JEP> Vol.2 No.5, July 2011

OPEN ACCESS

Implications of Secondary Treated Distillery Effluent Irrigation on Soil Cellulase and Urease Activities

PDF (Size:462KB) PP. 655-661 DOI: 10.4236/jep.2011.25075

Author(s)

Devendra Mani Tripathi, Smriti Tripathi, B. D. Tripathi

ABSTRACT

Currently distillery effluents have attracted worldwide attention for their application in agricultural land. The present investigation deals with the effect of application of various dosages of distillery effluent irrigation on soil physicochemical, Cellulase and Urease activities in a tropical agricultural field. Experiment was designed in factorial model by using randomized block design. Soil cores were sampled from the selected pits of both polluted and non polluted (control) sites. Majority of soil physicochemical properties (e.g. silt, clay, electrical conductivity, organic matter, total nitrogen contents, cellulase and urease activities) were significantly higher in the samples from polluted site than the non polluted site just after 15 to 30 days of incubation. Although application of effluents at lower rate substantially increased the enzyme activities, the same decreased at high effluent concentration. Prolonged incubation period resulted in gradual suppression of enzyme activity in both polluted and nonpolluted soil samples. Thus, the present investigation suggest that with the passage of time substrate for enzyme activity decreases which in association with residual toxicity resulted in the reduced enzyme activity.

KEYWORDS

Distillery Effluent, Cellulase, Urease, BOD, COD, Electrical Conductivity

Cite this paper

D. Tripathi, S. Tripathi and B. Tripathi, "Implications of Secondary Treated Distillery Effluent Irrigation on Soil Cellulase and Urease Activities," *Journal of Environmental Protection*, Vol. 2 No. 5, 2011, pp. 655-661. doi: 10.4236/jep.2011.25075.

References

[1] A. Karaca, M. M. Haggblomb and R. L. Tate III, "Effects of the Land Application of Sewage Sludge on Soil Heavy Metal Concentrations and Soil Microbial Sewage Sludge and Soil Urease Activity 147 Communities," Soil Biology and Biochemistry, Vol. 31, 10, 1999, pp. 1467-1470. doi:10.1016/S0038-0717(99)00060-7

[2] A. E. Linkins, J. M. Mellio and R. L. Sinsabaugh, "Factors Affecting Cellulase Activity in Terrestrial and Aquatic Systems," American Society for Microbiology, Vol. 62, 1984, pp. 4693-4700.

[3] APHA, "Standard Methods for the Examination of Water and Waste Water," 21st Edition, American Public Health Association, Washington D.C., 2005.

[4] B. N. Richards, "The Microbiology of Terrestrial Ecosystems," Longman Scientific and Technical, Essex, 1987.

[5] B. P. Splading, "Effect of Divalent Metal Cations Respiration and Extractable Enzymes Activities of Douglas-Fir Needle Litter," Journal of Environmental Quality, Vol. 8, 1979, pp.105-109. doi:10.2134/jeq1979.81105x

[6] C. Aravena, C. Valentin, M. C. Diez, M. L. Mora and F. Gallardo, "Aplicación de lodos de planta de tratamiento de celulosa: efecto en algunas propiedades físicas y químicas de suelos volcánicos," Journal of Soil Science & Plant Nutrition, Vol. 7, 2007, pp. 1-14.

- Open Special Issues
- Published Special Issues
- Special Issues Guideline

JEP Subscription

Most popular papers in JEP

About JEP News

Frequently Asked Questions

Recommend to Peers

Recommend to Library

Contact Us

[7] C. Xiao, M. Fauci, D. F. Bezdicek, W. T. McKean and W. L. Pan, "Soil Microbial Responses to Potassium-Based Black Liquor from Straw Pulping," Soil Science Society of America Journal, Vol. 70, 2005, pp. 72-77. doi:10.2136/sssaj2004.0339

[8] D. R. Rowe and I. M. Abdel-Magid, "Hand Book of Wastewater Reclamation and Reuse," CRC Press Inc. 550, 1995.

