Analysis of soil in three different areas of Manipal, India

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Abstract

Analysis of soil is a very vast subject due to the vast number of materials present in a soil sample. Various tests can be conducted on a soil sample, but the due to limited quantity of soil sample found in and around a crime scene and all the tests cannot be conducted on them. Soil tests which can be conducted and provide a very important data to the investigative agencies. This can be used to make a study of different soil components of which elemental composition can be used as a tool for usage of soil as an evidence in the area of forensic science. This study involves the analysis of top soil in three popular areas of Manipal and to determine if there is any difference in the common elemental quantity in the soil samples.

Keywords: Analysis, Components, Soil, Test, Quantity.

Introduction

Soil is the uppermost layer of the earth, and it is a mixture of organic, inorganic, minerals, organisms that are together supporting life. This layer is also known as pedosphere. Soil is formed due to the process of weathering over a long period of time and this long period of time has been useful for soil to accumulate different kinds of material in it. These different kinds of material in the soil can be used to classify and identify soils based on their location. Soil as an evidence in Forensic Science is overlooked most of the times due to the lack of research on it and the presumption that soil analysis is time consuming and costly but in fact, soil analysis is one the most useful techniques we can use in the area of Forensic Science. Criminological soil investigation includes the assessment of soil tests by different logical strategies to settle or help with criminal examinations[1]. The different varieties of components in the soil makes it a unique evidence. Forensic geology uses different earthly evidence, mostly soil samples, to evaluate the complications[2]. Legal geoscience is creating a basic sub-discipline inside legal science[3]. Earthly materials differ among various distances or ranges and have few attributes due to natural consequence and relocation produced by both human beings and additional living organisms over time[4]. There are some minerals in soil which are very abundant and can be easily estimated using some colour tests to test their quantity, this can be used to make a database of soil contents in a particular area so that they can be used as standard when required and to be compared with an unknown sample. The value of pH calculation as a distinguishing approach for soil is inspected with an appropriate reference to the advancement of a facility for the analysis of very minute quantities[5]. Soil can have a definitive impact in legitimate assessment, depicting as a fool proof evidence which may associate a casualty or a suspect to the location of wrongdoing[6]. Even though convincing information is given by a topographical proof in clearing a case, there is underutilization of soil proof in investigative laboratories[7]. Even incredibly minute amount of sample residue can contain huge number of elements and can give a large amount of data about the overall sample[8]. Forensic soil tags are especially convenient in wildlife criminal investigations, where huge fraction of breach arise outdoors, and soil is commonly shifted from the scene of crime[9]. The advantage of a process in the field of forensic knowledge is reliant on the partiality it presents amidst contrasting soils[10]. Measurable soil science exemplifies a growing subject of soil discipline and has advanced to the sum that apparent inquiries and viable wrongdoing scene appraisals can be refined in exceptionally eminent matters[11]. Each of the component such as organic matter, inorganic matter, minerals can be individually analysed both quantitatively and qualitatively using existing techniques such as spectrometry, chromatography[12]. Soil can be a basic physical proof in a criminal investigation which adds to supporting the association between the location of the wrongdoing and the suspect[13]. Soil can give a wide assortment of importance to various individuals, and this can be utilized by specialists to group or distinguish them to understand a wrongdoing[14]. Soil has been utilized as a proof since the medieval occasions in Rome when the dirt particles from the hooves of ponies were gathered to see where they have come from[15]. Analysis can be done using pre-existing kits which are used in the field of agriculture to find out the difference in quality of soil with respect to different quantity of minerals in the soil from an area. If pre-existing data is available regarding the quality of soil in an area it can be used along with our data and combine it to provide better results and use it in the field of criminological science.

Manipal is a multicultural hub of students coming from all over the world. Located at a distance 5 km from Udupi, in the coastal part of Karnataka overlooking Arabian sea to its west and

Western Ghats to its east. Its name is derived from Manipal Lake. Manipal Lake, end point park is visited by many people all around the year. The main building of Manipal Academy of Higher Education and most of the hostels are in Madhav Nagar so these three areas were selected and the soil samples from these three areas will be analysed using agricultural soil testing kits. Nitrogen, Potassium, Phosphorus, Carbon are all abundant minerals found in almost all the soil samples, but their quantities differ between different location and this difference can be used to isolate the source of a land sample is it found in a scene of crime. Soil can give portrayal in criminal examinations[16]. Soil is not that plain material that it sometimes is taken to be. The vast kinds of mineral grains, the effects of chilling and weathering, and the constant confrontation with organic and inorganic debris give soil different featured that can be analysed to give a huge amount of sample discrimination[17].

Materials and methods

Materials: i. Soil samples, ii. NICE soil testing kit for the estimation of NPK & pH, iii. NICE soil testing kit for the estimation of Organic Carbon.

Methods: The soil samples will be collected from the surface of three areas (End point park, Manipal lake, Madhav Nagar). All the dirt examples gathered were put away in polythene sacks.

