

OC Kit Manual



Do-It-Yourself Manual

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SCOPE

Organic carbon plays a central role in deciding the health of soil. These Parameters are like crust formation, drainage, salt accumulation, Alkalinity Beneficial microbes, pathogens and soil fertility factors are related to organic carbon. If organic carbon is very low in soil then the soil health gets affected badly. Hence monitoring organic carbon is the most essential and the important parameter of crop yield.

Farmers have become more aware about these ill effects of chemical fertilizers day by day and consumers are demanding organic foods. The kit will be an important tool to test the organic nature of soil. As this is a quick method and ordinary farmers can perform it on the field, then farmers don't have to rely on other agencies for the results. Organic carbon detection kit will be an important component of organic agriculture which is going to be agriculture in the coming decades.

Qualitative organic carbon detection kit is developed at BARC (Bhaba Atomic Research Centre) and modified (quantitative) in Vigyan Ashram. This kit is user friendly and analyses the soil in the field and it is not necessary to carry samples to the laboratory. This helps farmers to decide the doses of chemical as well as other fertilizers in proper time and improve the crop yield. Application of manures and fertilizers at proper time ultimately leads to better yield and hence this kit is expected to help farmers for this purpose.

SOIL ORGANIC CARBON DETECTION KIT (SOCDK).



1. INTRODUCTION

Soil organic carbon is a measurable component of soil organic matter. The ideal soil composition is 45% inorganic components, 5% organic components, 25% air and 25% water. Out of total organic components 50% is carbon; hence it is called organic carbon (OC)

Organic carbon plays a major role in deciding biological activity as well as fertility of the soil. In different parts of the world, positive correlation between the amounts of organic carbon and soil fertility is observed. Indian soil ecosystems are very dynamic due to its subtropical climate, resulting in rapid degradation of organic matter in these soils during monsoon season.

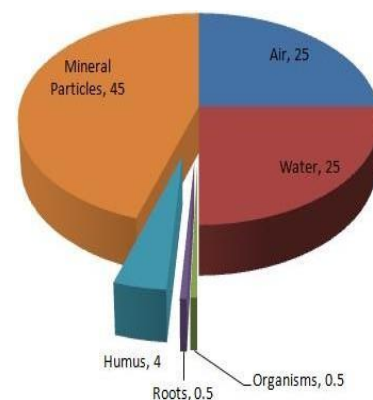


Image-1. Composition of Soil.

1.1 Importance of soil organic

Organic matter contributes to nutrients retention and turnover, soil structure, moisture retention and availability, degradation of pollutants, carbon sequestration of soil resilience.

Higher soil organic carbon promotes soil structure or tilts meaning there is greater physical stability. This improves soil aeration (oxygen in the soil) and water drainage and retention, and reduces the risk of erosion and nutrients leaching.

In the agriculture field organic carbon is called as indicator elements of soil health or the soul of the soil. Considering the importance of soil organic carbon, it was decided to modify a method of analysis of soil organic carbon on the farm suitable for the farmers. BARC has developed a qualitative test method, we want to modify it into a quantitative method.

Image 2-Soil organic carbon.



1.2 Soil organic carbon can help farmer in

- High levels of organic carbon help to maintain agriculture production through its positive role in maintaining soil health, raising fertility, reducing erosion and encouraging soil biota.
- Soil organic carbon is considered the basis of soil fertility.
- Soils with higher soil organic carbon levels are generally more fertile, more productive and easier to manage than low soil organic carbon levels.

1.3 Salient features of SOCDK developed at

1. It is user friendly as any farmer himself can perform this on the field.
2. Developing low cost & easy handling kit for rural labs as well as education institutes.
3. It gives quick and reliable results.
4. Evaluate the impact of organic carbon amendments supplemented periodically.
5. Highly economical as compared with other standard methods.

2. APPLICATIONS

This kit would be useful to a great extent in the agriculture sector.

1. Direct use by the farmer for organic carbon detection of soil before sowing of the crop and at the harvest of the crop. To take corrective measures to maintain the soil organic carbon at optimum levels and evaluating the effectiveness of the organic manure supplements periodically.
2. Agriculture universities and soil-testing labs for research purposes.

3. WORKING PRINCIPLE

There are various methods for extraction of organic carbon from soil. Alkali extraction is one of the methods sodium hydroxide (NaOH) is a strong alkali, which extracts the organic carbon from soil. Addition of disodium hydrogen orthophosphate and sodium pyrophosphate increases the extraction efficiency and a colored complex is formed. This colored complex formed is in direct proportion to the organic carbon content of the soil. Ethylene di-amine tetra acetic acid sodium salt (EDTA –Na salt) stabilizes color.

