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PERFORMANCE OF RECRON-3S FIBER ON BLACK COTTON SOIL

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Abstract

This study deals with the stabilization of soils through the application of recron fiber. The main aim of this study is to determine the percentage of recron fiber that would be added to black cotton soil to obtain the optimum stability of the soil. In order to achieve these, the following tests are carried out; pycnometer test, casagrande's test, proctor compaction test, sieve analysis, unconfined compressive strength test.

The soil index tests are carried out. Compaction test is carried out in order to determine the maximum dry density and optimum moisture content of black cotton soil. Specific gravity of soil is also determined as to know the index experiments values and lastly, unconfined compressive strength test should be carried out to determine the compressive strength of black cotton soil sample. Then unconfined compressive strength is repeated to the soil sample along with the addition of recron fiber and cement separately in percentages as a stabilizing agent. After carrying the above tests, observations are to be noted and results are calculated. A perfect material for the given sample is recommended for maximum stability.

Key words: Recron fiber, Compaction, unconfined compressive strength, stabilizing agent.

1. INTRODUCTION

Black cotton soil is one of the problematic soils that posses a high shrinkage and swelling. This soil is considered as a poor soil from civil engineering point of view. If any construction is built on this soil, it may lead to failure of the structure. Various ground improvement techniques are used for improving clayey soils. Among all other techniques, soil stabilization is considered as one of the most recommended method for such type of soils. Soil stabilization is a process of improving one or more properties of soil (index and engineering properties). There are many methods of stabilization to improve soil properties like additive stabilization, mechanical stabilization etc,. By the process of stabilization, shear strength of the soil can be improved. Bearing capacity of soil is also increased by this process. Some of the principles of stabilization are:

1. Properties of soil are evaluated.
2. Deciding the economical method of soil stabilization. Need for stabilization of soil:

Almost a11 constructions are constructed on soil. When unsuitable constructions are encountered, a contractor has four options.

1. Find a new construction site.
2. Redesign the structure in such a way that the soil bearing capacity is enough.
3. Poor soil has to be removed and replace with good soil

Above 3 conditions are practically not possible, so we have to go for another technique that is-

4. improving the engineering properties of site i.e. Stabilization of soil.

The main objective of stabilization of soil is to improve the performance of materials by increasing its strength, stiffness and durability.

2. LITERATURE REVIEW

P. Sowmya ratna et al (2016)[1] studied the behaviour of recron- 3s fiber with lime in black cotton soil stabilization. They have made a work to study California bearing ratio characteristics and compaction characteristics of black cotton soil by adding different proportions of recron- 3s fibers and lime for obtaining the optimum percentages. By using these stabilizing agents the liquid limit value was decreased from 84%to 67% and there is an increment of plastic limit from 55% to 60.5% and there by the value of plasticity index is decreased from 29% to 26.4%. Siyyagella subbarayudu et al (2017)[2] studied the soil stabilization with recron - 3s fiber, lime and fly ash. They have used lime with proportions as

2 %,3% and 4%, recron -3s fibers(1%, 2%) and fly ash of 10 %, 12%, 15%, 20% respectively. With these stabilizing agents the value of California bearing ratio has improved compared to other materials. So by this the pavement thickness can be reduced to some extent. Unnam Anil et al (2018) [3]studied the effect of recron 3s fiber and tile waste on the expansive soil. The MDD at 15% tile waste and optimum moisture content are decreasing with addition of tile waste. It attains MDD at 1.5% of recron 3s fiber. The soaked CBR increased with the increase in the percentage of tile waste. It is found that 15% tile waste and 1.5% recron 3s fibers are optimum percentages. Ashraf, Mohammad &Hossen, Md&M.A.Ali, &B.P.Chakraborty(2018) [4] has studied the stabilization of soil wit different percentage of lime. It was found that the strength of the soil increases with the increase in the percentage of lime content to a certain limit. On paddy land at 8% lime there is a maximum compressive strength while on hilly land; at 6% lime content there is a maximum compressive strength. Kolay, Prabir & R., Suraya. (2007). [5] has studied the organic soil stabilization using different types of stabilizers. They have used stabilizers like cement, lime and fly ash. From this study cement is highly suitable stabilizer. After cement, fly ash and lime are most suitable stabilizers. Sabat, Akshaya. (2012) [6] Studied the behavior of waste ceramic dust on soil. Irrespective of percentage of ceramic dust, the liquid limit, plastic limit and plasticity index goes on decreases. When 30% ceramic dust is added to expansive soil, it changes from CH to CL group. With the increase in the percentage of ceramic dust, the maximum dry density goes on

