ISSN: 2377-6196
The American Journal of
SCIENCE AND MEDICAL RESEARCH, 3(2), 1-4

Research Article Open Access

Protease Enzyme Activity in Sewage, Dairy, Aluminum, Tannery Industry Effluents Flooded Soils in Warangal City, District, Telangana state, India

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Abstract

The protease enzyme activity in different polluted and control soils in Warangal city were analyzed during 2014 -2015. The minimum and maximum protease enzyme levels were 0.46 to 1.10mg/L in the near kumarpally sewage canal, while this range was 0.32 to 1.11 mg/L in the soils amended with dairy industry waste water flooded soil. The minimum and maximum range of protease enzyme activity was 0.48 to 1.15 mg/L in aluminum industry waste water flooded soil. The protease enzyme activity range in soil amended with tannery industry waste water flooded soil was 0.44 to 1.13mg/L, while the range of activity was 0.28 to 0.84mg/L in control soils.

Keywords: Protease, Aluminum, Tannery Industry, Warangal.

INTRODUCTION

Enzyme activity of soil results on the activity of accumulated enzymes and enzymatic activity of proliferating micro – organisms. 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. 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. Microorganisms have the ability to degrade the protein by producing proteolytic exo-enzymes, called proteases, observation in the extracts obtained from soils exhibited a hydrolytic effect non proteins and peptides indicate accumulation protease in soil. Ladd (1972) found that the sum of the hydrolyzing activity of soil extracts and extracted soil in variable exceeded the activity of the unrestricted soil, and the specify activity of the proteases was increased by solubulization. Protease of soil extracts were un effected by incubation with added protease preparation. Jain, R.C. (1980) suggested that the extractable protease are present in the soil in a form which is more readily decomposed by proliferating micro- organisms , whereas non – extractable proteases are relatively stable to a loose associating with soil colloids Fanning and Fanning (1989) in their studies to proteases in relation to ammonia concluded that the soil enzymes do not participate in deamination of amino acids and therefore concluded deamination is due to exclusively to the enzymes of proliferating micro-organisms. Such interesting concerned about proteolytic activity of micro-organisms in the soils.

How to Cite this Article:
B. Lalitha Kumari (2017). Protease Enzyme Activity in Sewage, Dairy, Aluminum, Tannery Industry Effluents Flooded Soils in Warangal City, District, Telangana state, India. *The Ame J Sci & Med Res*, 3(2):1-4. doi:10.17812/ajsmr3201.

Received: 10 March 2017; Accepted: 09 April, 2017; Published online: 06 June 2017

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. It lies between 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 for the study:
Site 1. The soil sample collected from sewage canal near Kumarpally.
Site 2. The soil sample collected from near dairy industry flooded soil.
Site 3. The soil sample collected from near aluminum industry effluents flooded soil.
Site 4. The soil sample collected from near tannery industry effluents flooded soil.
Site 5. Control soil collected from near place.

The protease enzyme in soil samples was estimated as procedure suggested by Nannipieri et al. (1980). To one ml of soil enzyme extract, 1 ml of 1% casein solution was added and incubated for 10 minutes at 37°C. This reaction mixture was added with 2 ml 0.4 m tricarboxylic acid (TCA) and incubated for 20 minutes at 37°C. The contents were filtered through whatmann No.1 filter paper. One ml of filtrate was taken and with 5 ml 0.4 m sodium carbonate and 1 ml of diluted F C reagent. The contents were incubated at 37°C for 30 minutes and the absorbance was read at 660 nm in spectrophotometer. Blank was prepared without soil enzyme extract and the activity was expressed in terms of casein denaturation optical Density at 660. Nm for gram of oven dry soil per unit time with the help of standard graph prepared with casein.

RESULTS AND DISCUSSION

The proteolytic enzyme activity was estimated in different industrial polluted and control soils during the year 2014-2015 (Figures 1-4). In the figure-1, it was recorded that the proteolytic activity varied much among the soils under consideration. No much variations were recorded in the activity of proteases in between contaminated and uncontaminated soils. However, the range of activity was high in the soils amended with tannery industry effluents. The minimum and maximum

Figure-1. Proteolytic enzyme activity among the soil sample collected from sewage canal near Kumarpally.