4. MATERIALS AND THEIR SPECIFICATION

No	Materials/Chemicals	Material /Chemical form	Quantity	Specifications
1	NaOH (Sodium Hydroxide)	Pellets	10 gm	AR grade
2	EDTA (Ethylene Diamine Tetra Acetic Acid Sodium Salt)	Powder	20 gm	AR grade
3	Di-sodium Hydrogen Orthophosphate	Powder	5 gm	AR grade
4	Sodium Pyrophosphate	Powder	25 gm	AR grade
5	Distilled Water	Liquid	1 lit	Distilled
6	Test Tubes	Glass	5 Nos	Borosil glass
7	Spatula	Plastic	2 Nos	1 gm measure
8	Bottles	Plastic	2 Nos	500 ml
9	Funnel	Plastic	4 Nos	50 ml
10	Filter Paper	Paper	100 No	Whatman
11	Test Tube Stand	Plastic	1 No	5 no 50 ml & 5 ml test tubes
12	Dropper	Plastic	2 No	10 ml capacity
13	Hand Gloves	Rubber	1 pair	local

5. PREPARATION OF THE KIT

1. Preparation of solution -A

Dissolved 10gm of NaOH in 500ml distilled water & fill in 500 ml capacity plastic bottles. Stored the bottle at room temperature.

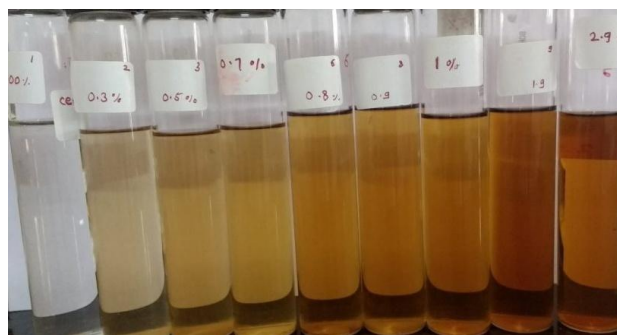
2. Preparation of solution -B

Take 500ml distilled water. Add 18.6gm EDTA-Na salt (Ethylene Diamine Tetra Acetic Acid with Sodium Salt). Keep stirring with your hand until the salt has dissolved completely. Add 5gm of Disodium hydrogen orthophosphate to the solution.

Sample analysis using modified BARC kit: -

1. Take 1gm soil with the help of a spoon.
2. Add it to one 25 ml test tube.
3. Add 10 ml solution -A & 10 ml solution - B to the test tubes with help of syringe or measuring cylinder.
4. Shake well & allow to settle for 30 minutes.
5. Filter above solution in 50 ml test tube using filter paper and compare the obtained color of filtrate with given color comparator.

Image-4 Quantitative Soil Organic Carbon Comparator



This color chart gives quantitative results. from left to right shows an increasing order of organic carbon.


Preparation of Actual Kit:-


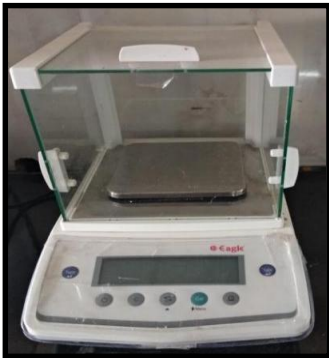

One kit requires the following materials:

MATERIALS	QUANTITY
Plastic Bottles (500 ml Capacity)	02 No
Glass Test Tubes	5 Nos (5ml capacity) 5 Nos (50 ml capacity)
Spatula/Spoon	2 Nos
Plastic Funnel	4 Nos
Filter Paper	50 Nos
Test tube stand	01 No
Hand Gloves	01 pair
Color comparator	01 No
Kit container (Box)	01 No

6. EQUIPMENT REQUIRED FOR TESTING OF KIT

Following Equipment is required for preparation of the kit:-

Sr.No.	Equipment Name	Description	Image
1.	Water distillation unit	This unit was designed in Vigyan Ashram with a cooker and Condenser.	

2.	pH meter	<p>Extraction of organic matter in a given soil sample depends on pH of extracting solution(solution A)</p> <p>Hence an accurate pH meter is required to monitor the extraction solution</p>	
3.	Weighing balance	<p>It is required to measure the chemicals before preparation of solutions required to analyze the samples.</p>	
4.	Magnetic stirrer	<p>It is required for proper mixing the chemicals in the reagents.</p>	

Comparison of standard method(H_2SO_4 Method, BARC and SOCDK (Vigyan Ashram).

Category	Standard Method	BARC SOCDk	Vigyan ashram SOCDK
Facility	Good laboratory with equipments	In farming field by farmer himself	In farming field by farmer himself
Man power	Need to skilled chemist	farmer	Farmer
Time	1-2 Hour per test	15 minutes per test	30 minutes per test
Cost	More cost	Less cost	Low cost
Results	Quantitative results	Qualitative results	Quantitative result
Efficiency	Gives exact carbon content in the field	Gives ideas of low, medium Sufficient level of organic carbon content in the field	Gives ideas on the percentage level (0 to 9) of organic carbon content in the field.

Soil Sample Collection & Processing: -

