

# Comparative Soil Study from the various beaches in Malvan, District Sindhudurg, Maharashtra, India

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## ABSTRACT

The soil is an intermediate between the atmosphere and lithosphere and also between the hydrosphere and lithosphere, thus forming a part of the biosphere. The soil may be defined as the uppermost weathered layer of the earth's crust, in which are mixed organisms and products of their death and decay. Malvan is an important town in the Sindhudurg district of Maharashtra state. Malvan is the main sea beach and also an important fish landing centre of the state. There are also a few important sea beaches around the Malvan town, namely Chivla, Tarkarli, and Deobaug. These beaches are known for sea sport activities. The beaches are really under tremendous anthropogenic pressure. The present research aims to determine the health and level of pollution of the seashore soil of Malvan and other beaches around Malvan, namely Chivla, Tarkarli, and Deobaug. In the present study the pH value of sea beach soil on all four beaches lies in the range of 7.5 to 8, hence the pH is normal. The soil texture of sea beach soil on all four beaches is sandy in nature. The chloride content of sea beach soil on all four beaches ranges from 51.06 to 54.25 mg/l, while the calcium and magnesium ranges from 1.2 to 1.8 g/kg, they are almost near to normal value. Soils of the coastal region are generally less fertile and poor in organic matter content, ranging from less than 1% to 1.5%. The organic matter content ranges from 3 to 4.5% on all four beaches near Malvan, that is slightly higher than the predicted range. The overall conclusion that we draw from the results, discussion and comparison of the observations with other research studies is that the beach soil from all four beaches near Malvan namely, viz., Chivla, Tarkarli, Deobaug, and Malvan are in good health and free from pollution even though they are subjected to severe anthropogenic activities.

**Key words:** pH, Soil Texture, Chloride, Hardness, Organic matter, Malvan.

## Introduction

The soil is an intermediate between the atmosphere and lithosphere and also between the hydrosphere and lithosphere, thus forming a part of the biosphere. The soil may be defined as the uppermost weathered layer of the earth's crust, in which are mixed organisms and products of their death and decay. It may also be defined as the part of the earth's crust in which plants are anchored. The soil is a mixture of inorganic matter, organic matter, soil organisms, soil moisture, soil solution, and soil air.

Roughly, the soil contains 50-60% mineral matter, 25-35% water, 15-25% air, and a small percentage of organic matter (Nisha *et al.*, 2017).

The health of beach soil depends upon the various parameters such as pH, texture, chloride, organic matter, calcium, and magnesium. The beaches in India are subjected to various anthropogenic activities, as most beaches are tourist destinations. Some of the beaches are used as fish landing centres. The fish landing centres are filthy due to waste materials (Perumal *et al.*, 2023).

Malvan is an important town in the Sindhudurg

district of Maharashtra state. Malvan is the main sea beach and also an important fish landing centre of the state. There are also a few important sea beaches around the Malvan town, namely Chivla, Tarkarli, and Deobaug. These beaches are known for sea sport activities. The beaches are under tremendous anthropogenic pressure.

The present research aims to determine the health and level of pollution of the seashore soil of Malvan and other beaches around Malvan, namely Chivla, Tarkarli, and Deobaug. The determination of health and level of pollution will be determined through analysis of various physico – chemical parameters. Very limited studies are carried out on sea beach soil analysis. Presently, studies are mostly focused on litter and microplastics from beaches and coastal environments. Sea beach pollution damages the aesthetic value of the seashores, and they also lead to the spread of various kinds of diseases as the beaches are frequently visited by tourists. Such kind of research helps the scientists, policymakers, industries, and the general public to prepare policies and help to control the pollution in the seashore soil. (Sivadas *et al.*, 2022).

## Materials and Methods

The soil samples from 4 different beaches near Malvan, Sindhudurg, Maharashtra, India, viz., Chivla, Tarkarli, Deobaug, and Malvan, were collected during the pre-monsoon period. The soil sample was lifted using a clean trowel, and it was collected in a sterilized, washed, and sun-dried plastic container and brought to the laboratory for further analysis.

The soil was analyzed for various parameters, as mentioned in Table 1. The readings were taken in multiples to minimize testing errors.

## Results

All the parameters were analyzed as per the meth-

ods mentioned. The readings were taken in multiples to minimize testing errors. The results were represented in the form of average and its standard deviation.

## Discussion

The present soil analysis was carried out at four beaches of Malvan, viz., Chivla, Tarkarli, Deobaug, and Malvan. Three beaches, namely Chivla, Tarkarli, and Deobaug, are tourist destinations famous for beach and water sports activities. While Malvan Beach is a major fish landing centre. All four beaches are under tremendous pressure due to anthropogenic activities.

The pH value of sea beach soil on all four beaches lies in the range of 7.5 to 8, i.e., slightly alkaline. It clearly shows the more alkaline nature of the seashore soil. This may be due to the presence of more amounts of different types of salt in the sand.

