

[Home](#) > [Journal](#) > [Biomedical & Life Sciences](#) | [Medicine & Healthcare](#) > [AIM](#)[Indexing](#) [View Papers](#) [Aims & Scope](#) [Editorial Board](#) [Guideline](#) [Article Processing Charges](#)[AiM](#) > Vol.2 No.4, December 2012

OPEN ACCESS

## *In-Situ* Biostimulatory Effect of Selected Organic Wastes on Bacterial Atrazine Biodegradation

PDF (Size: 261KB) PP. 587-592 DOI: 10.4236/aim.2012.24076

### Author(s)

Ahmed Faruk Umar, Fatimah Tahir, Michael Larkin, Olubukola Mojisola Oyawoye, Balarabe Lawal Musa, Mohammed Bello Yerima, Ediga Bede Agbo

### ABSTRACT

The biostimulatory effect of selected organic wastes on bacterial biodegradation of atrazine (2-chloro-4-ethylamino-6-isopropylamino-1,3,5-triazine) in three agricultural soils in Bauchi state, Nigeria, was carried out. The soil physico-chemical characteristics were investigated to further understand the environmental conditions of the sampling sites. Enrichment technique was used to isolate the atrazine-degrading strains. Mineralization studies were carried out to determine atrazine biodegradation potentials of strains. Polymerase Chain Reaction (PCR) amplification of total nucleic acid of strains revealed several bacterial species based on nucleotide sequence analyses. Biostimulatory effect of selected organic wastes carried out showed minimal to average extent of biodegradation. The highest mean values, in CFU/mL, increase in biomass was recorded in *Pseudomonas* sp for both Cow dung 16.76 (42.03%) and Chicken droppings 12.32 (38.46%). However, biostimulatory effect using consortia provided more promising results, with 41.51% and 42.08% in Cow dung and Chicken droppings, biomass increase, respectively, in studies conducted. This proves that competition, survival of inoculums, bioavailability of organic amendments and nature of chemical are important factors affecting bioremediation.

### KEYWORDS

Biostimulation; Biodegradation; Bioremediation; Mineralization; Atrazine

### Cite this paper

A. Faruk Umar, F. Tahir, M. Larkin, O. Mojisola Oyawoye, B. Lawal Musa, M. Bello Yerima and E. Bede Agbo, "In-Situ Biostimulatory Effect of Selected Organic Wastes on Bacterial Atrazine Biodegradation," *Advances in Microbiology*, Vol. 2 No. 4, 2012, pp. 587-592. doi: 10.4236/aim.2012.24076.

### References

- [1] ATSDR, "Agency for Toxic Substances and Disease Registry: Toxicological Fact for Atrazine," Mailstop Atlanta, Georgia, 2004, pp. 4-9.
- [2] I. E. Adieze, R. N. Nwabueze and G. O. C. Onyeze, "Effect of Poultry Manure on the Microbial Utilization of Hydrocarbon in Oil Polluted Soil," *Nigerian Journal of Microbiology*, Vol. 17, No. 1, 2003, pp. 12-16.
- [3] R. D. Fletcher, "Bioremediation of Aviation Oil Spill: An Environmental Alternative," *Journal Industrial Microbial*, Vol. 7, No. 1, 2002, pp. 28-111.
- [4] R. M. Atlas and R. Bartha, "Stimulated Biodegradation of Oil Slicks Using Leophillic Fertilizer," *Environmental Science Technology*, Vol. 7, 1981, pp. 538-541 doi:10.1021/es60078a005
- [5] G. C. Opkokwasili and W. A. James, "Microbiol Contamination of Kerosene, Gasoline and Crude Oil and Their Spoilage Potential," *Nigerian Journal of Microbiology*, Vol. 29, 1995, pp. 147-156.
- [6] R. T. Mandelbaum, D. L. Allan and L. P. Wackett, "Isolation and Characterization of a *Pseudomonas* sp. That Mineralizes the S-Triazine Herbicide Atrazine," *Journal Applied and Environmental Microbiology*, American Society for Microbiology, Vol. 61, No. 4, 1995, pp. 1451-1457.

[AiM Subscription](#)[Most popular papers in AiM](#)[About AiM News](#)[Frequently Asked Questions](#)[Recommend to Peers](#)[Recommend to Library](#)[Contact Us](#)

Downloads: 20,828

Visits: 116,054

[Sponsors >>](#)

