IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Experimental Analysis Of The Erosion Degree In The Menamkulam Coastal Region

[1]Merin Susan Manu, [2]Dr. Rani V

[1]PG Student, [2]Associate Professor

Dept. of Civil Engineering,
Marian Engineering College, Trivandrum, Kerala, India

Abstract: Kerala, located in the southwestern part of India, is vulnerable to various natural calamities, including floods, landslides, coastal erosion, tsunamis, and cyclones. As a result, it is considered a multi-hazard-prone state in the country. The state has a coastline of approximately 590 km, spanning nine districts. A study conducted by the National Centre for Earth Science Studies in November 2018 revealed that 60 per cent of Kerala's coastline is experiencing erosion. Notably, in 2021, 23% of Trivandrum's coastline was affected. Various research efforts have examined shoreline changes using satellite and remote sensing data, which have identified erosion hotspots based on historical data. Further investigations included setting up a laboratory model to assess the degree of erosion in selected regions. A sandy slope was created in a tank for the study, and the degree of erosion was evaluated under varying water velocities. Chitosan, a biopolymer that is usually extracted from crustacean shells of the food processing industry was used and its impact on erosion resistance was analyzed

Index Terms **- Coastal erosion, Field soil, Erosion Degree, Menamkulam region, Chitosan, Velocity variation**

I. INTRODUCTION

Coastal regions have garnered significant attention due to recent population growth and rapid development near coastlines. In India, 20% of the population and a considerable portion of the environment are located in coastal areas. Beach erosion is a global issue, with reports indicating that 70% of the world's beaches are experiencing erosion. [2]. Coastal erosion caused by ocean waves and near-shore currents is a significant issue affecting all of India's coastal states. As a result of erosion, extensive areas of land are lost, and valuable homes, businesses, and coastal structures suffer damage. Satellite-based studies are currently being conducted to analyze changes in shorelines over the years. [3,4], experimental studies considering particular areas are limited especially those of the Kerala region. Though eco-friendly measures are experimented for the stabilization of various soil types and erosion control [5,6], the effect of natural byproducts on erosion resistance of coastal regions is a lesser investigated area. The current paper tries to assess the erosion degree of Menamkulam region, Kerala, India considering varying velocities and analyze the effect of using Chitosan on erosion resistance

II. MATERIALS

2.1 Soil

The soil taken for the study is collected from the Menamkulam region of Trivandrum district, Kerala, India. The soil collected is shown in Fig.1. The soil was collected from Arattuvazhi beach of Menamkulam region. The soil was found to be poorly graded sand (SP). The properties of the soil are listed in Table 1.

FIG.1. MENAMKULAM SOIL

TABLE 1 PROPERTIES OF SOIL SAMPLE

Property	Values
Specific Gravity	2.66
Coefficient of uniformity, C_u	1.77
Coefficient of Curvature, C_c	1.13
IS Classification	SP
Angle of Internal Friction, ϕ (degrees)	31°
Cohesion, c (kg/cm^2)	0.05

2.2 Chitosan

The chitosan used in the study was collected from Matsyafed Fishmart, Palayam, Trivandrum. The properties of the chitosan collected are listed in Table 2.

FIG.2. CHITOSAN

TABLE 2 PROPERTIES OF CHITOSAN

Property	Values
Appearance	Off-white powder
Particle Size	80µm
Degree of deacetylation	> 90%
Viscosity	150-200mPa.s
Moisture Content	< 10%
Ash Content	<1%

III. METHODOLOGY

The literature indicates that the erosion rate increases with the slope angle [1]. For this study, a slope of 30 degrees was chosen. The 30-degree slope was modelled in a glass tank for experimentation. Waves were generated using a wave generator at velocities of 0.06, 0.07, 0.08, and 0.09 m/s. The study was conducted for one hour. The erosion degree, denoted as De, was calculated as described in equation (1). An erosion degree of unity represents the maximum stability, indicating that the soil is not eroding. As the erosion degree deviates from unity, it indicates that a greater amount of soil is being eroded.

$$D_e = \Theta/\Theta' \qquad (1)$$

The erosion degree of untreated soil at various time intervals was calculated, and was done similarly by considering Chitosan as an erosion-resisting agent. The optimum dosage of chitosan was obtained as 5% through the Direct Shear Test.

