Rapid Detection of Phenol Constituents from Industrial Effluents Using Microbial Tyrosinase and Nanoparticles

Bi Bi Zainab*¹ and Dayanand Agsar²

¹Department of Microbiology, Jouf University, KSA

²A-DBT Research Laboratory, Gulbarga University, India

*Corresponding author: Bi Bi Zainab Mazhari, Department of Microbiology, Jouf University, KSA

ARTICLE INFO

Received: March 18, 2019

Published: March 29, 2019

ABSTRACT

Citation: Bi Bi Zainab, Dayanand Agsar. Rapid Detection of Phenol Constituents from Industrial Effluents Using Microbial Tyrosinase and Nanoparticles. Biomed J Sci & Tech Res 16(4)-2019. BJSTR. MS.ID.002874.

Opinion

Environmental sensors are gaining importance because of ever-growing environmental concerns and their ability to provide rapid information on detection of toxic compounds especially phenols [1]. In particular, there is a great need for synthesis of systems for analysis and detection of phenolic compounds. Phenols are found in waste water of large number of industries [2]. Phenol and its derivatives which are carcinogenic and toxic, even at low concentrations are important pollutants [3]. Hence the development of analytical methods for determination and monitoring of phenols is necessity. In this context, enzymes are used for fast detection and screening of phenols. Among enzymes, tyrosinase is used for the detection of phenolic compounds and attracting great interest for fast and simple detection of phenols [4]. Tyrosinase is one of the metallic coppers containing protein and part of polyphenol oxidases and classified as monophenol, o-diphenol oxidoreductase with EC; 1.14.18.1. Its catalysis oxidation of phenols to ortho-quinones, both in the presence of molecular oxygen [5,6]. These enzymes are widely distributed in nature (mammals, plants, bacteria, fungi and actinomycetes) [7]. Various spectrometric and chromatographic methods are in common use for phenol determination. Thus, biological active compound *Streptomyces* tyrosinase for phenol detection is the innovative idea to prevent the use of conventional methods [8,9]. The advantage of using enzymes as biological element for detection of phenols is it can bind to the substrate with great specificity and high selectivity [10,11]. The highest production of tyrosinase was achieved by *Streptomyces*

[12-15]. Thus this tyrosinase was used for the detection of phenols. Effect of pH and temperature on the detection process was also analyzed [16,17]. Phenolic solutions such as synthetic wastewater containing catechol, pyrogallol, resorcinol, P-nitrophenol were treated with tyrosinase at different concentration [18]. The total phenol assay was calorimetrically determined using 4-AAP method. The literature for detecting phenol using other enzymes takes 2hr, whereas this enzyme detects the phenol with 10mins [19,20]. This proves the potentiality of *Streptomyces* tyrosinase enzyme for detecting phenols.

References

1. F Naghibi, F Pourmorad, S Honary, M Shamsi (2003) Decontamination of water polluted with phenol using *Raphanussativus* Root. Iranian Journal of Pharmaceutical Research 2(1): 29-32.
2. C Hansch, S Mc Carns, C Smith, D Dodittle (2000) Comparative QSAR evidence for a free-radical mechanism of phenol-induced toxicity. Chem Biol Interact 127(1): 61-72.
3. M Laine, NK Jorgense (1996) Straw compost and bioremediated soil as inocula for the bioremediation of chlorophenol contaminated soil. Appl Environ Microbiol 62(5): 1507-1513.
4. VM Daskalaki, Z Frontistis, D Mantzavinos, A Katsaounis (2011) Solar light-induced degradation of bisphenol-A with TiO₂ immobilized on Ti. Catalysis Today 161(1): 110-114.
5. KP Lisha, Anshup, T Pradeep (2009) Enhanced visual detection of pesticides using gold nanoparticles. J Env Sci Health Pesticides Food contaminants and agricultural wastes 44(7): 697-705.
6. Keisuke Ikehata, A James Nicell (2009) Color and toxicity removal following Tyrosinase-Catalyzed Oxidation of Phenols. Biotechnology Progress 16(4): 533-540.