increasing and optimum moisture content goes on decreasing. The unconfined compressive strength of expansive soil goes on increasing with the increase in percentage of ceramic dust. When 30% of ceramic dust is added, the swelling pressure is decreased to some extent. From this analysis it is found that upto 30% of ceramic dust can be used for stabilizing the expansive soil. Lakshmi, S. Muthu & Sasikala, S &Padmavathi, V &Priya, S &Saranya, V. (2018) [7] studied the behavior of coconut coir fiber with expansive soil. Compaction parameters have changed with the addition of coconut coir fiber. With the addition of coir fiber, the MDD is increased and OMC gets decreased. CBR value also improved with the addition of coconut coir fiber. Shaia, Hussein & Aodah, Haider & Al-Humeidawi, Basim. (2016) [8] studied the soil stabilization using natural coir fiber. From direct shear test by adding 0.5%,1.0% and 1.5%, there is an increase in cohesion found to be 10%, 4.8% and 3.73% and internal friction is increased. Other parameters like UCS, shear strength also increased by adding coir fiber to the soil. So reinforcing with coir fiber is considered as a good ground improvement technique.

3. MATERIALS USED

Black cotton soil:

About 50 kg of black cotton soil sample is collected by excavation from a depth of 1 m from ground, near marri laxman reddy institute of technology and management, gandimaisamma, telangana. The soil sample is air dried and it is pulverized to a powder. The soil is cleaned by removing dried leaves, boulders etc. The soil is sieved through IS sieve 425 microns. And this soil is used for testing. The physical properties of soil are specific gravity =2.351, liquid limit =69%, plastic limit =29.165%, maximum dry density =1.94 g/cc, optimum moisture content =10.8%.

Recron 3s fibers:

In this study, recron 3 s fiber is used, since it is a synthetic material fiber and has low cost. And it will not allow absorption with moisture present in soil. In this study we have used 12 mm length fiber. And this fiber was manufactured by Reliance industries. All the tests are done by adding recron fiber randomly.

4. EXPERIMENTAL INVESTIGATION

Some of the tests are done in the laboratory for determining Index and other engineering properties of the soil. Tests, such as liquid limit, plastic limit, proctor compaction, CBR tests were conducted by using different proportions of recron fiber with black cotton soils. This is to find optimum percentage of fiber.

The overall tests are performed with different percentages of recron fiber i.e., 0.1%, 0.2%, 0.3%, 0.4%, 0.5% by weight was used.

Index properties: Plastic limit and liquid limit of black cotton soil are determined by adding different percentages of recron fiber .These tests are carried out as per IS code.

Compaction properties: OMC and MDD of black cotton soil and stabilized black cotton soil with different percentages of recron fiber were determined according to IS light compaction test.

California bearing ratio tests: Different samples were prepared for this test using BC soil mixing with different percentages of recron fibers, to determine optimum percentage. The CBR test is done as per IS code (IS : 2720 (part - 16)-1979) under unsoaked condition.

5. RESULTS AND DISCUSSIONS

Liquid limit results

It is observed that with the addition of recron fiber, the liquid limit continuously decreases from 69% to 56.25%.The variation of liquid limit with the addition of different proportions of recron fiber is shown in Figure 1.

