Study And Analysis Of Agar Added Alluvial Soil

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ABSTRACT

Agar powder was added to alluvial soil collected from Ranipet region, Tamil Nadu, India and. Soil substance from the top layer 15 cm depth of the experimental section location were collected using a conventional soil tillage technology. We present a detailed comparison of the morphological and physicochemical changes of Alluvial soil with and without the addition of agar powder. The FTIR, SEM, EDAX, and soil data analysis confirm that the application of agar powder has a large impact on the soil organic carbon molecule, soil physicochemical parameters, and exchange capacity of Alluvial soil.

KEYWORDS: Agar powder, Alluvial soil, Morphological & physico-chemical properties, soil quality,

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INTRODUCTION

The enhancement of the soil's quality by means of the use of soil organic carbon (SOC) control has remained the primary issue for tropical soils [1]. Soil organic matter (SOM) is crucial for the movement of nutrients and promotes the formation of good soil structure. The ideal soil contains a lot organic matter, enough mineral content, good soil aeration, and a higher water-holding capacity, resulting in more effectively crop development and growth. Soil pH levels, cation exchange capacity (CEC), and availability of nutrients are essential soil analysis of chemical properties over crops development and growth. High mass density of soil (SBD) and Water holding capacity (WHC) are basic soil physical properties that play an important role in cropping growth and efficiency [2]. The attendance of organic matter, mineral content, and porosity of the soil all have a significant impact on the dynamics of the aforementioned soil properties. Frequent studies have previously been carried out to easy understand the connection among SBD and SOM content of soil, and they have found a strong connection that is beneficial. [3]

Soil organic matter [17] is most strongly essential soil element. which improves soil structure, water-holding capacity, and availability of nutrients. Organic matter is the primary habitat for a wide range of soil wildlife and microflora, which production on significant role in soil health and productivity [1]. The SOM is extremely liable to changes at land usage and management, in addition to temperature and moisture of the soil substance. India in Tamil Nadu (TN), alluvial soil occupies 1.2% of the area and is spread across every district of the state.

Agars are technically produced from the agarophytes red seaweed genera Gelidium and Gelidiella [5]. Gelidium seaweed is harvested in large quantities on the north coast of Spain, and on the southern coast of Portugal, whereas Gelidiella acerosa is the primary source of agar in India [5] agar is a neutral mover for nutrients and growth substances. Seedling germination crap from meristematic tissue use agar as a nutrient substance. Gelidiella whereas Gelidiella acerose is the primary source of agar in India, in addition, agar is widely used in growth shown for culturing bacteria for scientific research [4].

Soil Orgonic Carbon [12] build-up in. Under climates that are vulnerable, alluvial soil is necessary to maintain crop protection and minimize soil degradation. In this particular situation, the use of Agar powder as a Soil amendment to increase organic carbon is recommended. The soil analysis built nutrient running has emerged as a key issue in efforts to increase soil mobility and agriculture productivity. In current years agriculture growth has been different methods from conventional farming methods to more intensive practices using activated agar powder added soil and other sea wood with irrigation facilities. Continuous use of chemical fertilizers slowly changes soil properties; ultimately the production in the long run is reduced. It has resulted in the leaching of chemicals into the surface and groundwater [1-5]. Due to increasing demand for cash growth crops the practice of monoculture cropping patterns has further helped to deteriorate water in terms of soil quality [6]. Soil and water are the most important natural resources in the farming of crops. The main impartial of the analysis was to assess the present status of soil. The physicochemical different properties like soil basicity and acidity (pH), electrical charge conductivity (EC), organic carbon (OC), available inorganic materials like nitrogen (N), phosphorus (P), and potassium (K) of Soil substance from several sources sites were analysed [7,8].

The physicochemical properties [13] of soils and their relationship with one another, as well as variation in nutrient-supply capacity, are natural phenomena. As a result, different organisation performs are required at various sites to sustain crop productivity. Therefore, the nutritional status of the sample is extremely important. [9] The soil has an adverse impact on the development and yield of crop plants due to adverse physical and chemical features [10]. These physicochemical features of sample vary over time and space due to changes in geography, temperature, weathering processes, cover vegetation, bacteriological activities, and several other abiotic and biotic factors. Vegetation affects the physicochemical physical properties of the soil sample to a greater extent [11].