7. M El Shora, Hamed, Metwally (2008) Use of tyrosinase enzyme from *Bacillus thuringiensis* for the decontamination of water polluted with phenols. *J Biotechnology* 7(2): 305-310.
8. E Selinheimo, C Gasparetti, M Mattinen, CL Steffensen, J Buchert, et al. (2009) Comparison of substrate specificity of tyrosinases from *Trichoderma reesei* and *Agaricus bisporus*. *Enzyme Microbial Technol* 44(1): 1-10.
9. M Beatriz Serra, Dolores Morales, A Jinbiao Zhang, Julio Reviejo, H Elizabeth Hall, et al. (2005) In-a-Day Electrochemical Detection of Coliforms in Drinking Water Using a Tyrosinase Composite Biosensor. *Anal Chem* 77(24): 8115-8121.
10. DG Mita, A Attanasio, F Arduini, N Diano, V Grano, et al. (2007) Enzymatic determination of BPA by means of tyrosinase immobilized on different carbon carriers. *Biosens Bioelectron* 23(1): 60-65.
11. S Chen, J Huang, D Du, J Li, H Tu, et al. (2011) Methyl Parathion Hydrolase Based Nanocomposite Biosensors for Highly Sensitive and Selective Determination of Methyl Parathion. *Biosensors and Bioelectronics* 26(11): 4320-4325.
12. M Xia, C Chen, M Long, C Chen, W Cai et al. (2011) Magnetically separable mesoporous silica nanocomposite and its application in Fenton catalysis. *Micropor Mesopor Mater* 145(1-3): 217-223.
13. CC You, A Verma, VM Rotello (2011) Engineering the nanoparticles-biomacromolecule interface. *Soft Matter* 2: 190-204.
14. O Kreft, M Prevot, H Mohwald, G Sukhorukov (2007) Shell-in-shell microcapsules: A novel tool for integrated, spatially confined enzymatic reactions. *Angew Chem Int Ed* 46(29): 5605-5608.
15. SJ Ramiz, Alkasir, Maryna Ornatska, SilvanaAndreeescu (2012) Colorimetric Paper Bioassay for the Detection of Phenolic Compounds. *Anal Chem* 84(22): 9729-9737.
16. GY Kim, MS Kang, J Shim, SH Moon (2008) Substrate bound tyrosinase electrode using gold nanoparticles to pyrroloquinoline quinone for a pesticide biosensor. *Sens Actuators B Chem* 133(1): 1-4.
17. GY Kim, J Shim, MS Kang, SH Moon (2008) Preparation of a highly sensitive enzyme electrode using gold nanoparticles for measurement of pesticides at the ppt level. *J Environ Monitor* 10(5): 632-637.
18. GY Kim, J Shim, MS Kang, SH Moon (2008) Optimized coverage of gold nanoparticles at tyrosinase electrode for measurement of a pesticide in various water samples. *J Hazard Mater* 156(1-3): 141-147.
19. JC Vidal, S Esteban, J Gil, JR Castillo (2006) A comparative study of immobilization methods of a tyrosinase enzyme on electrodes and their application to the detection of dichlorvos organophosphorus insecticide. *Talanta* 68(3): 791-799.
20. Bi Zainab Mazhari, Dayanand Agsar, MVN Ambika Prasad (2017) Development of paper biosensor for the detection of phenol from industrial effluents using bioconjugate of Tyr-AuNps mediated by novel isolate *Streptomyces tuius* DBZ39. *Journal of nanomaterials*.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2019.16.002874

Bi Bi Zainab Mazhari. Biomed J Sci & Tech Res

This work is licensed under Creative Commons Attribution 4.0 License

Submission Link: <https://biomedres.us/submit-manuscript.php>

Assets of Publishing with us

- Global archiving of articles
- Immediate, unrestricted online access
- Rigorous Peer Review Process
- Authors Retain Copyrights
- Unique DOI for all articles

<https://biomedres.us/>