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Urease Enzyme Activity in polluted and control soils in Warangal City, Telangana State, India

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ABSTRACT

The urease enzyme activity in different polluted and control soils in Warangal city were analyzed during 2014 -2015. The minimum and maximum urease enzyme levels were 0.15 to 114 µg/g in the near Kumarpally sewage canal, while this range was 0.10 to 1.10 mg/L in the soils amended with dairy industry waste water flooded soil. The minimum and maximum range of urease enzyme activity was 0.21 to 1.13 µg/g in industrial estate waste water flooded soil. The urease enzyme activity range in soil amended with tannery industry waste water flooded soil was 0.10 to 1.12 µg/g, while the range of activity was 0.17 to 1.2 µg/g in control soils.

Key words: Urease, Polluted soil, Warangal, Telangana

INTRODUCTION

Enzyme activity of soil results on the activity of accumulated enzymes and enzymatic activity of proliferating microorganisms. Accumulated enzymes are regarded as enzymes present and active in soil, in which no microbial proliferation takes place. Sources of accumulated enzymes are primarily the microbial cells. Enzymes in soils, however, can also originate from plant and animal residues. Different soils have different stable levels of urease activity determined by the ability of their constituents to protect urease against microbial decomposition and other processes that lead to destruction or inactivation of enzymes (Zantua et al., 1975 and 1976). Urease, being liberated during microbial and plant root metabolism and death. This is intracellular as part of the soil biomass. Although most organic materials are metabolized rapidly by micro-organisms, both in vivo and *in vitro*, urease enzyme proteins persists active moieties in the soil for very long periods of time (Burns et al.,1972).

The addition of urease to soil urea hydrolysis only temporarily (Moe, 1967; Roberge, 1970) suggesting that added urease is with inactivated or destroyed by proteolysis. The presence of constituent background the level of enzyme activity independent of microbial proliferation suggest the existence of protective mechanism (Pancholy and Rice, 1973; Bremner, and Douglas, 1971; Kizilkaya et al, 2005). Urease activity has been detected in soils stored for decades and correlated better in with organic matter content (Skujins and MC larnen, 1969). Urease activity was established in correlation with number of microbes in microbial succession by many a workers (Skujins, 1967; Ross et al., 1973; Bronger and Heinkele, 1989; Kaspar and Bland, 1992) Knowledge of the relative effect of sewage sludge on urease activity is important because this enzyme is highly sensitive to small quantities of trace ions and because its substrate urea is added to soil as a synthetic fertilizer and in animal excreta. These diversified roles and properties of urease to estimation of urease in different soils amended with sewage and industrial effluents in Warangal city between 2014-2015.

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MATERIALS AND METHODS

Study Area:

Warangal, historically known as Orugallu, is a historic city the capital of erstwhile Kakatiya dynasty who

ruled this area from 12th to 14th century. It is about 140 Km. Away from Hyderabad, well connected by rail and road from all major cities in Telangana Latitude 17°58'8.04"N longitude 79°35'8.04"E. The Liquid solid wastes and industrial effluents generated from Warangal city area are mostly dumped in open land fill in low lying areas. This is creating an important source of soil pollution. Today, in Warangal city, the accelerated pace of development, rapid industrialization and growing human population are responsible for enormous amounts of sewage and industrial effluents every year and these waste materials are increasing tremendously.

The following sites were selected in this study:

Site 1. The soil sample collected from sewage canal near Nayeemnagar.
Site 2. The soil sample collected from sewage canal near Peddamma Gadda.
Site 3. The soil sample collected from industrial estate, Mulugu Road.
Site 4. The soil sample collected from near tannery industry at Desaipet
Site 5. Control soil collected from near place.

The urease activity was assayed by the buffer method described by Tabatabai and Bremner (1972). To 70 ml soil enzyme extract 10 ml of phosphate buffer (pH 6.7), 10 ml of 1%. Urea solution, 1 ml of 10 % $ZnSO_4$ and 0.5 ml of 6N NaOH was added and allowed it to settle for 30 minutes and filtered the supernatant through whatmann No. 42 filter paper. The obtained aliquot was made upto 50 ml and added with one drop of EDTA solution and 3 ml of Nesseler's reagent and the content were made upto 100 ml with distilled water. The developed orange colour was read at 440 nm with the help of a reference blank. The urease activity was expressed in mg of urea hydrolysed for gram of oven dry soil per unit time.

RESULTS AND DISCUSSION

These diversified roles and properties of urease to estimation of urease in different soils amended with sewage and industrial effluents in Warangal city between 2014-2015. The obtained data recorded in Figures 1-4.

From the figure-1 it was evident that the urease enzyme activity varied among different polluted soils with sewage and industrial effluents. The accumulation of this enzyme was in general high over control. The accumulation of enzyme was high during summer months (April and May) over the rest of the months. The moderate to high activity was recorded during rainy months. The urease activity ranged between 0.15 to 1.14 µg/g/hr (expressed as µg of urea hydrolysed by gram of soil by one hour) in the soils amended with sewage waste water (Figure-1). The minimum and

Figure-1. Urease enzyme activity among the soil sample collected from sewage canal near Nayeemnagar.