The current study used agar powder combined with alluvial soil to evaluate soil ‘C’ accumulation, physical and chemical properties are changed in the soil, and positive and negative interactions under laboratory circumstances. Alluvial soil adding agar powder tasters were composed and analysed using FTIR, SEM, and EDAX.

MATERIALS AND METHODS:

Samples of soil were gathered from the Ranipet district in order to analyse its chemical and physical properties. While collecting soil samples the upper layer of vegetation, surface litter, and stone stubble if any were cleared away and then a layer of soil immediately below (0-15m) was collected in polythene bag. This research investigates the impression of agar (highly purified Agar powder) application on the positive charged cation exchange capacity and organic carbon of soil, and also it interacts. The present study was directed applying Agar powder combined with Alluvial soil to assess FTIR, SEM, and EDAX analysis.

The research study was carried out in Nemili, Ranipet district of Tamil Nadu. It is situated between 12° 55' 55.4268" N and 79° 20' 0.4776" E at an altitude of 90 m amsl. Figure 1 shows that the average maximum and minimum temperatures range from 34°C to 27°C. 29.8°C is the lowest recorded temperature, and 39.8°C is the highest. The district receives 939 mm of precipitation annually on average; 272.1 mm come from the southwest monsoon (June–September), while 398.3 mm come from the northeast monsoon (October–December).

A 2.5 kg alluvial soil sample with a size of about 2 mm was taken, and it was left to dry in the air for 14 hours. Using accepted methods, its physical, chemical, and physico-chemical properties were examined. The physico-chemical characteristics and nutrient concentrations of the alluvial soil sample are displayed in Table 1. The soil samples' pH and EC were measured in a 1:2.5 soil and water deferral. The conversion equation SOM = 1.53'SOC was used to get the SOM from the estimated SOC.

The Keen-Rackzowski box method was used to regulate the physical properties of the soil, such as bulk density, porosity, and particle density [14, 15]. The Cohex method was applied to determine soil nutrients like calcium, magnesium, and CEC; a flame photometer was used to define sodium and potassium; the Walkley and Black method was used to limit SOC [16]. The equation was used to analyse the red soil CEC.

CEC (centi-mol+ /kg) = Exchangeable (Ca^{++} + Mg^{++} + K^{+}) × factor value (1.0)

