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Effect of Marble Dust and Silica Fume on Expansive Soil Properties

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Abstract: ***This Reserch paper presents the improment of engineering properties of black cotton soil with the addition of stabilizers of silica fume and marble dust. The black cotton soil have the poor supporting capacity that is load bearing capacity and also having high strength and swelling due to which when water mixed with black cotton soil then its volume will increase up to approximate two to three times of its initial volume (Enhance volume up to 220%), due to this swelling phenomena bearing capacity of black cotton soil will decrease and when the water content of these soil is reduced to a certain extent then cracks will be generated.***

So stability of foundation and payment will badly affected hands to overcome these problems some additives are mixed with different amount and various steps tests was performed to find the most appropriate quantity of that additive. The marble dust contains high amount of calcium, silica, alumina which aids in stabilization of the soil. The tests are performed a various percentage of Marble Dust is the (0, 2 , 4 and 6%) and the Silica Fume is performed a various percentage (0, 2.5, 5, 7.5 and 10%) .

The adding the Marble dust increasing the percentage of marble dust, the decrease plasticity index and liquid limit. Increasing in marble dust causes an optimum moisture content decrease and maximum dry density is increasing. The compressive shear strength, California Bearing Ratio (CBR), swell pressure is improved by using of Marble Dust so that Mable Dust is considered as successful material in improving the soil properties. The results clarified that the silica fume increasing leads to decrease the plasticity index and liquid limit. Increasing in silica fume causes an increasing in plastic limit and optimum water contents while the maximum dry unit weight values decrease. The compressive shear strength, California Bearing Ratio (CBR), swell and swell pressure is improved by using silica fume so that silica fume can be considered as successful material in improving the soil properties.

Keywords: Black cotton soil, Marble Dust, Silica Fume

I. INTRODUCTION

The any Engineering structure for land based construction there structure, foundation is most important and should be strong enough to supports, the any structure have a load and its transfer to the soil. So any civil engineering construction the foundation, pavements, highway railways. The soil bearing capacity is mostly important part of any construction, if there is soil have poor bearing capacity then structure is a collapse. A civil engineering especially when the subgrade soil is found to be clayey soil, these soils usually have a tendency to change in volume if there is any change in moisture content.

A great challenge faces civil engineering especially when the subgrade soil is found to be clayey soils, these soils usually have in moisture content [1]. The changes in moisture content may be due to floods, rain, leaking sewer lines or water evaporation this due to the fact that soil is covered by a pavement or a building, Remarkanly , these case cause the crackin and breaking up of pavements, highway, railways and embankments, foundations and reservoir lining or channe [2,3].

The Black cotton soil contains high percentage of montmorillionite mineral which imparts expansive behaviour to it. Disposal of water materials generated from different industries causes many problems like environment pollution in the nearby locality, scarcity of land for disposal, etc. Industrial waste like blast furnace slag, fly-ash, rice husk ash and ston dust, etc are considered as alternative materials for soil stabilization. The marble dust such as one of waste product. The marble dust is generated from cutting and polishing of marble stone. The same as a silica fume is also waste industrial product. It coud be made from other silicon alloys such as ferrochromium, ferromanganese, ferromagnesium, and calcium silicon.

This Reserch concentrates on investigating experimentally the feasibility of stabilizing and improving the geotechnical properties of soft clay soil using a marble dust and silica fume material in different proportions and the study the marble dust and silica fume effect on engineering characteristics of the stabilized clay.

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II. MATERIAL USED

1) *Black Cotton Soil (BCS):* The Black Cotton Soil (BCS) are characterized by high shrinkage and swelling properties. This BCS occurs mostly in the central and western parts and covers approximately 20% of total area of India.

Fig. 1 Black Cotton Soil (BCS)

2) *Marble Dust (MD):* The used material is Marble Dust (MD) its industry produces large waste in Marble Dust. The Marble Dust MD occurs mostly in cutting and polishing of marbles, the recycling of waste material in the construction industry has environmental and engineering roles.