The soil texture of all four beaches is sand 90 to 92%, silt 8 to 10%, and particle size between 0.05 and 2 mm in diameter. The soil texture clearly indicates the sandy soil. Sandy shores are highly dynamic environments. They have a characteristic biodiversity and represent a unique gradient of habitats.

The chloride content ranges from 51.06 to 54.25 mg/l; only Deobaug Beach shows a higher chloride content in the soil, i.e.,  $79.78 \pm 13.91$  g/L. The chloride content in sea sand depends on the chloride content in sea water. The sea water contains relatively constant chloride content, but more moisture content in sand retains more chloride around particles. In hot climates, though the moisture content is less, due to the evaporation of moisture, chloride coating will be formed around sand particles, due to which the chloride content in sea sand is higher.

The calcium and magnesium ranges from 1.2 to 1.8 g/kg; only the Tarkarli beach shows higher calcium and magnesium content in the soil, i.e.,  $1.8 \pm$

**Table 1.** Parameters and methods of analysis

Sr. No.	Parameter	Method
1	pH	Universal Indicator
2	Texture	Sedimentation Method
3	Chloride	Argentometric Method
4	Calcium and Magnesium	EDTA Method
5	Organic Matter	Walkley and Black Method

(Gupta, 2007)

**Table 2.** Results of the Analysis of Soil Samples from the Beaches in Malvan

Sr. No.	Parameter	Sampling Station 1 Chivla beach	Sampling Station 2 Tarkarli beach	Sampling Station 3 Deobaug beach	Sampling Station 4 Malvan beach
1	pH	7.5 ± 0.86	8.0 ± 1.04	7.5 ± 0.28	8.0 ± 0.86
2	Texture	Sand 91 % and Silt 9 % 0.05 to 2 mm diameter	Sand 90 % and Silt 10 % 0.05 to 2 mm diameter	Sand 90 % and Silt 10 % 0.05 to 2 mm diameter	Sand 92 % and Silt 8 % 0.05 to 2 mm diameter
3	Chloride	51.06 ± 13.02 g/L	57.44 ± 3.19 g/L	79.78 ± 13.91 g/L	54.25 ± 15.74 g/L
4	Calcium and Magnesium	1.5 ± 0.26 g/kg	1.8 ± 0.25 g/kg	1.7 ± 0.15 g/kg	1.2 ± 0.25 g/kg
5	Organic Matter	3 ± 0.64%	4 ± 0.5 %	3.5 ± 0.5 %	4.5 ± 0.76 %

0.25 g/kg. The calcium and magnesium content are high in the soil as the seawater is rich in calcium and magnesium ions that get deposited in the soil. The organic matter content ranges from 3 to 4.5%; only Malvan Beach shows higher organic matter in the beach soil, i.e., 4.5 ± 0.76 %. The higher organic matter indicates a higher amount of carbon and nitrogen ratio. The sea soil is periodically inundated by sea water during high tide; this increases the amount of organic matter in the beach soil.

## Conclusion

As per Nisha *et al.*, (2017), the most significant property of soil is its pH level, Its effects on all other parameters of soil. Therefore, pH is considered while analysing any kind of soil. If the pH is less than 6 then it is said to be an acidic soil, the pH range from 6 - 8.5 it's a normal soil and greater than 8.5 then it is said to be alkaline soil. In the present study the pH value of sea beach soil on all four beaches lies in the range of 7.5 to 8, hence the pH is normal.

As per Rejith *et al.*, (2019) the soil texture of beaches varies as different locations and is never uniform. The soil texture of sea beach soil on all four beaches is sandy in nature, which is normal.

As per Geilfus, (2019), Chloride content in sea beach soil in India varies depending on the vicinity to the shore. In coastal areas, it can be as high as 50 mg/L, while in inner continental areas, it decreases to 2-6 mg/l. The chloride content of sea beach soil on all four beaches ranges from 51.06 to 54.25 mg/l, hence its almost near to normal.

The Pandya *et al.*, (2022) research study on coastal soil of selected coastal areas of Bhavnagar District, Gujarat, India clearly stated that the highest content of Magnesium ion found was 2.49 g/kg. Whereas, the calcium and magnesium content of sea beach soil on all four beaches ranges from 1.2 to 1.8 g/kg.

This clearly shows that the hardness of the sea beach soil is within the normal range.

As per Rejith *et al.*, 2019, soils of the coastal region are generally less fertile and poor in organic matter content, ranging from less than 1% to 1.5%. The low organic content indicates poor physical condition of the coastal soils. The organic matter content ranges from 3 to 4.5% on all four beaches near Malvan, that is slightly higher than the predicted range. This show a good health condition of the soil even though it is still poor in organic matter content.

The overall conclusion that we draw from the results, discussion and comparison of the observations with other research studies clearly states that the beach soil from all four beaches near Malvan namely, viz., Chivla, Tarkarli, Deobaug, and Malvan are in good health and free from pollution even though they are subjected to severe anthropogenic activities. The government and policy makers must frame certain policies and try to maintain the pollution free nature of the beach soil along the various beaches in and around Malvan.

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**Conflict of Interest - None**

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