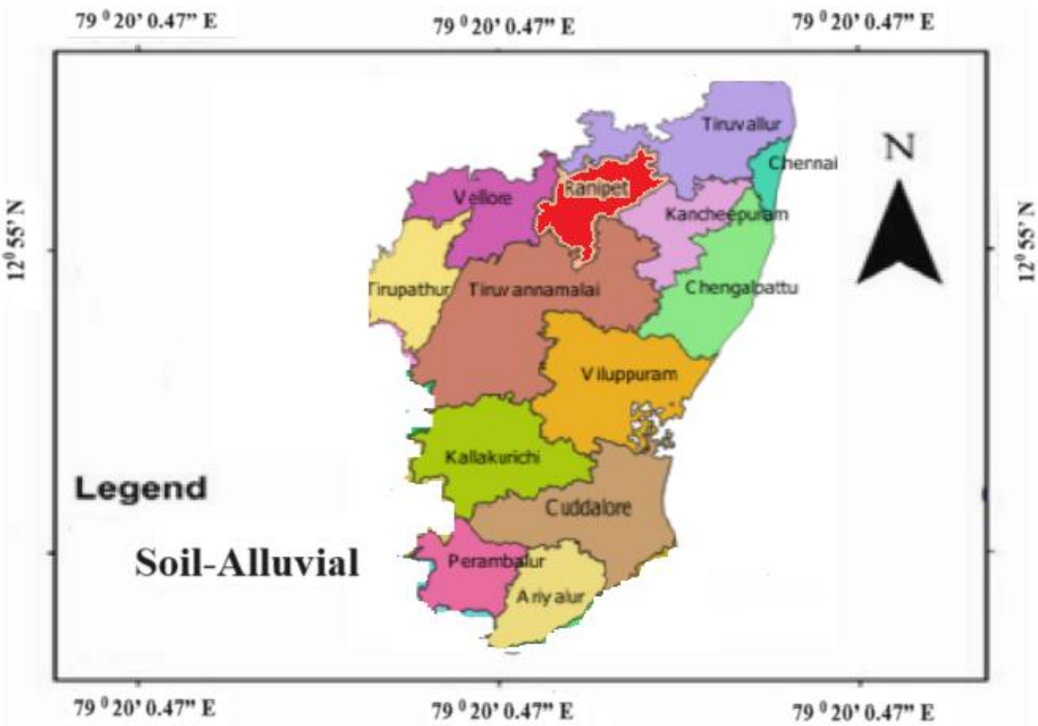


Figure 1. (a) Map of Study Area

(b)

Figure 1. (b) Image of Alluvial soil

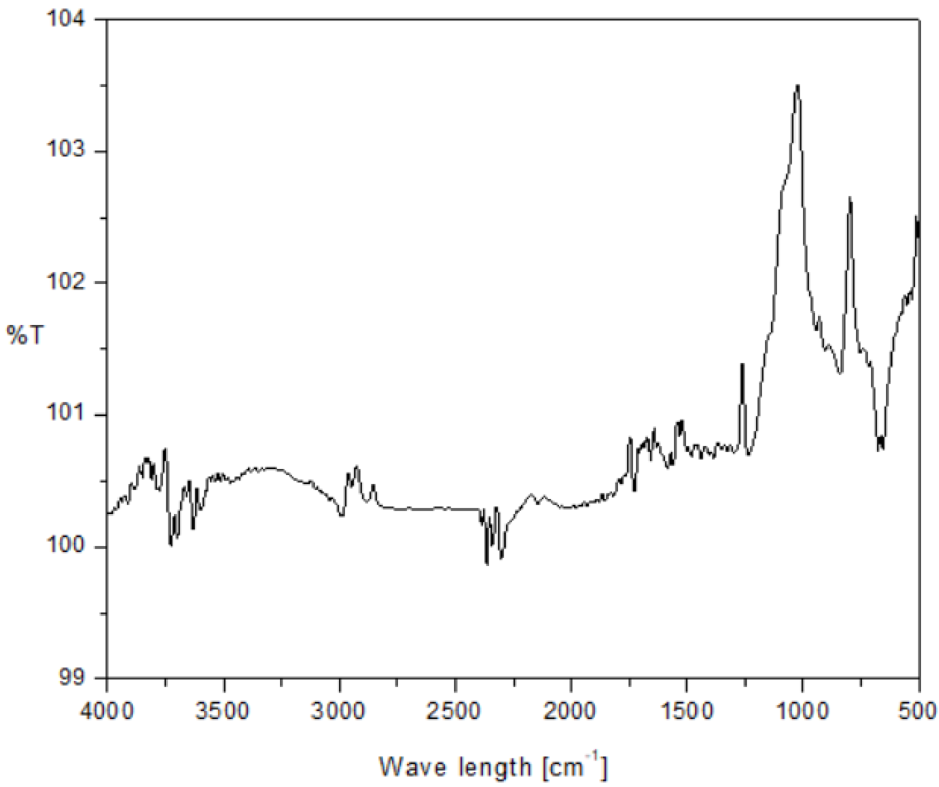
RESULT AND DISCUSSION:

FTIR Analysis

The primary vibrations of orgonic molecules occur in the infrared region and can be examined in FTIR spectra. FTIR analysis uses agar powder to verify its presence in alluvial soil. The organic substance effect arising from the bending and stretching of different functional groups like N-H, O-H and C=C, is the process that causes overtones and combination bands.

After adding the agar powder to the soil, FTIR analysis, as shown in Fig. (ii), revealed its presence. The IR band of the alluvial soil sample after the mixed of agar powder exhibited that the N-H stretching frequency decreased to 3631 cm1 and the band at N-H amine. This infers that the addition of agar powder in the alluvial soil was clearly evidenced from the FTIR spectra shown in Fig. (ii). After the addition of agar powder, the frequency decreased to 3421 cm-1 O-H stretching of the hydroxyl group [19], which supports the existence of agar powder in the soil sample [17–19].