Fig 2 Marble Dust (MD)

3) *Silica Fume (SF):* The during manufacture of silicon and ferrosilicon alloys, Silica Fume (SF) which is also know as micro-silica, is produced as secondary poduct from reduction of hight-purity quartz with coal in electric oven. The Silic Fume (SF) use in this study was industrial waste.

Fig 3 Silica Fume (SF)

III. METHODOLOGY

In this Reserch soil sample taken for this study is obtained from **Simritaal – Dabra , Gwalior (M.P.),** and take to lab testing. The soil classified as clay of expansive behavior with high plasticity having (Gs = 2.48 with 78.8% Fines). The Black Cotton Soil is Montmorillonite group of soil having swelling and shrinking characteristics. In BCS **Perform Tests:-** Atterberg Limet, Compaction Test, Differentialn Free Swell (DFS), California Bearing Ratio(CBR), and Unconfined Compressive Stength (UCS) and Finding the soil engineering properties in different percentages.

IV. RESULTS AND DISCUSSION

1) *Atterberg Limits:* The increasing MD and SF content there there was a decrease in liquid limit and plasticity index. This could be because MD and SF coats and bind all clay particles.

TABLE 3 Black Cotton Soil with Marble Dust

Tests (%)	BCS+0% MD	BCS+2%MD	BCS+4%MD	BCS+6%MD
Liquid Limit (L.L)	52	50	48	45
Plastic Limit (P.L)	28	27	26	25
Plasticity Indx (P.I)	24	23	22	20

TABLE 4 Black Cotton soil with Silica Fume

Tests (%)	BCS+0%SF	BCS+2.5%SF	BCS+5%SF	BCS+7.5SF	BCS+10%SF
Liquid Limit (L.L)	52	52	49	46	42
Plastic Limit (P.L)	28	27	26	24	21
Plasticity indx (P.I)	24	24	23	22	21

2) *Compacation Test:* In the compaction test the MD increasing the OMC is decreasing and MDD is increasing and its highly in 4% MD is used, the increasing in SF in BCS the OMC is increasing and MDD is literally decreasing.

TABLE 7 Black Cotton Soil with Marble Dust

Tests (%)	BCS+0%MD	BCS+2%MD	BCS+4%MD	BCS+6%MD
Moisture Content	16	15	13	14
Maximum Dry density	1.64	1.70	**1.82**	1.75

TABLE 8 Black Cotton soil with Silica Fume

Tests (%)	BCS+0%SF	BCS+2.5%SF	BCS+5%SF	BCS+7.5%SF	BCS+10%SF
Moisture Content	16	19	18	20	21
Maximum Dry density	1.64	1.56	**1.62**	1.60	1.58

3) *Differebtial Free Swell:* In the both of MD and SF there increasing the percentage of MD and SF there is DFS is decreasing.

Table 9 Black Cotton Soil with Marble Dust

Test (%)	BCS+0%MD	BCS+2%MD	BCS+4%MD	BCS+6%MD
DFS	47.05	`41.23	38.01	29.16

Table 10 Black Cotton soil with Silica Fume

Test (%)	BCS+0%SF	BCS+2.5%SF	BCS+5%SF	BCS+7.5%SF	BCS+10%SF
DFS	47.05	32.82	25.03	20.62	15.17

4) *California Bearing Ratio:* The CBR in increasing the content of MD is increasing and is the good on 4% of MD using, and Using in SF in BCS the increasing the CBR value .