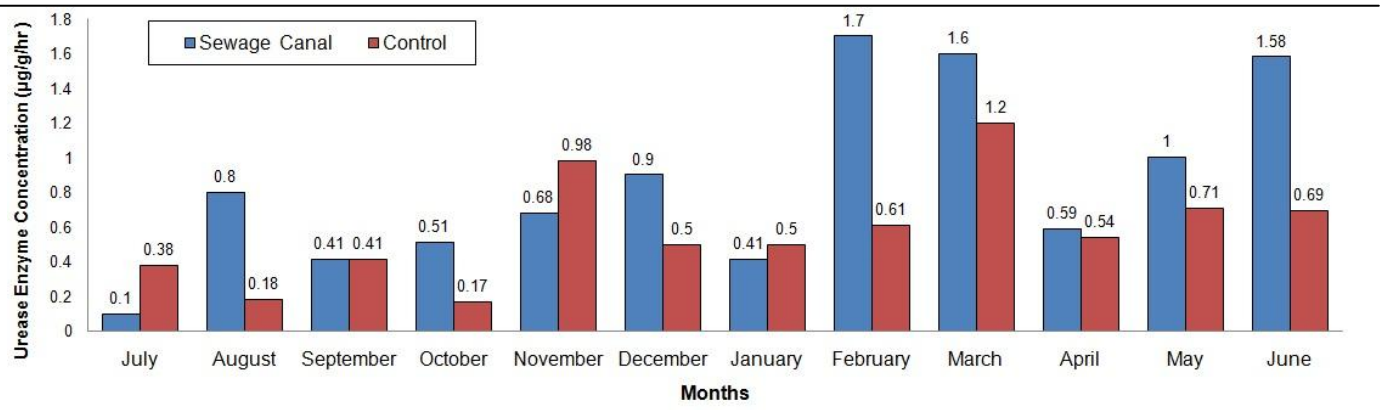


Figure-2. Urease enzyme activity among the soil sample collected from sewage canal near Peddamma Gadda.

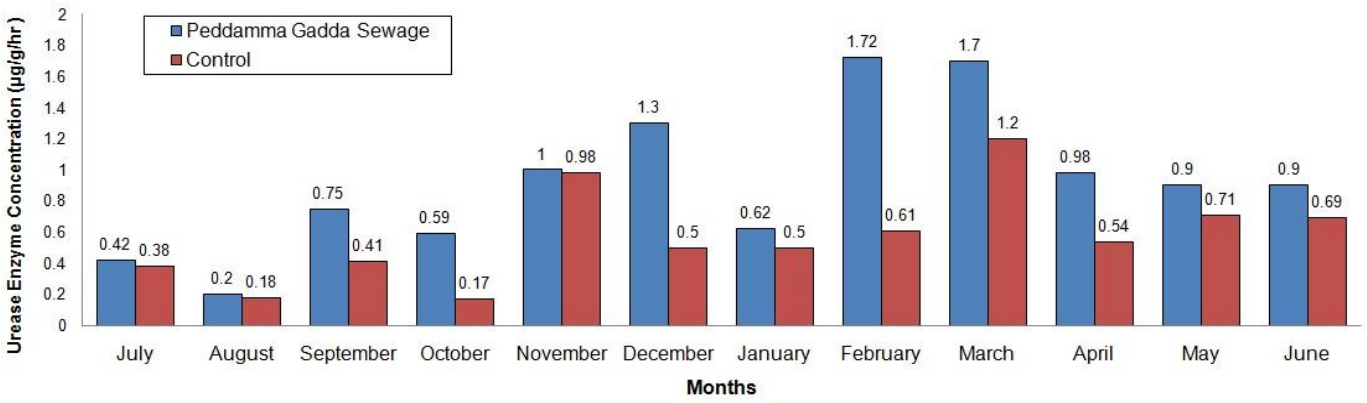


Figure-3. Urease enzyme activity among the soil sample collected from industrial estate, Mulugu Road.

