STUDY OF ANALYTICAL AND MICROBIOLOGICAL PROCEDURES INVOLVED IN SOIL SCIENCE

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Abstract :

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Soil is a key component of Earth's critical zone. It provides essential services for agricultural production, plant growth, animal habitation, biodiversity, carbon sequestration and environmental quality, which are crucial for achieving the United Nations' Sustainable Development Goals (SDGs).

In their natural environment, plants are part of a rich ecosystem including numerous and diverse microorganisms in the soil. It has been long recognized that some of these microbes, such as mycorrhizal fungi or nitrogen fixing symbiotic bacteria, play important roles in plant performance by improving mineral nutrition.

In this study, we focus on the interaction of microorganism associated voids percentage and moisture content summarizing the current knowledge in several research fields that can converge to improve our understanding of the molecular microorganism mechanisms.

Keywords: ***Soil; Micro-organisms; Soil Structure; Microbes ;Organic; Sampling; Bacteria; Actinomycetes; Fungi; Aglae; Protozoa***

1. INTRODUCTION

GENERAL

The soil microbiology is study of micro-organism in soil and their functions and their effect on soil properties. Between two and four billon years the first ancient bacteria and micro-organisms came into exist on earth's oceans.

The soil biology is essential for the maintenance of biodiversity above and below ground. The wealth of biodiversity below is vast and unappreciated millions of microorganisms live and reproduce in a few gram of topsoil, an ecosystem essential for life on earth.

As the world's increasing population and global climate change takes place which produce stress on earth's freshwater systems, microbiological and chemical pollutants in our water will create acute challenges for environmental engineers and public health scientists.

The concept of using biological process in soil improvement which is known as bio-medicated The Soil improvement technique has shown greater potential in geotechnical engineering application in terms of performance and environmental sustainability.

The soil micro-organism present in soil are responsible for biological process and factors that affects their metabolic activities and geometric compatibility with soil sizes.

TYPES OF MICROORGANISM

1. Bacteria
2. Actinomycetes
3. Fungi
4. Aglae
5. Protozoa

1. Bacteria- It is smallest organism present in the soil. The are prokaryotic in structure i.e(simple cell structure with no internal organlles). It is the the most abundant microoganisums present in soil. They also serve many important purpose one of those being nitrogen fixtation among other biochemical processes.
2. Actinomycetes- There are Similar to both bacteria amd fungi. Have characteristics linking them to both group. They have characteristics linking them to both group and missing evolutionary link between bacteria an fungi.They also produce antibiotics which is the one important function. Charateristics –

- Similarities to bacteria- There are prokaryotic in structure and sensitive to anti-bacterials. They also resemble to bacteria in size, shape and gram-staining properties.
- Similarities to fungi- There are similar in shape and branching properties, spore for motion. They have reproduction mechanism.

3. Fungi- They are mostly abundant after bacteria and they are also food source for other organisms. It also acts as a beneficial symbiotic relationship with plant or other organisms. The crop residues is reduce by them by means of decomposation.They also perform biochemically process nutrients to improve the soil.They also futher split into different species based on sized,shaped and colour of their spored and these spores aredd used to reproduce. Factors effecting growth of fungi- The quality as well as quantity of fungi depends on OM in the soil has direct correlation to the growth of fungi.They are abundunt in acidic area compared to bacteria. It also grows well in dry,arid soil,aerobic or dependent on oxygen.
4. Algae- Algae can make its own nutrients through a process of photosynthesis.They distributed evenly where

ever sunlight and moderate moisture and is avaiable and they do not need soil surface to grown in directly exposed to sunrays. Algae can live below the soil surface as long as the algae has uniform temperature and moisture.

Characteristic of algae- In most of the soil algae acts as cementing agent in binding soil particles and there by reduce and prevent soil erosion. They also possess the character of symbiotic nitrogen fixation in association with other organisms like fungi,mosses and liverworts. Algae is also associated with fixed nitrogrn symbiotically in rice fields. It also plays an important role in the maintenance of soil feretility especially in tropical soils. They also add organic matter to soil when soil die thus increase the amount of organic carbon soil. It also plays an important role in the maintenance of soil fertility especially in tropical soils.