Figure 2. FTIR spectrum of Alluvial soil after the addition of agar powder

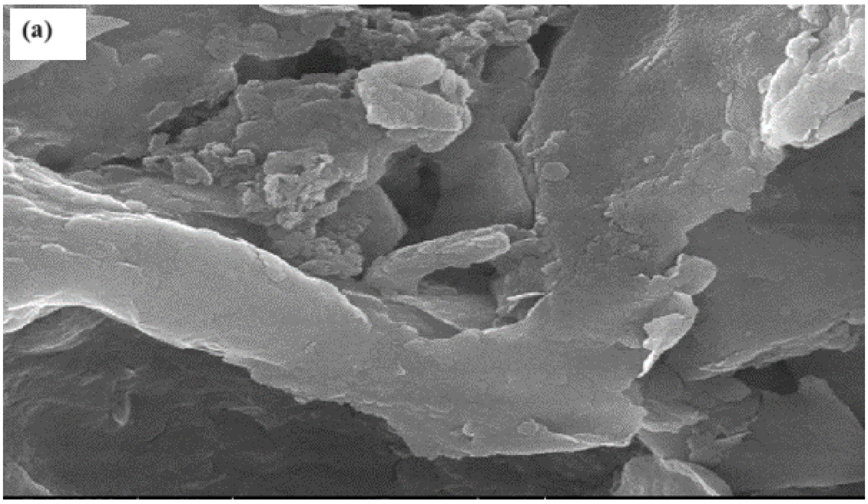


After the adding of agar powder the CO-NH group vibration decreased to 1600cm-1 band at CO-NH of amide. infers that the addition of agar powder in the alluvial soil sample the frequency decreased to670 cm-1 the bond at C=C alken which supports the occurrence of agar power in the soil sample shown in fig (ii).

Table 1: FTIR spectrum of Alluvial soil after the addition of Agar powder

s.no	Wave number	Band type	Functional groups
1	3631	N-H stretching	Amine group
2	3421	O-H stretching	Hydroxyl group
3	1600	CO-NH	Amide group
4	670	C=C Bending	Alken group

SEM Analysis:
The SEM images in Figure 3 indicate that the mean diameter of agar powder is about 30 µm and that the shape is uneven. Similarly, the mean diameter of alluvial soil and Agar powder added Alluvial soil is near 10 µm. The scanning electron microscope image of Alluvial soil visibly shows that it has more macrospores and micro particles, which are straight accountable for low Water Holding Capacity and aeration. SEM image of Agar powder mixed with Alluvial soil shows smaller particle size and more micropores[15]. This may be due to the minor particle size of Agar powder. The fine particles of Agar powder enter into the cavity of the macropores and reduce the pore size, which finally raises the microspores in the soil. Agar powder mixed with Alluvial soil also raises the Water hoiding capacity and aeration[15] location of the soil, which is mainly due to the presence of more micropores in the Agar powder applied to Alluvial soil.