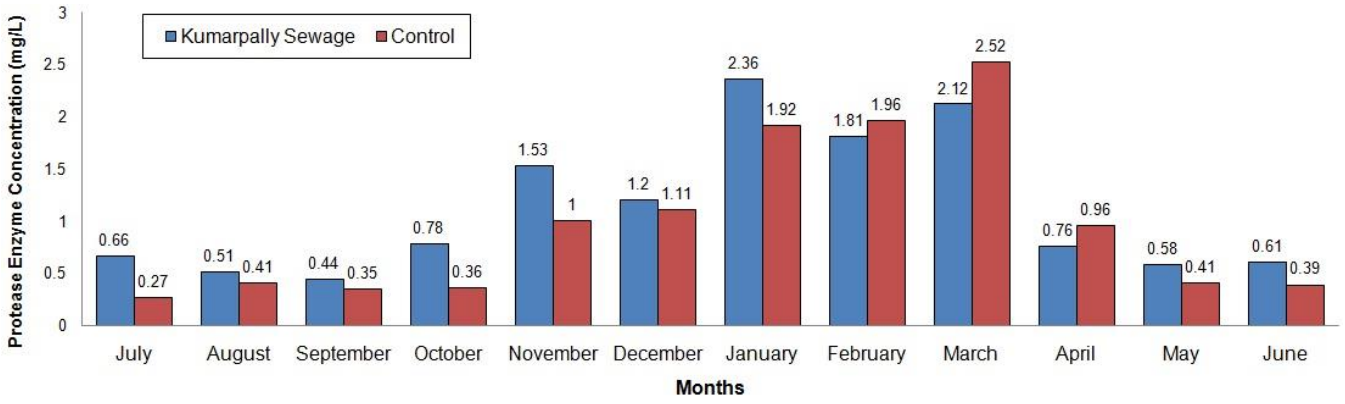


Figure-2. Proteolytic enzyme activity among the soil sample collected from near dairy industry flooded soil.

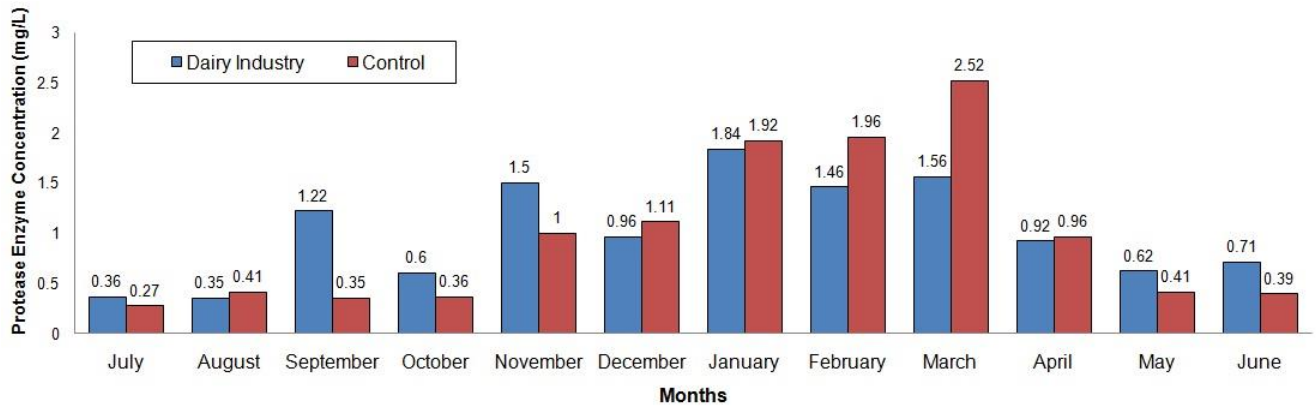


Figure-3. Proteolytic enzyme activity among the soil sample collected from near aluminum industry effluents flooded soil.