5. Protozoa- Protozoa are in eukaryotic organisms in structure. They are reproduce by sexual reproduvtion. It also acts as biological control agent and maintain the equilibrium in soil microbes. Protozoa can be split up into three categories-

a. Flagellates
b. Amoebae
c. Cillates

a. Flagellates –A flagellates is a cell or organism with one or more whip like appendages called flagella. The word flagellate also describe a particular construction or level of organization. Characteristic of many prokaryotes and eukaryotes and their means of motion. The term presently does not imply any specific relationship or

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2. OBJECTIVES

1. To know role of microorganism in soil health.
2. To understand affect of microorganism on structure and fertility soil.

3.LITERATURE REVIEW

Hong Yan,David E. Crowley (2000)
In this paper authors performed an experiment with barley plants under iron-limiting and iron-sufficient growth condition and plants were grown in an iron-limiting soil in root box microcosms. And there results showed that the microbial communities associated with the different root locations produced many common 16S rDNA bands but that the com munities could be distinguished by using correspondence analysis.

Ron J. Yates[3] (2004)
In tnis paper author studied about the Bacteria were isolated from root-nodules collected from indigenous legumes at 38 separate locations in the Gascoyne and Pilbara regions of Western Australia. Authentication of cultures resulted in 31 being ascribed status as root-nodule bacteria based upon their nodulation of at least one of eight indigenous legume species. The authenticated isolates originated from eight legume genera from 19 sites. Isolates were characterised on the basis of their growth and physiology; 20 isolates were fast-growing and 11 were slow-growing.

Debendra neupane[2](2014)
In this paper author studied about the application of enzyme mediated calcite precipitation (EMCP) as soil improvement technique. They also explain various experimental works on the EMCP technique. Author also carried out mechanical experiment of the improved portion of soil specimens.

Farhana Jamaludin Alia[4](2015)
In this paper author studied about water in the paddy field covered by acid sulfate soils having very low pH contains high amount of Al and Fe that affects rice growth. A laboratory study was conducted in a laboratory study to qualify rice grown under the adverse conditions can withstand the stresses on two rice varieties, MR219 and MR253 were grown under various pH, Al and Fe concentrations. They concluded the result that effect of Al on the root length and root surface area were negatively and highly correlated with Al concentration Author also concluded that effect of Fe on the root length and root surface area was negatively correlated with Fe concentration

Noor Muhammad[5]. (2019)
In this paper author studied about the presence of aluminium in the soil surrounding the plant roots. They have observed the ill-effects such as less growth of roots, less water uptake capacity, reduction in nutrients of soil and roots due to the presence of aluminium. Authors also stated that the phosphorous value also increases in the soil , also there is change in the cell membrane of the plant.

Shi Ren-young [6]. (2019)
In this paper author studied about extensive acidic soil, which suffer from accelerated soil acidification, are found in south China and also soil acidity, aluminium toxicity and nutrient deficiencies severely limited crop productivity. Author also summarized the positive effects and mechanism involved in correction of soil acidity. Author also concluded that application of crop residue biochars may be a better option than traditional liming to ameliorate acidic soils.

Yuan Hong-zhao1 [4] (2019)
In this paper author studied in brief about the application of straw and biochar for the improvement of soil fertility. The author carried out an investigation to study the diversity of microbial carbon use patterns in paddy soils amended with straw in a 3-year field. And they concluded investigation with a result that the functional diversity of microorganisms in organic paddy soils is affected by both physicochemical properties of amendment and plant growth stage.

SHI Ren-yong[3](2019)
In this paper author studied about extensive acidic soils which are found in southern China. Author also summarized the positive effects and mechanisms involved in the correction of soil acidity and the increase of soil pH buffering capacity by crop residue biochars. They also concluded that application of crop residue biochars may be a better option than traditional liming to ameliorate acidic soils.

Deyi Hou[5] (2020)
In this paper author research in the field of sustainable soil use and management should prioritize the multifunctional value of soil health and address interdisciplinary linkages with major issues such as biodiversity and climate change. Author also studied in field of to increase soil organic carbon levels, especially with recalcitrant forms of carbon.

Gui-Feng Gao el [4](2020)
In this paper author research about Soil microbial communities are fundamental to maintaining key soil processes associated with litter decomposition, nutrient cycling, and plant productivity and are thus integral to human well-being. Recent technological advances have exponentially increased our knowledge concerning the global ecological distributions of microbial communities across space and time and have provided evidence for their contribution to ecosystem functions.