Table 11 Black Cotton Soil with Marble Dust

Tests	BCS+0%MD	BCS+2%MD	BCS+4%MD	BCS+6%MD
2.5mm	2.27	2.685	4.624	3.494
5mm	2.12	2.37	4.425	3.187
CBR (%)	2.27	2.685	4.624	3.494

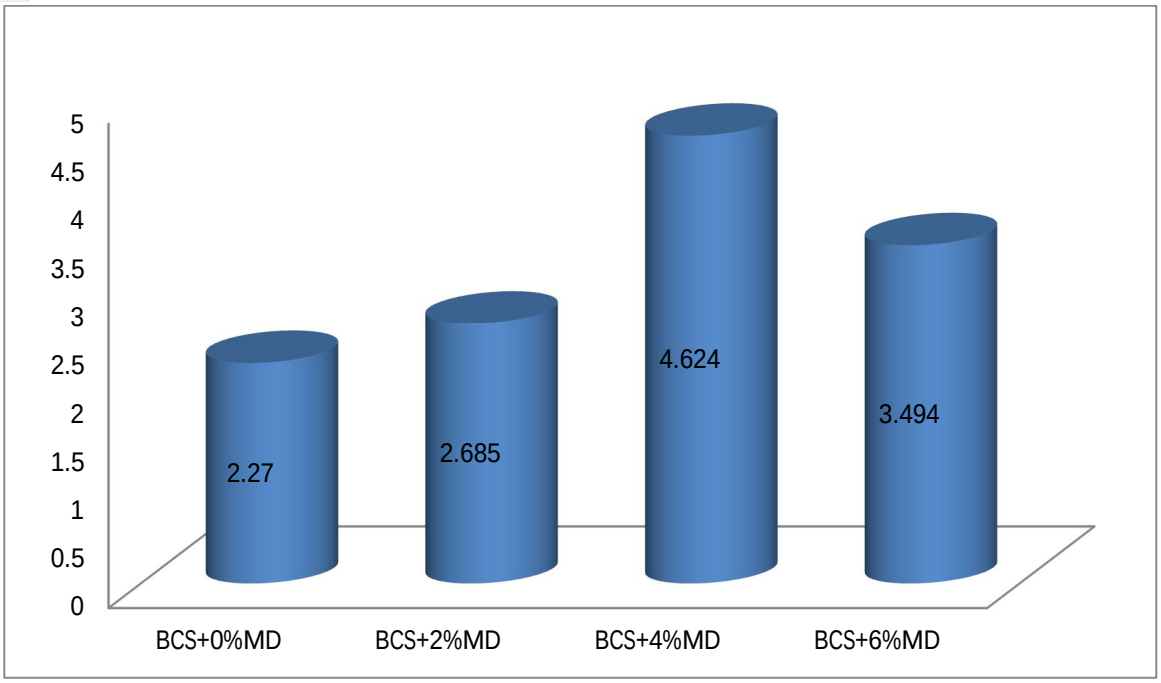


Fig 4 CBR Test with Marble Dust

Table 12 Black Cotton soil with Silica Fume

Tests	BCS+0%SF	BCS+2.5%SF	BCS+5%SF	BCS+7.5%SF	BCS+10%SF
2.5mm	2.27	2.451	2.897	2.920	3.947
5mm	2.12	2.326	2.704	2.932	3.413
CBR (%)	2.27	2.451	2.897	2.920	3.947