[9] D. W. Nelson, L. E. Sommers, "Total Carbon, Organic and Organic Matter," In: D. L. Sparks, Ed., Methods of Soil Analysis, Part 3. Soil Science Society of America Book Series, American Society of Agronomy and Soil Science Society of America, Madison, Wisconsin, Vol. 5, 1996, pp. 961-1010.

[10] E. Johansson, G. Krantz-Rulcker, B. X. Zhang and G. Oberg, "Chlorination and Biodegradation of Lignin," Soil Biology and Biochemistry, Vol. 32, 7, 2000, pp. 1029- 1032. doi:10.1016/S0038-0717(00)00001-8

[11] E. Kandler, C. Kampichler and O. Horak, "Influence of Heavy Metals on the Functional Diversity of Soil Microbial Communities," Biology and Fertility of Soils, Vol. 23, 3, 1996, pp. 299-306. doi:10.1007/BF00335958

[12] F. V. Kakhki, G. Hagnia and A. Lakzian, "Effect of Enriched Sewage Sludge on Soil Urease Activity," Soil and Environment, Vol. 27, No. 2, 2008, pp 143-147.

[13] G. Narasimha, G. V. A. K. Babu and B. Rajasekhar Reddy, "Physicochemical and Biological Properties of Soil Samples Collected from Soil Contaminated with Effluents of Cotton Ginning Industry," Journal of Environmental Biology, Vol. 20, 3, 1999, pp. 235-239.

[14] G. G. Hoffmann and K. Teicher, "Ein Kolorimetrisches Verfahren zur Bestimmung der Urease Activitat in Boden," Z. Pflanzenernahr. Bodenk, Vol. 91, 1961, pp. 55-63.

[15] G. W. Thomas, "Soil pH and soil acidity," In: D. L. Sparks, Ed., Methods of Soil Analysis, Part 3. Soil Science Society of America Book Series, American Society of Agronomy and Soil Science Society of America, Madison, Wisconsin, Vol. 5. 1996, pp. 475-490.

[16] H. A. Ajwa, C. J. Dell and C. W. Rice, "Changes in Enzyme Activities and Microbial Biomass of Tallgrass Prairie Soil as Related to Burning and Nitrogen Fertiliza- tion," Soil Biology and Biochemistry, Vol. 31, 5, 1999, pp. 769-777. doi:10.1016/S0038-0717(98)00177-1

[17] J. Rato Nunes, F. Cabral and A. López-Pi?eiro, "Short-Term Effects on Soil Properties and Wheat Production from Secondary Paper Sludge Application on Two Mediterranean Agricultural Soils," Bioresource Technology, Vol. 99, 11, 2008, pp. 4935-4942. doi:10.1016/j.biortech.2007.09.016

[18] J. M. Bremner, and R. L. Mulvaney, "Urease Activity in Soil," In: R. G. Burns, Ed., Soil Enzymes, Academic Press, New York, 1978, pp. 149-196.

[19] K. Kannan and G. Oblisami, "Influence of Pulp and Paper Mill Effluents on Soil Enzyme Activities," Soil Biology and Biochemistry, Vol. 22, 1990, pp. 923-927. doi:10.1016/0038-0717(90)90130-R

[20] L. Gianfreda, J. M. Bollag, "Effect of Soils on the Behavior of Immobilized Enzymes," Soil Science Society of America Journal, Vol. 58, 1994, pp. 1672-1681. doi:10.2136/sssaj1994.03615995005800060014x

[21] L. Gianfreda and J. M. Bollag, "Influence of Natural and Anthropogenic Factors on Enzyme Activity in Soil," In: G. Stotzky and J. M. Bollag, Eds., Soil Biochemistry, Vol. 9, Marcel Dekker, New York, 1996, pp. 123-193.