IV. RESULTS AND DISCUSSIONS

The erosion degree obtained for 30˚ slope in the untreated case and after treating with chitosan is discussed. Fig. 3 represents the comparative graph showing the variation in erosion degree for time in four varying velocities.

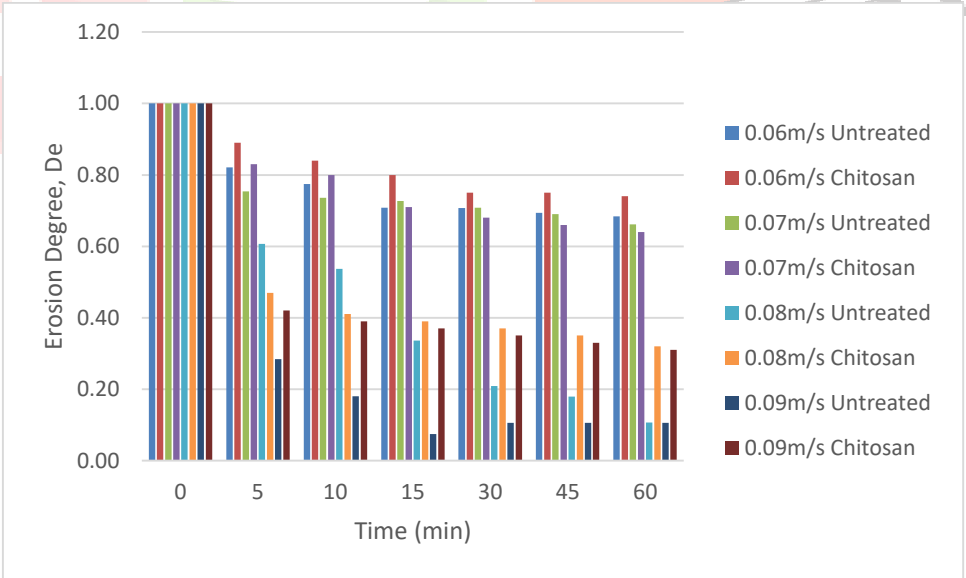

FIG.3 COMPARATIVE GRAPH SHOWING VARIATION IN EROSION DEGREE WITH TIME AND VELOCITY

From the data, it can be observed that the erosion degree is lesser at peak velocities indicating that more amount of soil mass is being eroded. The least value of erosion degree obtained is 0.11 in the case of untreated soil in peak velocity. The erosion degree is improved to 0.31 with the use of Chitosan. This enhanced erosion resistance is due to the interaction between the Chitosan and soil particles. Though it offers erosion resistance, it's effect is minimal in higher velocities

V. CONCLUSIONS

The experimental studies are carried out for a period of 1 hour in 30˚ slope and at four velocities. The following conclusions are made from the study:

- Menamkulam soil is found to have erodible soil from experimental test results.
- Erosion degree is found to be the least in peak velocities, indicating more soil mass being eroded.
- Chitosan offers an erosion degree value of at least 60% in all cases except the higher two velocities
- In the peak velocities, it offers around 30 to 40% resistance

REFERENCES

[1] Hataf N, Ghadir P and Ranjbar N(2018), "Investigation of soil stabilization using chitosan biopolymer", *Journal of Cleaner Production*,170(1), 1493-1500.

[2] Husseinsyah S , Azmin A N , and Ismail H(2013), "Effect of Maleic Anhydride-Grafted-polyethylene (MAPE) and Silane on Properties of Recycled Polyethylene/Chitosan Biocomposites", *Polymer-Plastics Technology and Engineering*, 52, 168–174

[3] Islam MA, Islam MS , Chowdhury E, Badhon FF (2021), Influence of vetiver grass (Chrysopogon zizanioides) on infiltration and erosion control of hill slopes under simulated extreme rainfall condition in Bangladesh", *Arabian Journal of Geosciences*,14: 119, https://doi.org/10.1007/s12517-020-06338-y