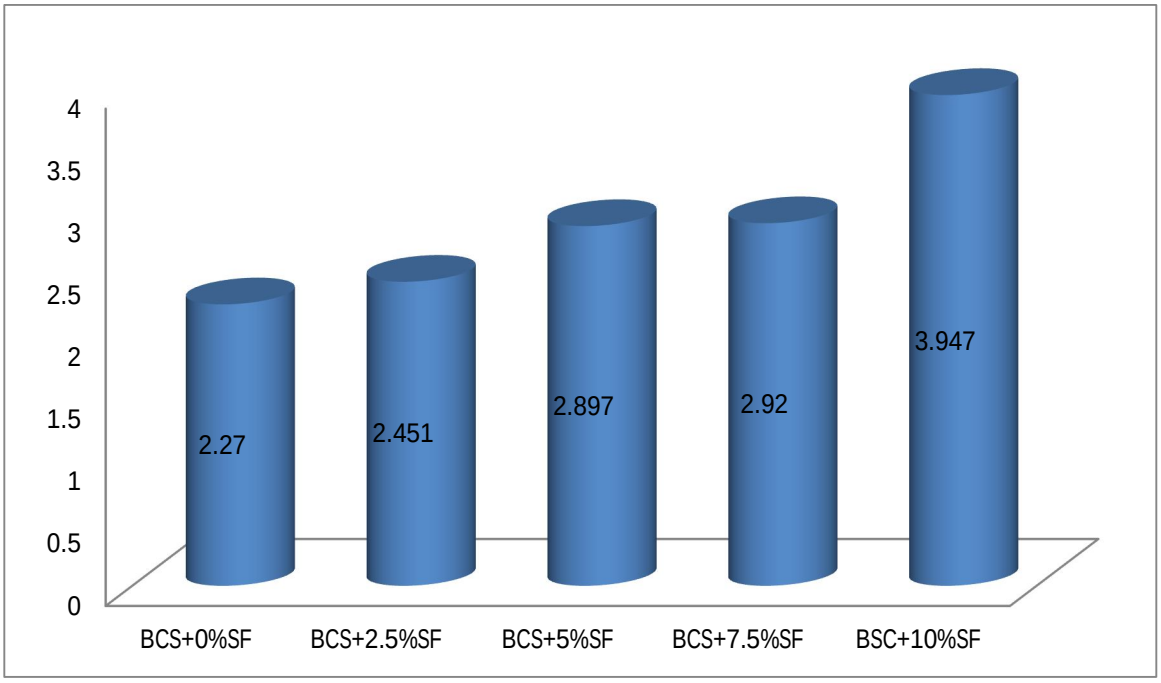


Fig 5 CBR Test with Silica Fume

5) *Unconfined Compressive Strength:* In the UCS the increasing there MD percentages there increasing the UCS and its good on 4% of MD value, and there increasing the SF in BCS its also increasing the percentages .