The soil samples collected were dried under sunlight for 1 hour before starting any of the below mentioned processes.

All the soil samples collected were analysed using NICE soil testing kit for the estimation of NPK and pH and NICE soil testing kit for the estimation of Organic Carbon.

Results and discussion

Organic carbon: The organic carbon quantity in most of the samples are high this is due to the fact that most of the area from where the soil sample was collected had vegetation around it and this naturally increases the quantity of organic carbon in the soil. Only certain samples from Manipal lake showed a medium quantity of organic carbon and almost ¼ of the sample from Madhav Nagar had medium quantity of organic carbon present this can be due to the fact that in Madhav Nagar the amount of vegetation is less than the lake and this has had an effect on the quantity of carbon present in the soil.

Nitrogen: Due to the quantity and variety of different flora in the lake the quantity of nitrogen in different parts of the cycle varies from low to high quantity. The nitrogen cycle is different due to the variation in the plant and this might have caused the difference in the quantity of soil in the same area whereas in Madhav Nagar the quantity of nitrogen in the dirt is steady in all the dirt examples.

Phosphorus: The average quantity of phosphorus is low in all the different areas shown in Table-3 suggesting that the quantity of phosphorus on an average is less than 1kg/acre. The equal quantity of phosphorus suggests that the quantity of vegetation and the land use has not affected the quantity of phosphorus in the soil.

Potassium: The quantity of potassium in the soil sample lies in the range of 81-120 Kg/Acre in all the soil samples which shows that in spite of the different locations and the use of soil in different ways the potassium level in the soil has been more or less the same quantity in all the different areas.

pH: The soil samples in Manipal lake and Madhav Nagar are both in slightly acidic and their pH level at 6.5, but the soil sample in end point is slightly more acidic with pH of 6.0 in some of the soil samples and the other are consistent with the other areas with the pH of 6.5.

After all the parameters were analysed which includes four minerals and one chemical property of the soil, the above results display that there is no major difference in the quantity of the major minerals found in the soil in different areas of Manipal. But the kits provide a very precise value of the different quantities this can be utilized to decide the beginning of an addressed soil test. Soil as an evidence is a very vague substance but as it is more researched, and a proper database of soil parameters is formed, and the above results can be very useful in reinforcing soil as a reliable evidence in the court of law. The dirt's generally looked by legal researchers, notwithstanding, come from nurseries and hence could show pretty unmistakable varieties relying upon treatment and techniques for development. Some all around burrowed and raked garden plots might be practically the same, though, spot burrowing, and treatment might cause critical varieties in soil properties. It might in this way be insightful to inspect the variety of pH across the space of soil associated with each case and treat the outcomes independently.

Table-1: Quantity of Organic Carbon in soil.

Number of samples	Manipal lake	Madhav Nagar	End Point
	Quantity/ Quantity in percentage	Quantity/ Quantity in percentage	Quantity/ Quantity in percentage
27	AA/ >0.75% in 21 samples A/ 0.5-0.75% in 6 samples	AA/ > 0.75% in 19 samples and A/ 0.5-0.75% in 8 samples	AA/ > 0.75% in 26 samples and A/ 0.5-0.75 in 1 sample

Table-2: Quantity of Nitrogen in the soil.

Sample number	Manipal lake	Madhav Nagar	End Point
	Quantity/ Estimated Quantity in Kg/Acre	Quantity/ Estimated Quantity in Kg/Acre	Quantity/ Estimated Quantity in Kg/Acre
27	M2/151-200	M2/151-200	M2/151-200

Table-3: Quantity of Phosphorus in the soil.

Number of samples	Manipal lake	Madhav Nagar	End Point
	Quantity/ Estimated Quantity in Kg/Acre	Quantity/ Estimated Quantity in Kg/Acre	Quantity/ Estimated Quantity in Kg/Acre
27	BA /<1	BA /<1	BA /<1

Table-4: Quantity of Potassium in the soil.

Number of samples	Manipal lake	Madhav Nagar	End Point
	Quantity/ Approximate Quantity in Kg/Acre	Quantity/ Approximate Quantity in Kg/Acre	Quantity/ Approximate Quantity in Kg/Acre
27	M2/81-120	M2/81-120	M2/81-120

Table-5: pH of soil.

Number of samples	Manipal lake	Madhav Nagar	End Point
	pH	pH	pH
27	6.5	6.5	6.5 in 17 samples and 6.0 in 10 samples

Table abbreviations: AA- Above Average, A-Average, Kg – Kilogram, M2 – Medium 2, BA – Below Average.

Conclusion

There are no major differences in the soil in the three different areas of Manipal, but the above results can be used to create a database and improve upon it further. The above tests can be used as a preliminary test to determine the quality of the soil and to rule out the extremities. Advanced techniques such as chromatography and spectroscopy can be employed to accurately quantify the elements present in the ground and this can be cross checked with a database. It is anticipated that advancement will continue to develop these systems with ever growing affectability, versatility, and diminished cost[18].

Acknowledgement

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