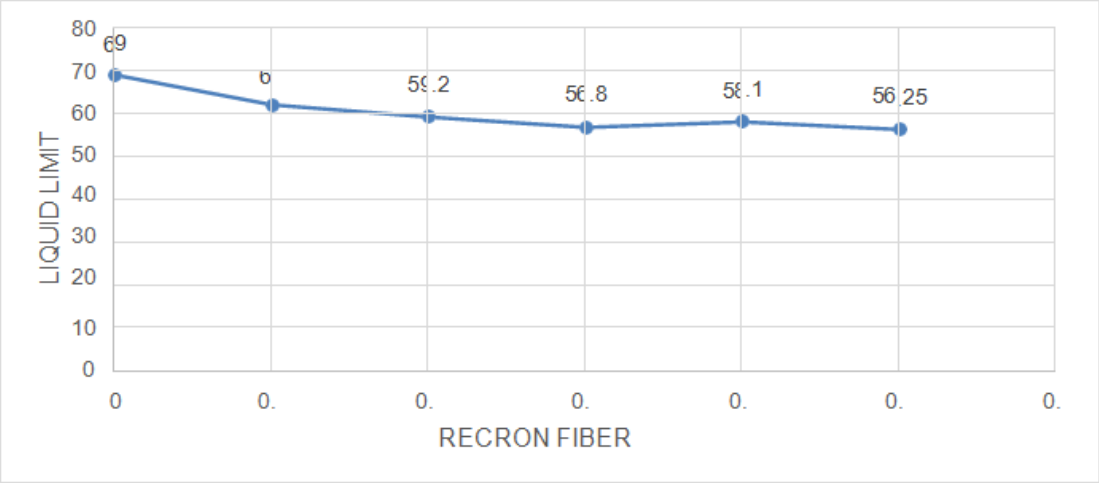

Fig.1 Variation of liquid limit with fiber content

Plastic limit results

It is observed that with the addition of recron fiber, the plastic limit continuously increases from 29.165% to 44.33%.The variation of plastic limit with the addition of different proportions of recron fiber is shown in Figure 2.

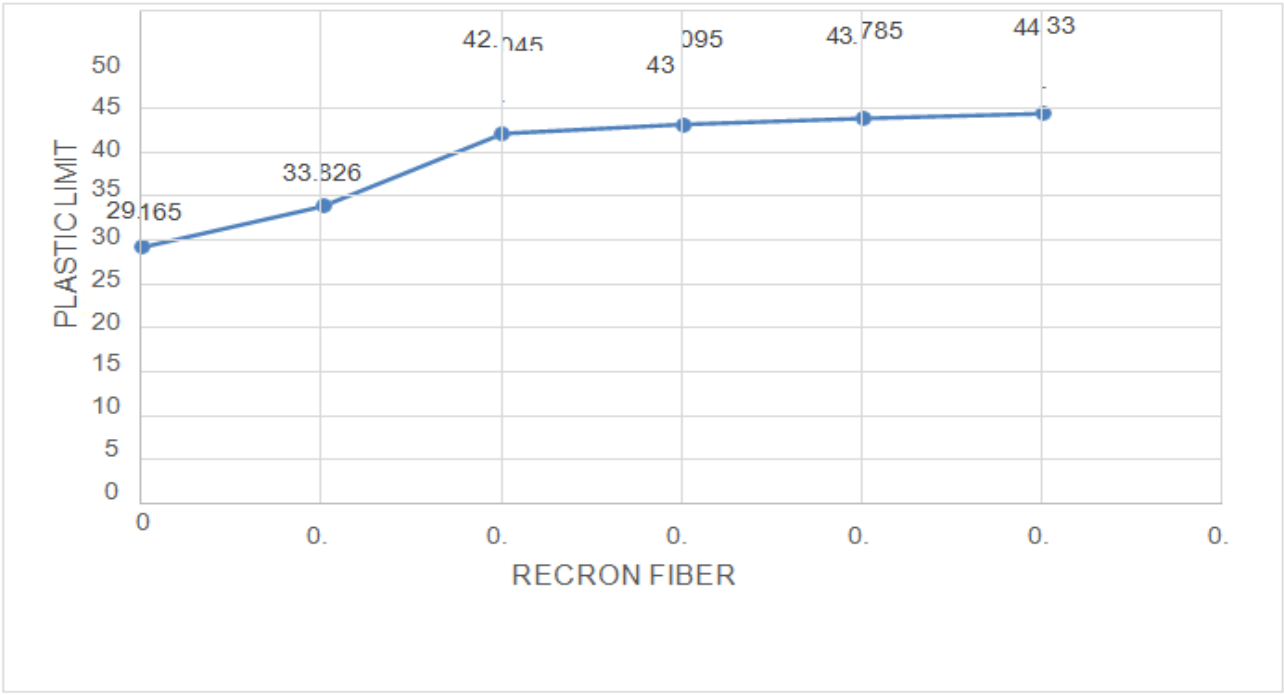

Fig.2 Variation of plastic limit with fiber content

Compaction Characteristics

The variations of Maximum dry density and Optimum moisture content with recron fiber contents mixed with black cotton soil are shown in Figure 3 and 4 respectively. The OMC is increased while the MDD is decreased with increase in recron-3s fiber content.