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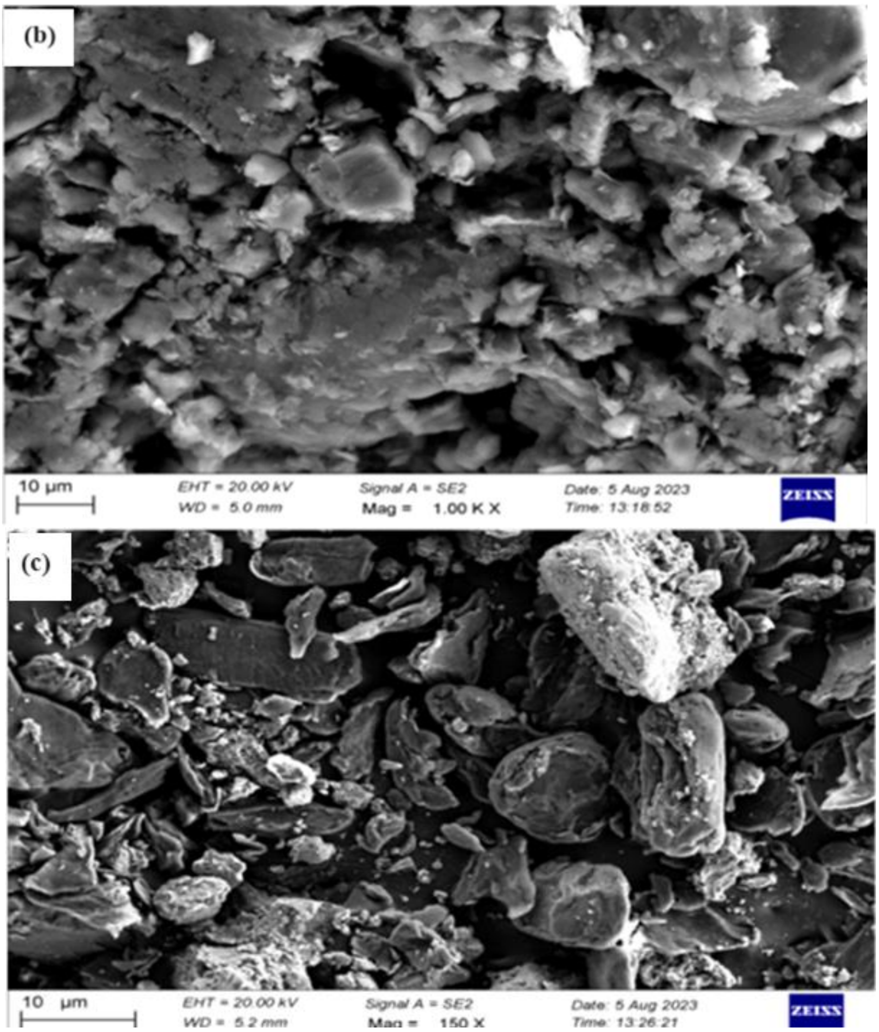


Figure 3: SEM image of (a)Agar powder (b)Alluvial Soil (c) Alluvial soil Added agar powder .

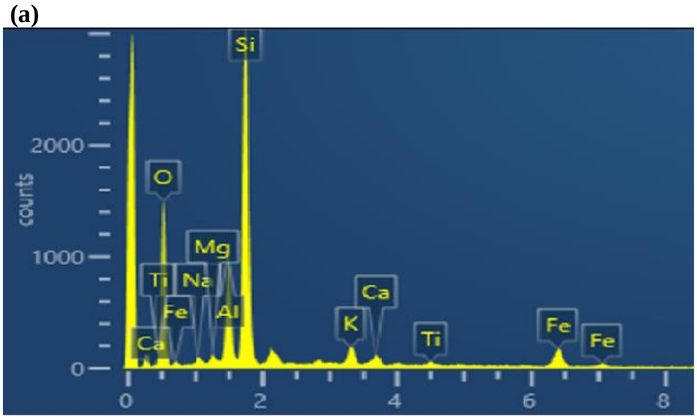
The analytical report of the soil samples before the addition of agar powder is compared to after the addition of agar powder its increase to PH, EC, SOM, SOC and CEC basic Exchangeable bases increases above table 2.

TABLE-2: ALLUVIAL SOIL SAMPLES - ANALYTICAL REPORT

S. No	**Name of the parameter**	**Alluvial soil**	**Alluvial soil added Agar powder**
1.	pH	7.21	7.32
2.	Electrical conductivity(dsm^{-1})	0.16	0.22
3.	Orgonic carbon (%)	0.29	0.38
4.	Orgonic matter (%)	0.58	0.72
5.	Nitrogen(kg/ac)	102.4	109.6
6.	phosphorus(kg/ac)	3.75	3.85
7.	potassium (kg/ac)	132	162
8.	zinc (ppm)	1.21	1.23
9.	Copper(ppm)	1.45	1.30
10.	Iron (ppm)	8.65	8.22
11.	Manganese(ppm)	3.15	384
12.	Cation Exchange Capacity ($cmol^{+}$ /kg)	21.8	24.6
Exchange able Bases (cmol $^{+}$/kg)			
13.	Calcium	15.6	13.2
14.	Magnesium	11.2	10.2
15.	Sodium	2.19	1.63
16.	Potassium	0.26	0.12

