboratory scale bioremediation of petroleum-contaminated soil by indigenous microorganisms and added *Pseudomonas aeruginosa* strain Spet." *Bioresour. technol.* 101.16(2010), 6545-6552.

21. O'Brien, S., et al., "Social evolution of toxic metal bioremediation in Pseudomonas aeruginosa." *Proc. R. Soc. B: Biol. Sci.* 281.1787(2014): 20140858.

22. Thavasi, R., et al., "Biosurfactant production by *Pseudomonas aeruginosa* from renewable resources." *Indian j. microbiol.* 51.1(2011): 30-36.

23. Lakshmanan, R., et al., "Identification and characterization of *Pseudomonas aeruginosa* derived bacteriocin for industrial applications." *Int. J. Biol. Macromol.* 165 (2020): 2412-2418.

24. Zhao, F., et al., "Enhanced production of mono-rhamnolipid in *Pseudomonas aeruginosa* and application potential in agriculture and petroleum industry." *Bioresour. Technol.*, 323(2021): 124605.

25. Perfumo, A., et al., "Rhamnolipid production by a novel thermophilic hydrocarbon-degrading *Pseudomonas aeruginosa* AP02-1." *Appl. microbiol. biotechnol.* 72.1(2006): 132-138.

26. Chandrashekar, V., et al., "Assessment of acrylamide degradation potential of *Pseudomonas aeruginosa* BAC-6 isolated from industrial effluent." *Appl. biochem. biotechnol.* 173.5(2014): 1135-1144.

27. Ashengroph, M., et al., "Use of growing cells of *Pseudomonas aeruginosa* for synthesis of the natural vanillin via conversion of isoeugenol." *Iran. J. Pharm. Res.: IJPR* 10.4(2011); 749.

28. Soberon-Chavez, et al., "Production of rhamnolipids by *Pseudomonas aeruginosa." Appl. microbiol. biotechnol.* 68.6(2005): 718-725.

29. Engel, L. et al., "Protease IV, a unique extracellular protease and virulence factor from Pseudomonas aeruginosa." *J. Biol. Chem.* 273.27(1998): 16792-16797.

30. Sokol, P., et al., "A more sensitive plate assay for detection of protease production by Pseudomonas aeruginosa." *J. clin. microbiol.* 9.4(1979): 538-540.

31. Kathiravan, T., et al., "Studies on nutritional requirements of *Pseudomonas aeruginosa* for lipase production." *Adv Appl Sci Res* 3.19(2012): 591-598.

32. Wilson, R., et al., "Measurement of *Pseudomonas aeruginosa* phenazine pigments in sputum and assessment of their contribution to sputum sol toxicity for respiratory epithelium." *Infect. immun.* 56.9(1988): 2515-2517.

33. Chang, P., & Blackwood, A., "Simultaneous production of three phenazine pigments by *Pseudomonas aeruginosa* Mac 436." *Can. J. Microbiol.* 15.5(1969): 439-444.


**Cite this article:** Khan NT. *Pseudomonas aeruginosa* in Industries. J Pharmac Sci Drug Dev. 2022, 4(2), 001-002