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EVALUATION OF PROTEASE ACTIVITY IN THE SOIL OF MUNICIPAL SOLID WASTE DUMPING SITES IN BALASORE DISTRICT OF ODISHA, INDIA

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ABSTRACT

The dumping of waste poses various detrimental effects on the soil quality i.e., mostly soil microbial and biochemical properties. In the present study the soil protease activity was evaluated in various sites of Balasore District such as Balasore Sadar, Soro NAC, Nilagiri NAC and Jaleswar NAC. For each dumping site there was a control site. The maximum protease activity found in Balasore Sadar was 6.78±0.05 µg tyrosine g^{-1} of soil hr^{-1} and minimum was 3.62±0.14 µg tyrosine g^{-1} of soil hr^{-1}. In Soro NAC the highest protease activity was 6.62±0.74 µg tyrosine g^{-1} of soil hr^{-1} whereas lowest was 2.98±0.14 µg tyrosine g^{-1} of soil hr^{-1}. Similarly in case of Nilagiri NAC the major protease activity was recorded to be 6.71±0.15 µg tyrosine g^{-1} of soil hr^{-1} however lower protease activity was found 4.02±0.013 µg tyrosine g^{-1} of soil hr^{-1}. It was found in that Jaleswar NAC that the protease activity was maximum in dumping site (6.75±0.034 µg tyrosine g^{-1} of soil hr^{-1}) and minimum in control site (3.68±0.019 µg tyrosine g^{-1} of soil hr^{-1}). The present experiment showed that dumping of waste on open land field increases the soil protease activity as compared to their control site soil.

KEY WORDS : Protease, Municipal solid waste, Balasore, Soro, Nilagiri, Jaleswar, Soil enzyme

INTRODUCTION

The 17th century holds the topmost position regarding growth of industrialization and exploration of various metals and resources. The scientific investigation and creation of new products were at its peak in this period. With making of various life sustaining and easy going products for daily life, the generation of another product was emerged. This has been called as waste. The waste generated after the use of resources were categorized based on their generation point. Those wastes which are generated due to the household, market and educational institutions are called as Municipal Solid Waste (MSW). After that the MSW has differentiated into two main parts one is non-biodegradable waste and biodegradable waste. This categorization has been done because of the degradability by the soil microbial population. Several researchers worked on the effect of MSW on protease activity (Alvarenga *et al*., 2023; Castaldi *et al*., 2008; Crecchio *et al*., 2004; Reddy *et al*., 2017; Raut *et al*., 2008; Samanta *et al*., 2012).

MATERIALS AND METHODS

For the evaluation of protease activity in soil of four municipal solid waste dumping sites in Balasore district, i.e., Balasore Sadar, Soro NAC, Nilagiri NAC and Jaleswar NAC were taken. Also, the respective control sites of the above mentioned dumping sites were taken at a distance of about 1km away from each dumping site which are mostly unaffected by any contamination due to MSW

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dumping. The collected samples were taken to the laboratory for enzymatic study. The protease activity in soil is measured by the method of Speir and Ross (1975) modified by Mishra *et al*., (1979)

RESULTS AND DISCUSSION

Soil protease consisting of different group of enzymes which acts on the organic matters present in the soil and it catalyzes the process of hydrolysis in the peptide bonds to form the amino acids which can be consumed by the plants and microbes.

Figure 1 shows the protease activity in control and MSW dumping site soil of Balasore Sadar. In the control site and MSW dumping site the data ranged between 3.62±0.14 μg tyrosine g^{-1} of soil hr^{-1} to 4.51±0.16 μg tyrosine g^{-1} of soil hr^{-1} and 6.78±0.05 μg tyrosine g^{-1} of soil hr^{-1} to 4.78±0.12 μg tyrosine g^{-1} of soil hr^{-1}.