EDAX Analysis:

(a)



(b)

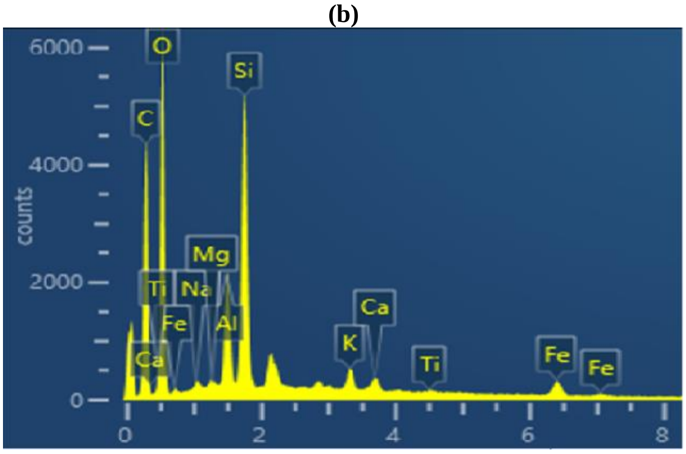


Figure 4: Edax image of (a) Alluvial soil sample (b) Alluvial soil added Agar powder

According to EDX, the addition of agar powder to alluvial soil affects the soil's oxygen dynamics (Figure 4). Soil has an oxygen content of 33.95%, but soil mixed with agar powder has an oxygen content of 35.69%. This difference is primarily caused by the agar powder's changing porosity and the increased accumulation of oxygen (Table 3). Positive changes are also seen in the iron content, which rises by 1.5% in the soil upon the addition of agar. Calcium, potassium, sodium and magnesium are more important basic cations influencing the CEC [16] of the soil.

Application of agar powder greatly increases the Ca, K, Na and Mg contents to the tune of 0.4%, 0.15%, 0.67 and 0.36% in the soil. This is mainly responsible for the higher Cation exchange capacity of agar powder applied to soil. Compared to the other components, nitrogen content increased from 2% to 8.40% which is 10.60% higher than Alluvial soil. Agar powder has nitrogen content, which, in alluvial soil, serves as food and promotes microbial growth. Because the microbes were growing, they needed more nitrogen to continue growing, so they took up nitrogen from the soil to meet their needs, which caused the soil's nitrogen content to drop. Applying a mixed soil containing agar powder increased the soil's orgonic corban [20] and had a positive impact on the physico-chemical and morphological characteristics of the soil.

Table: 3 Composition of the elements in Alluvial soil and Agar powder added Alluvial soil

Elements	Alluvial soil (%)	Agar Powder added Alluvial soil (%)
Oxygen	33.95	35.89
Silicon	25.95	29.29
Aluminium	11.34	12.49
Iron	13.02	14.44
Sodium	0.27	0.94
Calcium	1.60	1.71
Nitrogen	8.40	10.60
Potassium	4.99	5.35
Magnesium	0.75	0.83

CONCLUSION:

In the present study, Agar powder application increased the SOC and had a good impact on the physico-chemical and morphological characteristics of the alluvial soil. SEM image of the agar powder combined with alluvial soil revealed larger micropores and smaller particle sizes. It changed the oxygen, nitrogen, calcium, potassium, magnesium, and sodium contents of the alluvial soil and raised the CEC. Alluvial soil's CEC and SOM and SOC have showed a strong correlation. Agar powder continued the following factors improve the Cation exchange capacity of alluvial soil: pH and Electric conductivity and particle density. This study demonstrated how added SOC under specific management schemes can impact the physical, physico-chemical, and chemical properties of soil. Application of Agar powder to alluvial soil enhances the supply of nutrients like Calcium, Magnesium, sodium, and K as well as the soil's ability to hold water. To improve the Agar powder dose for various crops in a changing environment, it must be evaluated in field settings with various soil types.

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