- [7] N. Udikovic, D. Hrsak, G. Mendas and D. Filipic, " Enrichment and Characterization of Atrazine Degrading Bacterial Communities," *Food Technology and Biotechnology*, Vol. 41, No. 3, 2003, pp. 211-217.
- [8] R. I. Griffith, A. S. Whiteley, A. G. O' Donnell and M. J. Bailey, " Rapid Method for Co-Extraction of DNA and RNA from Natural Environments for Analysis of Ribosomal DNA and rRNA-Based Microbial Community Composition," *Applied Environmental Microbiology*, American Society of Microbiology, Vol. 66, No. 12, 2000, pp. 5488-5491.
- [9] A. L. Davidson, " *Soil Chemical Analysis*," Prentice Hall, New York, 1955, pp. 44-48.
- [10] R. H. Bray, " Determination of Total Organic and Available Forms of Phosphorus in Soil," *Soil Science*, Vol. 59, 1965, pp. 39-45. doi:10.1097/00010694-194501000-00006
- [11] C. A. Black, " *Methods of Soil Analysis*," American Society of Agronomy, Vol. 9, No. 2, 1965, pp. 12-15.
- [12] A. Wakley and I. A. Black, " An Examination of the Method for Determining Soil Organic Matter and Proposed Modification of the Acid Titration Method," *Journal of Soil Science*, Vol. 37, 1965, pp. 29-38.
- [13] M. N. P. F. S. Couto, E. Monteiro and M. T. S. D. Vasconceles, " Mesocosm Trials of Bioremediation of Contaminated Soil of a Petroleum Refinery: Comparison of Natural Attenuation, Biostimulation and Bioaugmentation," *Environmental Science and Pollution Research*, Vol. 17, No. 7, 2010, pp. 1339-1346. doi:10.1007/s11356-010-0318-y
- [14] T. B. Moorman, J. K. Cowan, E. LArthur and J. R. Coats, " Organic Amendments to Enhance Herbicide Biodegradation in Contaminated Soils," *Biology and Fertility of Soil*, Vol. 33, No. 6, 2001, pp. 541-545.
- [15] G. M. Coleres, " Soil Organic Matter-Driven Selection of Atrazine-Degrading Microbial Population," 2005. <http://www.reis.usda.gov/webcrisprojectpages/195956>
- [16] R. M. Zablotowicz, M. A. Weaver and M. A. Locke, " Microbial Adaptation for Accelerated Atrazine Mineralization/Degradation in Missisipi Delta Soils," *Weed Science*, Vol. 54, 2006, pp. 538-554. doi:10.1614/WS-04-179R3.1
- [17] E. Barriouso and S. Houot, " Influence of Compost Addition to Soil on the Behavior of Herbicides," *Pesticides Science*, Vol. 4a, No. 1, 1996, pp. 665-757.
- [18] F. Martin-Laurent, L. Cornet, L. Ranjard, J. C. Lopez- Gutierrez, L. Phillipport, C. Schwartz, C. Cartoux and G. Soulas, " Estimation of Atrazine-Degrading Genetic Potential and Activity in Three French Agricultural Soils," *FEMS Microbiology Ecology*, Vol. 48, No. 1, 2004, pp. 5425-5435.
- [19] M. Alexander, " *Introduction to Soil Microbiology*," 2nd Edition, John-Wiley and Sons, New York, 1984, pp. 281-299.
- [20] R. D. Rhin, J. J. Fuhrmann and M. Radosevich, " Microbial Community Response to Atrazine Exposure and Nutrient Availability: Linking Degradation Capacity to Community Structure," *Microbiology Ecology*, Vol. 46, 2003, pp. 145-160. doi:10.1007/s00248-002-1048-6
- [21] S. Houo, E. Barriouso and V. Bergheaud, " Modifications Atrazine Degradation Pathways in a Loamy Soil after Addition of Organic Amendments," *Soil Biology Biochemistry*, Vol. 30, 14, 2000, pp. 2147-2157.
- [22] M. Farhadian, C. Vachelard, D. Duchez and C. Larroche, " In Situ Bioremediation of Monoaromatic Pollutants in Groundwater: A Review," *Bioresource Technology*, Vol. 99, 2008, pp. 5296-5308. doi:10.1016/j.biortech.2007.10.025
- [23] A. K. Haritash and C. P. Kaushik, " Biodegradation Aspects of Polycyclic Aromatic Hydrocarbons (PAHs): A Review," *Journal of Hazardous Materials*, Vol. 169, 2009, pp. 1-15. doi:10.1016/j.jhazmat.2009.03.137
- [24] D. Dellile, E. Pelletier, A. Rodriguez-Blanco and J. F. Ghiaglione, " Effects of Nutrient and Temperature on Degradation of Petroleum Hydrocarbon in Sub-Artarctic Coastal Sea Water," *Polar Biology*, Vol. 32, 2009, pp. 1521-1528. doi:10.1007/s00300-009-0652-z
- [25] M. Nikolopoulou and N. Kalogeraski, " Biostimulation Strategies for Fresh and Chemically Polluted Marine Environments with Petroleum Hydrocarbon," *Journal of Chemical Technology & Biotechnology*, Vol. 84, No. 1, 2009, pp. 802-807.

- [26] G. B. Clausen, L. Larsen, K. Johnson, J. R. Liphay and J. de Aamand, " Quantification of the Atrazine-Degrading *Pseudomonas* sp Strain ADP in Aquifer Sediment by Quantitative Competitive Polymerase Chain Reaction," *FEMS Microbiology Ecology*, Vol. 41, 2002, pp. 211-229. doi:10.1111/j.1574-6941.2002.tb00983.x
- [27] V. Garcia Gonzalez, F. Gorantes, O. Porrua and E. Santero, " Regulation of the *Pseudomonas* sp Strain ADP Cyanuric Acid Degradation Operon," *Journal of Bacteriology*, Vol. 187, No. 1, 2003, pp. 155-167.