Figure: 1 – Protease activity in control and MSW dumping site soil of Balasore Sadar

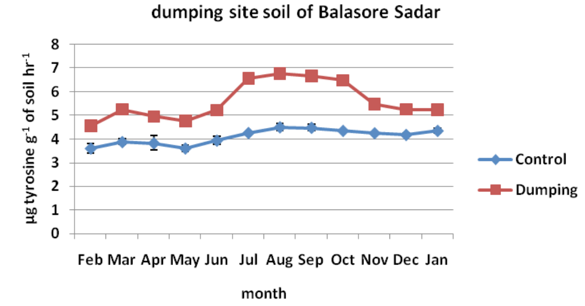


Figure 2 demonstrates the protease activity in control and MSW dumping site soil of Soro NAC. In the control site the soil protease ranged from 2.98±0.14 μg tyrosine g^{-1} of soil hr^{-1} to 3.98±0.04 μg tyrosine g^{-1} of soil hr^{-1}. In the MSW dumping site soil the protease activity ranged from 4.85±0.6 μg tyrosine g^{-1} of soil hr^{-1} to 6.62±0.74 μg tyrosine g^{-1} of soil hr^{-1}.

Figure 3 depicts the protease activity in the control and MSW dumping site soil of Nilagiri NAC. In the control site protease ranged between 4.02±0.013 μg tyrosine g^{-1} of soil hr^{-1} to 5.63±0.041 μg tyrosine g^{-1} of soil hr^{-1}. In MSW dumping site soil the protease activity was in between 4.77±0.026 μg tyrosine g^{-1} of soil hr^{-1} to 6.71±0.15 μg tyrosine g^{-1} of soil hr^{-1}.

Figure: 2- Protease activity in control and MSW dumping site soil of Soro NAC

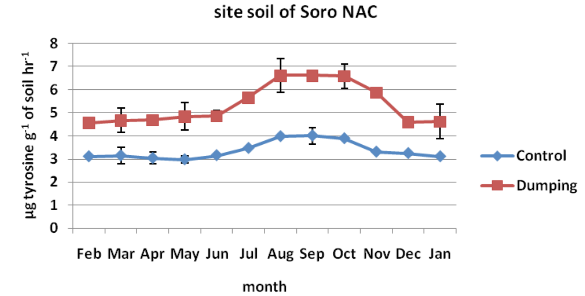


Figure: 3 - Protease activity control and MSW dumping site soil of Nilagiri NAC

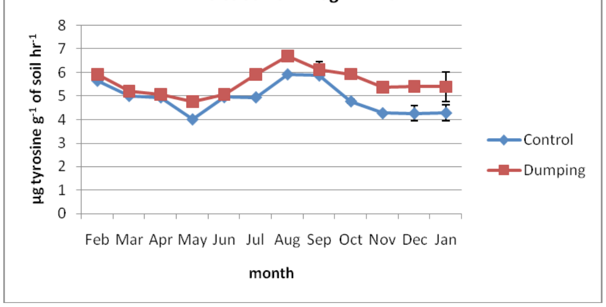
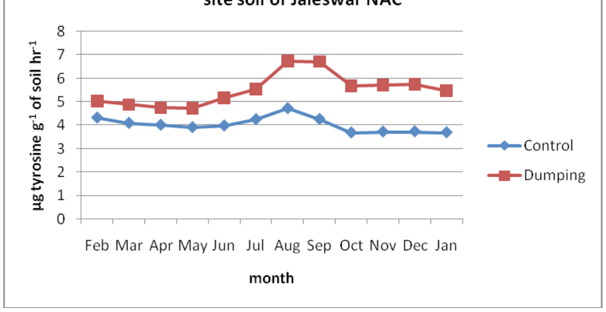


Figure 4 demonstrates the protease activity in control and dumping site soil of Jaleswar NAC. In the control soil the protease was in between 3.68±0.019 μg tyrosine g^{-1} of soil hr^{-1} to 4.72±0.058 μg tyrosine g^{-1} of soil hr^{-1}. In the MSW dumping site soil the protease was in between 4.71±0.074 μg tyrosine g^{-1} of soil hr^{-1} and 6.75±0.034 μg tyrosine g^{-1} of soil hr^{-1}.

Figure: 4 – Protease activity control and MSW dumping site soil of Jaleswar NAC



Pati and Sahu (2004) investigated the enzymatic activities and respiration due to the application of fly ash in soil in the absence and presence of *Drawida willsi*. Direct application of fly ash with elevated concentration decreases the soil protease activity. Mishra *et al*. (1988) studied the soil protease activity after being treated with insecticide i.e., carbaryl.

CONCLUSION

The generation of various types of wastes enumerates many folds of problems towards the environment in which the soil pollution holds the major position. The influenced effect of organic wastes in the soil microbial activity modifies enzymatic activity in it. The present study on protease activity in soil shows more influenced activity as compared to control soil.

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Conflict of Interest - None

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