Ajit K Sarma And Jean Sabadie (2002)
In this paper author Sulfonylureas are a unique group of herbicides used for controlling a range of weeds and some grasses in a variety of crops and vegetables. They have been extremely popular worldwide because of their low mammalian toxicity, low use rate, and unprecedented herbicidal activity. Knowledge about the fate and behavior of sulfonylurea herbicides in the soil-water environment appears to be of utmost importance for agronomic systems and environmental protection. Because these herbicides are applied at a very low rate, and their mobility is greatly affected by the chemicals' anionic nature in alkaline soils, a thorough understanding of their degradation/hydrolysis processes and mechanisms under aqueous and soil systems is important

1. CONCLUDING REMARK

Improving the prediction accuracy of models is critical for microbial mapping. First, soil samples must be collected from more types of habitats and as many locations as possible to enrich the database.

Second, soil microbial communities are temporally dynamic; therefore, it is necessary to understand microbial variations at different time

Third, not only the microbial diversity and community composition but also other information, such as microbial interactions (microbe-microbe, microbe-plant, microbe-host interactions), need to be considered and integrated into the model to improve our capacity to predict changes in key ecosystem functions (e.g., carbon storage) on a global scale.

These accuracy-improved models may be further used to predict the temporal-spatial dynamics in soil biodiversity and ecosystem functions under changing environments, which will aid the conservation of soil biodiversity and the display of ecological functions under future climate change.

2. REFERENCES

1. Baker, D.E. & Suhr**,** N.H. 1982. Atomic absorption and flame emission spectrometry. Methods of soil analysis, Part 2. 2nd edition. Agronomy Monogram. Madison, USA, ASA and SSSA.
2. Ferreira, A.M.R., Rangel, A.O.S.S. & Lima, J.L.F.C. 1998. Flow injection system for elemental soil analysis determination. Comm. Soil Sci. Plant Anal., 29(344): 327–360.
3. McQuaker, N.R., Kluckner, P.D. & Chang, G.N. 1979. Calibration of an inductivity coupled plasma – atomic emission spectrophotometer for analysis of environmental material. Anal Chem., 51(7).
4. Munter, R.C**.** 1990. Advances in soil testing and plant analysis analytical technology. Comm. Soil Sci. Plant Anal., 21(13–16): 1831–1841.
5. Singh, D., Chhonkar, P.K. & Pandey, R.N. 1999. Soil plant water analysis – a methods manual. New Delhi, Indian Agricultural Research Institute.
6. Skotnikov, A**.** 1998. Automated unit for soil sample preparation and processing. Comm. Soil Sci. Plant Anal., 29 (11–14): 2015–2033.
7. Soltanpour, P.N., Johnson, G.W., Workman, S.M., Jones, J.B. Jr & Miller, R.O. 1998. Advances in ICP emission and ICP mass spectrometry. Adv. Agron., 64: 27–113
8. Osterton, J. W., R. T. Irvin, and K. J. Cheng, The bacterial glycocalyx in nature and disease, Annu. Rev. Microbiol., 35, 299-324, 1981.
9. De Smedt, F., and P. J. Wierenga, Mass transfer in porous media with immobile water, J. Hydrol., 41, 59-67, 1979.
10. Fredrickson, J. K., and R. J. Hicks, Probing reveals many microbes beneath earth's surface, ASM News, 53, 78-79, 1987.
11. Gaudet, J.P., H. J•gat, F. De Smedt, P. Wierenga, and G. Vachaud, Transfert d'un crOneau d'•lution dans une colonne de sol non saturn, Mesure et simulation, C. R. Acad. Sci. Paris, Set. B, 281, 615-617, 1975.
12. Geesey, G. G., Microbial exopolymers: Ecological and economical considerations, Am. Soc. Microbiol. News, 48, 9-14, 1982.
13. Gray, T. R. G., P. Baxby, I. R. Hill, and M. Goodfellow, Direct observation of bacteria in soil, in The Ecology of Soil Bacteria, edited by T. R. G. Gray and D. Parkinson, pp. 171-192, University of Toronto Press, 1968.
14. Harvey, R. W., R. L. Smith, and L. George, Effect of organic contamination upon microbial distributions and heterotrophic uptake in a Cape Cod, Mass. aquifer, Appl. Environ. Microbiol., 48, 1197-1202, 1984.
15. Herbert, D., Some principles of continuous culture, in Recent Progress in Microbiology, edited by G. Tunevail, Blackwell Scientific, Boston, Mass., 1958.
16. McCarty, P. L., B. E. Rittmann, and E. J. Bouwer, Microbiological processes affecting chemical transformations in groundwater, in Groundwater Pollution Microbiology, edited by G. Bitton and C. P. Gerba, pp. 89-115, John Wiley, New York, 198