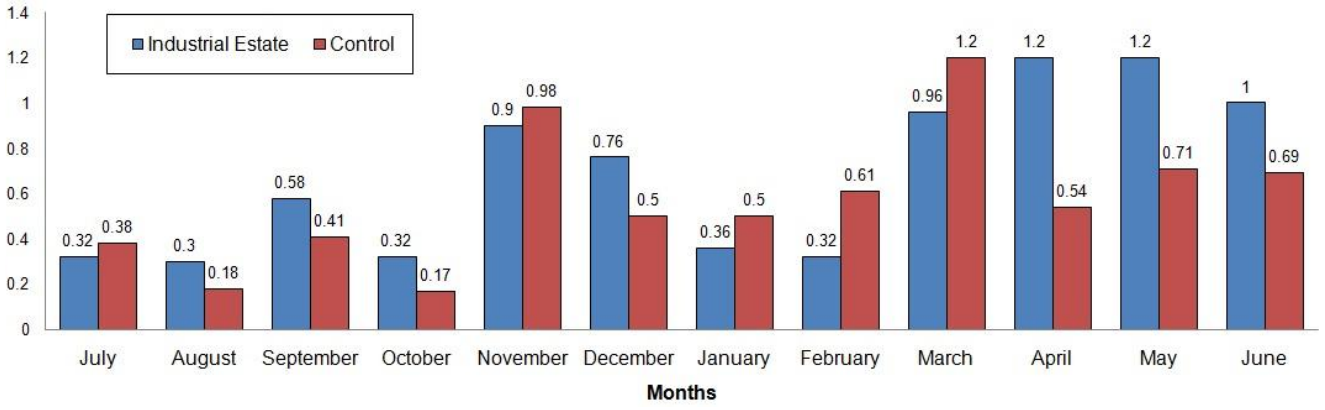
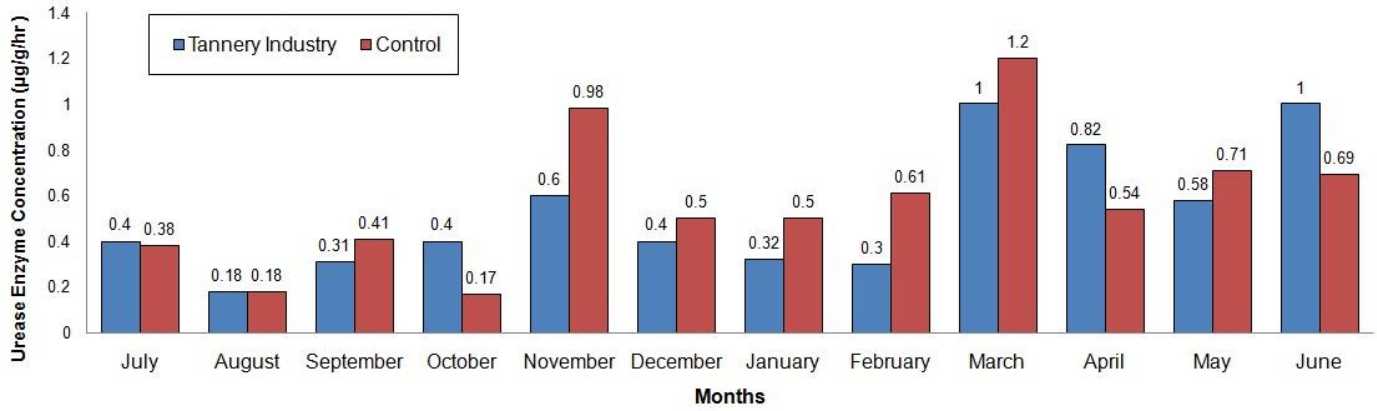


Figure-4 Urease enzyme activity among the soil sample collected from near tannery industry at Desaipet



maximum accumulation of urease enzyme was recorded 0.10 and 1.10 µg/g/hr soil in the soils contaminated with dairy effluents flooded soil (Fig-2). This range of activity was 0.21 to 1.13 µg/g/hr and 0.10 to 1.125 µg/g/hr in the soils amended with Industrial estate effluents flooded soil (Fig-3) and toxic tannery waste water flooded soil respectively (Fig-4).

The control soils supported for lesser accumulation of urease enzyme during 2014-2015 with marginal increase in the accumulation of urease. Nannipieri et al. (1980) recorded the yields of soil organic matter and urease activity during the extraction showed different pattern. Burns et al. (1972), Roberge (1970) studied urease activity in soil with persisting for long periods under the low water, low temperature and sterilized regions, and it has been suggested that same forms of enzyme protective mechanism exists in soil. Paulson and Kurtz (1969) recorded urease activity in tropical rice soils and flood water and reported that the flood water of tropical low land rice soils had measurable amounts of urease activity.

Sundaram and Hornby (1970) determined the kinetics and stabilities of various humus urease preparation extracted and purified from soil. They recorded KM values of five different fractions ranged from 8-40 mm and it was similar to those of urea extracted from various other sources. Ceccanti et al. (1978) and Chen et al (2001) in their fractionation of humus urease complexes recorded increases in total activities both ultrafiltration and gel chromatography, and they achieved the most effective purification of soil urease in the soil extract against 0.1 M pyrophosphate at pH 7.1. Recently, Retallack (1990) and Red ford et al. (1996) and Jezierska-Tys, S. And M. Frac (2009) developed some management techniques, enhancement of crop establishment with modified urease activities and enzyme composition.

Conflict of Interests

Authors declare that there is no conflict of interests regarding the publication of this paper.

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