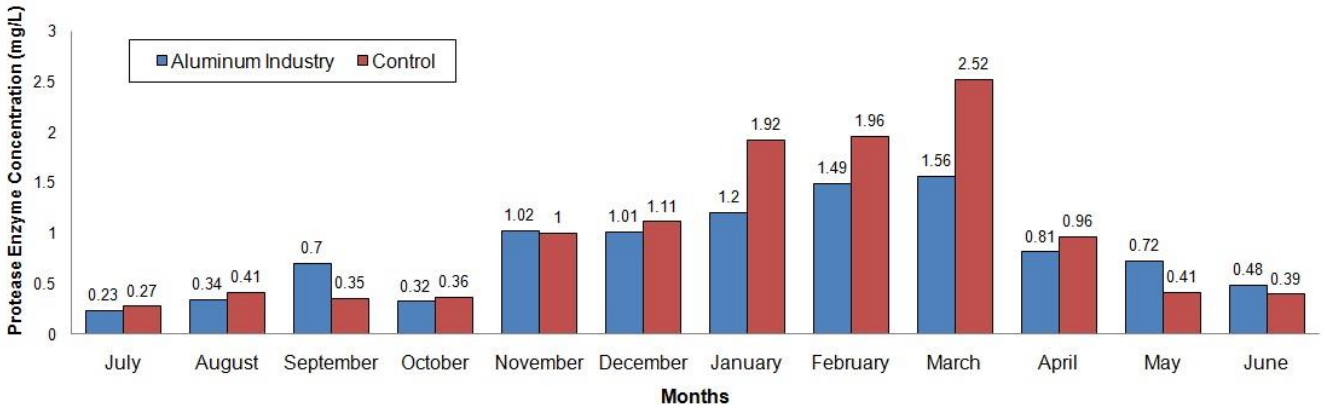
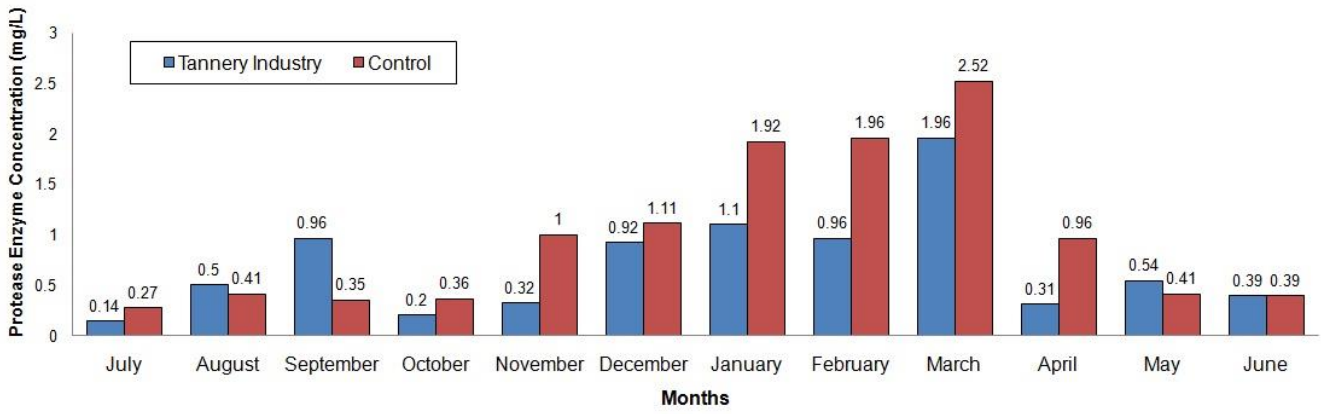


Figure-4. Proteolytic enzyme activity among the soil sample collected from near tannery industry effluents flooded soil.



ranges of proteases were in between 0.46 to 1.10 mg/L in the soils near Kumarpally sewage canal, while this range was 0.32 to 1.11 mg/L in the soils amended with dairy industry effluents. Schnizer (1991) considered the protease in the soil play an important role in the abatement of soil pollution and help to improve the soil structure and function which intern promotes its productivity.

Vimal and Talashilkar (1985) feel the important role of protease in the soil in recycling of urban waste and improving soil productivity. Important role of protease in the soil it was 0.32 to 1.11 mg/L in the soils amended with dairy industry effluents. The proteolytic activity was maximum (1.15 mg/l) in the month of February and minimum (0.48 mg/L) in August in 2014-2015. The protease activity range was 0.44 to 1.13 mg/L in the soils amended with tannery industry waste water flooded soil, while the range of activity was 0.28 to 0.84 mg/L in control soils. Nannipieri et al. (1980) in the extractions of various soil enzymes recorded the high amounts of casein hydrolyzing proteases in the soils studied by them. Gray and Williams (1971) in their studies on microbial productivity in soil ascertained the affinity of pyrophosphate for extraction of proteases from three different soils and also compared the yields of proteases with carbon and organic nitrogen.

Coaklet et al. (1977) observed the role of proteases in the disruption of micro-organisms such as bacteria, fungi and yeast. Skujins (1978) and Nannipieri et al. (1979) recorded the extraction of proteases from different soils which gave good yields because sodium pyrophosphate was an effective extractant of organic matter. Measurement of enzyme activities such as protease and urease and biochemical nitrogen transformations can be sensitive indicators of soil microbial activity which plays a major role in affecting soil quality (Emmerling et al., 2002; Nannipieri et al., 2003) Proteases are actively involved in carbon recycling and biological transformations of soil fertility (Bolon et al., 2008). Decrease in free amino acids at high salinity can be attributed to the inhibitory effect of the effluents on protease activity. Zaman et al (2002b) Zaman et al (2004) visualised the recycling of urban wastes as resource material in agriculture, and strengthened the role of proteases and related enzymes in substantiating the biological significance of these enzymes in soil productivity.

Competing interests

The authors have declared that no competing interests exist.

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