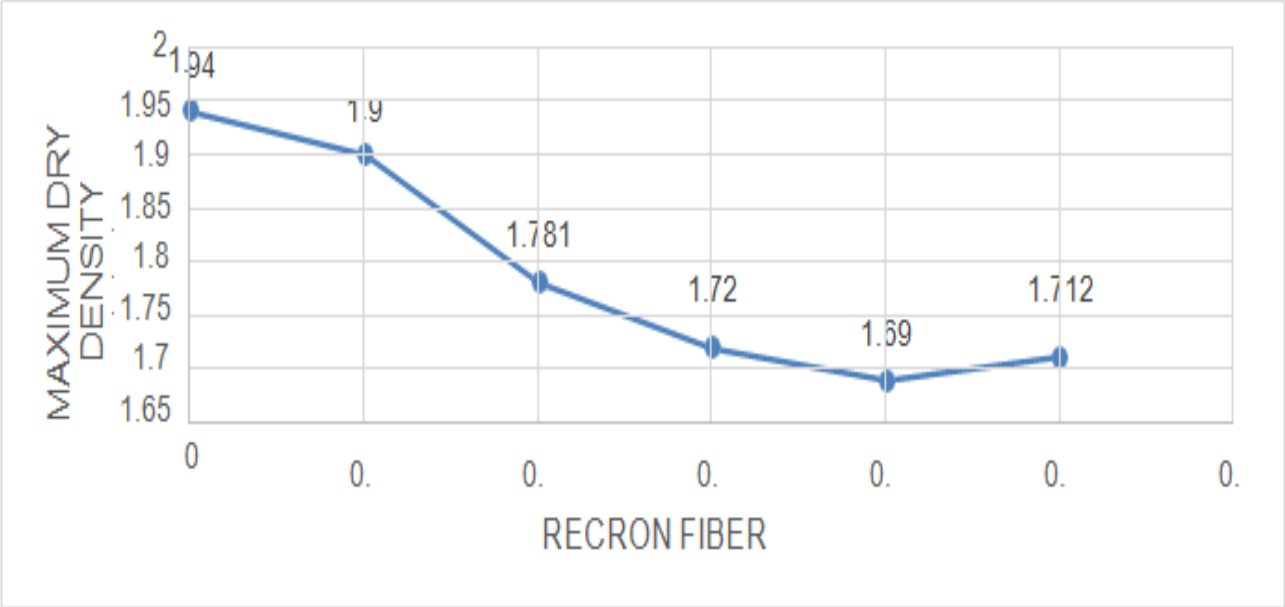

Fig.3 Variation of MDD with fiber content

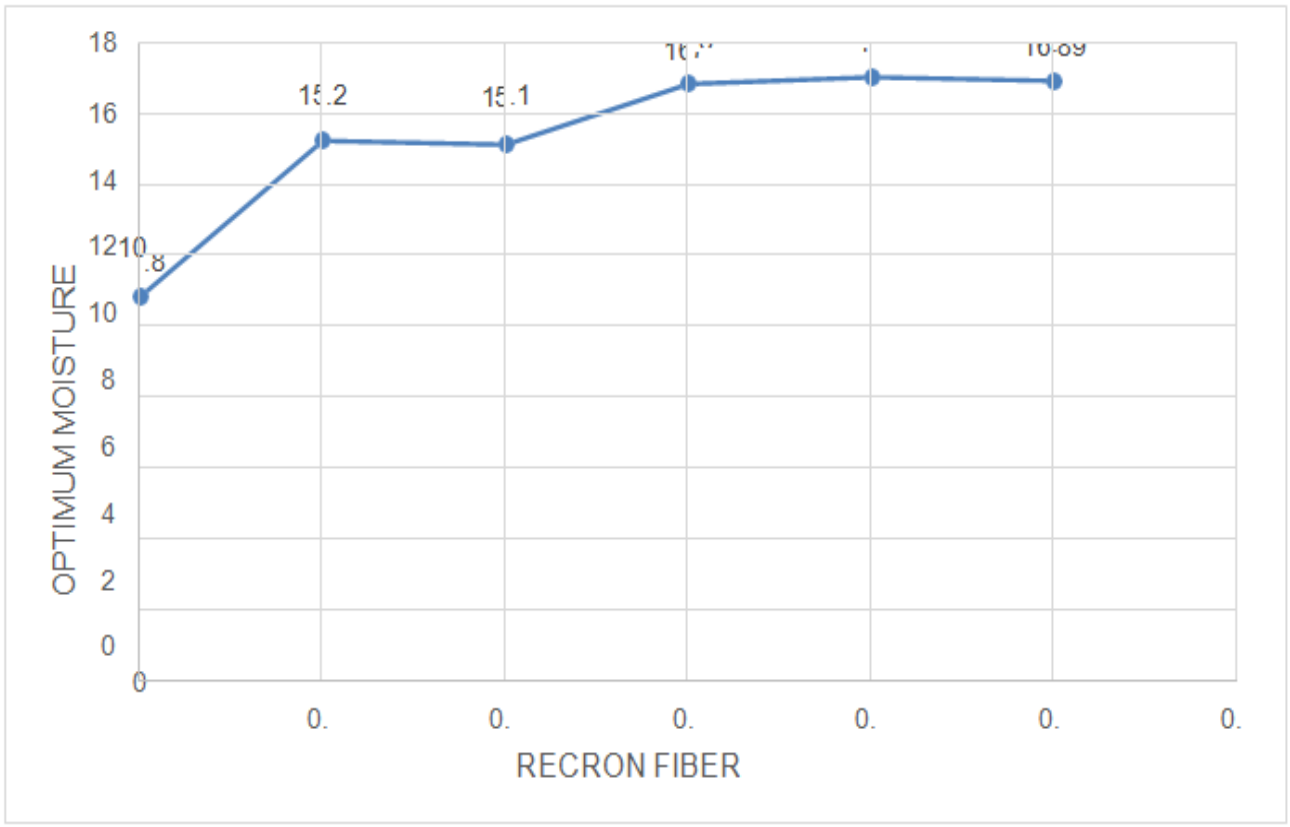

Fig.4 Variation of OMC with fiber content

California Bearing Ratio

California bearing ratio test is one of the common test used in pavement design.CBR is used in the design of sub base material and base material of pavement. If the value of CBR is more then we can reduce the thickness of pavement. In the present study the value of CBR increases with the increase in fiber content. The variation of CBR with different proportions of fiber content is shown in below Figures 5 and 6.