[22] L. M. Dudley, B. L. McNeal and J. E. Baham, "Time- Dependent Changes in Soluble Organics, Copper, Nickel, and Zinc from Sludge-Amended Soils," Journal of Environmental Quality, Vol. 15, 1986, pp. 188-192. doi:10.2134/jeq1986.00472425001500020020x

[23] M. Nagaraj, G. narsimha and V. Rangaswami, "Impact of Sugar Industry Effluent on Soil Cellulose, Activity," Intetnational Biodeterioration and Biodegradation, Vol. 63, 8, 2009, pp.1088-1092. doi:10.1016/j.ibiod.2009.09.006

[24] M. Renukaprasanna, H. T. Channal and P. A. Sarangamath, "Characterization of City Sewage and Its Impact on Soils and Water Bodies," 24th Symposium, 17th World Congress of Soil Science, Thailand, 14-21 August 2002.

[25] M. Sreenivasulu, "Interactions between Tridemorph and Captan (Fungicides) with Microorganisms in Ground Nut (Arachis hypogaea L.) Soils," M. Phil Thesis. Sri Krishna- devaraya University, Anantapur, India, 2005.

[26] M. L. Jackson, "The Text Book of Soil Chemical Analysis," Prentice-Hall Inc, Engle Wood Cliffs, Jersy, 1973.

[27] M. Y. Ahn, J. Dec, J. E. Kim and J. M. Bollag, "Treatment of 2,4-Dichlorophenol Polluted Soil with Free and Immobilized Laccase," Journal of Environmental Quality, Vol. 31, 5, 2002, pp. 1509-1515. doi:10.2134/jeq2002.1509

[28] P. Nannipieri, "The Potential Use of Soil Enzymes as Indicators of Productivity, Sustainability and Pollution, Soil Biota Management in Sustainable Farming Systems," In: C. E. Pankhurst, B. M. Double, V. V. S. R. Gupta and P. R. Grace, eds., CSIRO, East Melbourne, 1994, pp. 238- 244.

[29] P. Ruggiero, J. Dec and J.M. Bollag, "Soil as a Catalytic System," In: G. Stotzky and J. M. Bollag, Eds., Soil Biochemistry, Marcel Dekker, New York, Vol. 9, 1996, pp. 79-122.

[30] P. K. Donnelly, J. A. Entry, Craw Ford Jr. and K. D. L. Cromack, "Cellulase and Lignin Degradation in Forest Soils Response to Moisture, Temperature and Acidity," Microbial Ecology, Vol. 20, 1990, pp. 289-295. doi:10.1007/BF02543884

[31] R. Albiach, R. Canet, F. Pomanes and F. Ingelmo, "Microbial Biomass Content and Enzymatic Activities after the Application of Organic Amendments to a Horticulture Soil," Bioresource Technology, Vol. 75, 1, 2000, pp. 43-48. doi:10.1016/S0960-8524(00)00030-4

[32] R. Kizilkaya, T. Askin, B. Bayarkli and M. Saglam, "Micro-Biological Characteristics of Soils Contaminated with Heavy Metals," European Journal of Soil Biology, Vol. 40, 2004, pp. 95-102. doi:10.1016/j.ejsobi.2004.10.002

[33] R. L. Cruz, A. M. Righetto and M. A. Nogueira, "Experimental Investigation of Soil Groundwater Impacts Caused by Vinasse Disposal," Water Science Technology, Vol. 24, No. 11, 1991, pp. 77-85.

[34] S. Kanazawa and K. Miyashita, "Cellulase Activity in Forest Soil," Soil Science and Plant Nutrition, Vol. 33, 3, 1987, pp. 399-406.

[35] S. K. Pancholy and E. L. Rice, "Soil Enzymes in Relation to Old Field Succession: Amylase, Cellulase, Invertase, Dehydrogenase and Urease," Soil Science Society of American Proceedings, Vol. 37, 1973, pp. 47-50. doi:10.2136/sssaj1973.03615995003700010018x

[36] S. R. Joshi, G. D. Sharma and R. R. Mishra, "Microbial Enzyme Activities Related to Litter Decomposition Near a Highway in a sub tropical forest of North East India," Soil Biology and