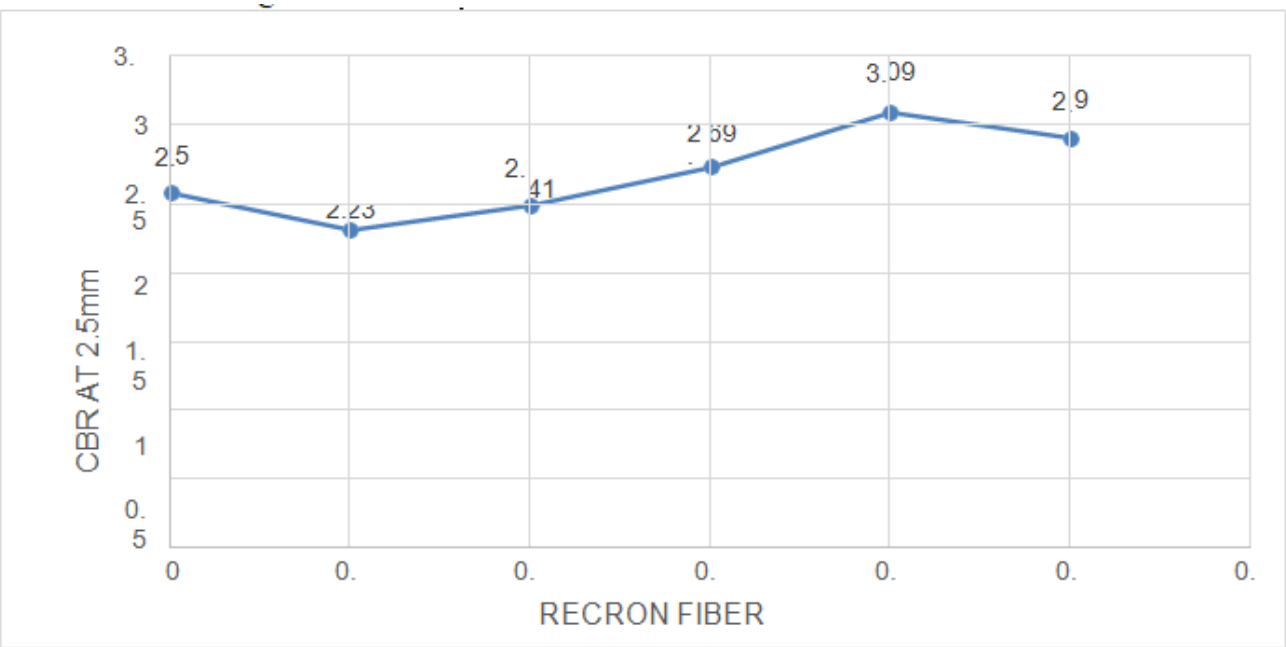

Fig.5 Variation of CBR 2.5 mm with fiber content

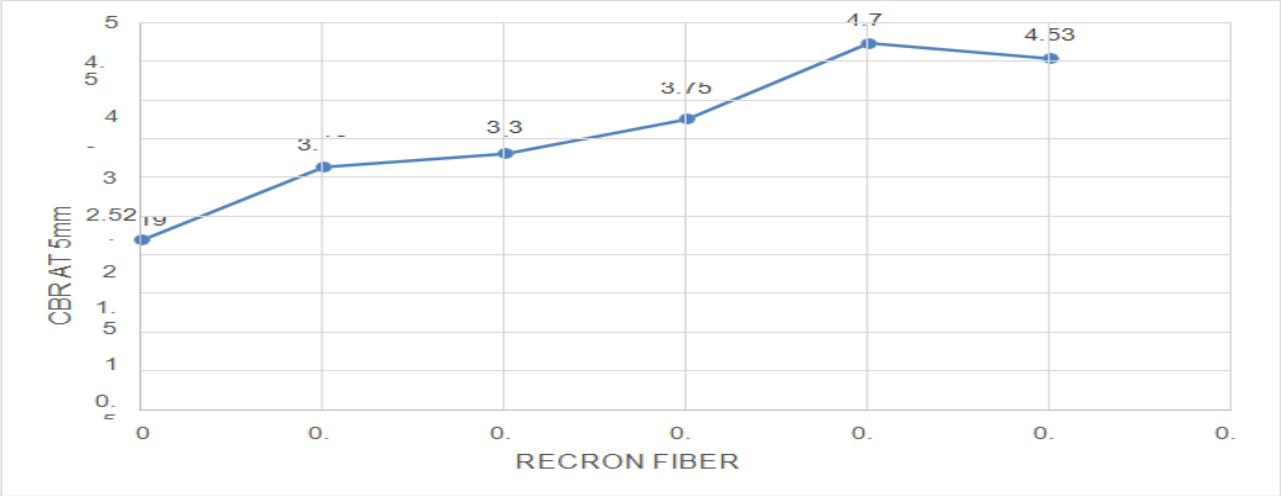

Fig.6 Variation of CBR 5mm with fiber content

6. CONCLUSION

The present study on the topic “performance of Recron-3s fiber on black cotton soil" has been carried out to assess the effectiveness of Recron-3s fiber on soil by adding it in different proportions. Extensive experimental work was carried out on the some of the engineering properties of soil. Major changes were observed in the properties of soil on the addition of recron fiber. The following conclusions were yielded from this study.

Addition of recron fiber has shown decrement in liquid limit from 69% to 56.25% and plastic limit increases from 29.165% to 44.33%.

Maximum dry density decreased to 1.712 g/cc from 1.94 g/cc. The decrease in the MDD may be explained by considering recron fiber as filler in the soil voids.OMC increased from 10.8% to 16.89%.

CBR values of unsoaked with the addition of recron fiber (0.1 % to 0.4%) beyond the value are decreased with further addition of fiber content. From the above experimental results the optimum percentage of recron fiber is 0.4%.

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