Table 13 Black Cotton Soil with Marble Dust

Test	BCS+0%MD	BCS+2%MD	BCS+4%MD	BCS+6%MD
UCS (KN/m^2)	130	140	**190**	165

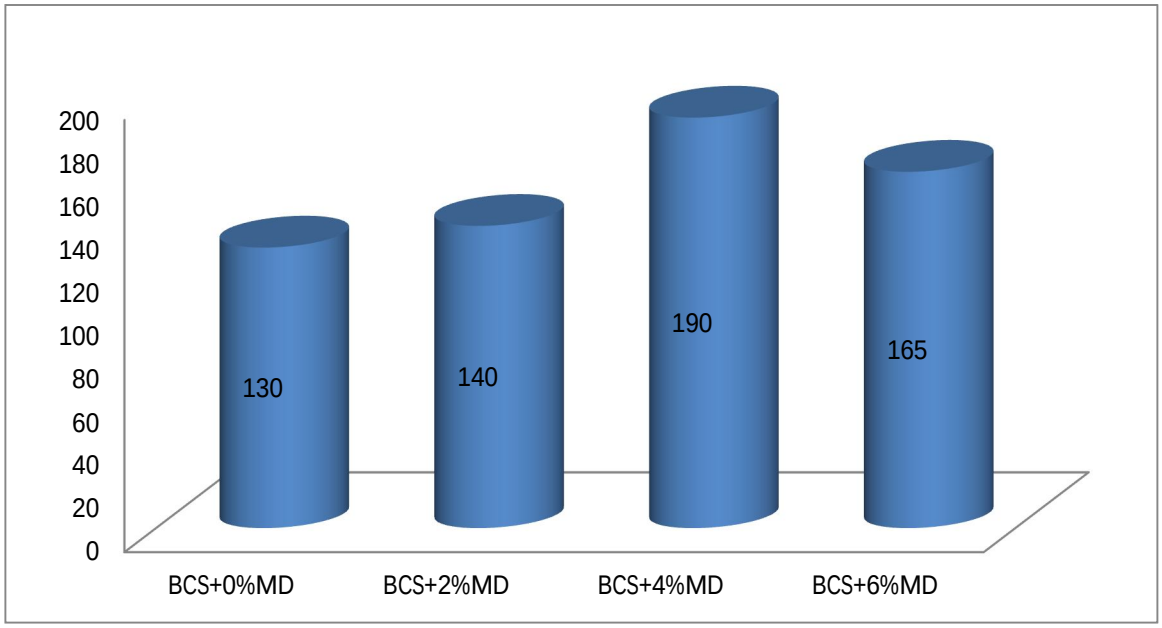


Fig 6 CBR Test with Marble Dust

TABLE 14 Black Cotton soil with Silica Fume

Test	BCS+0%SF	BCS+2.5%SF	BCS+5%SF	BCS+7.5%SF	BCS+10%SF
UCS (KN/m^2)	130	145	180	195	210

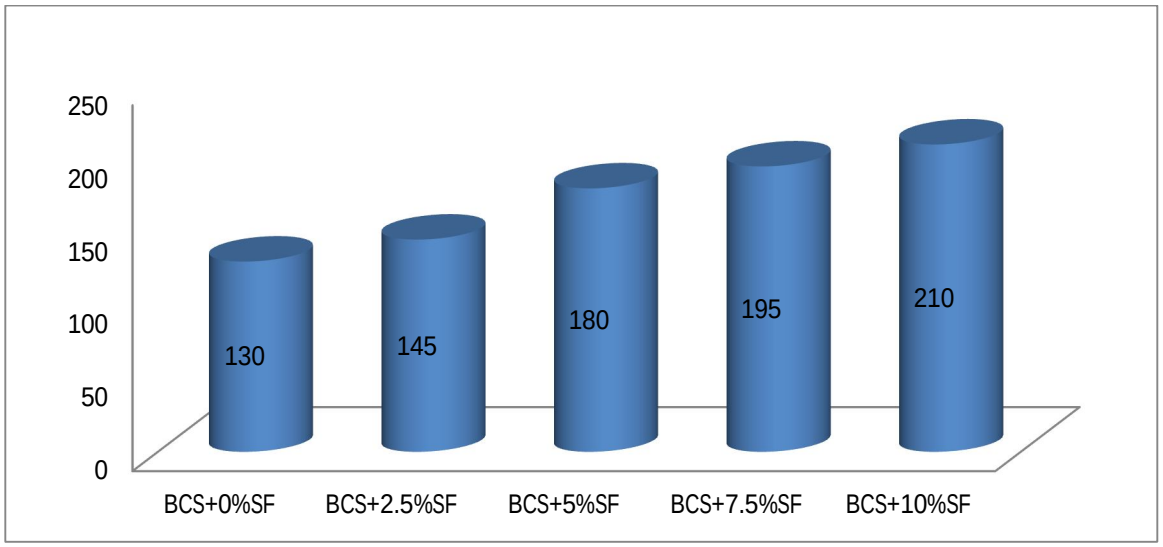


Fig 7 CBR Test with Silica Fume

V. CONCLUSIONS

In this study the virgin soil is mixed first Marble Dust various percentages and after the virgin soil mixed with the Silica Fume material this both material is waste material.

A. There Atterbegs limits, decreasing in both (MD and SF) liquid limit and increasing in both (MD and SF) plasticity index, with the increasing of content.

B. The Marble Dust and Silica fume changes compaction parameters of clays soil. The maximum dry density increasing in Marble dust and the optimum moisture content is decreases, and the in Silica Fume there is maximum dry density is decreases with increasing of SF content and optimum moisture content increases with increasing SF content

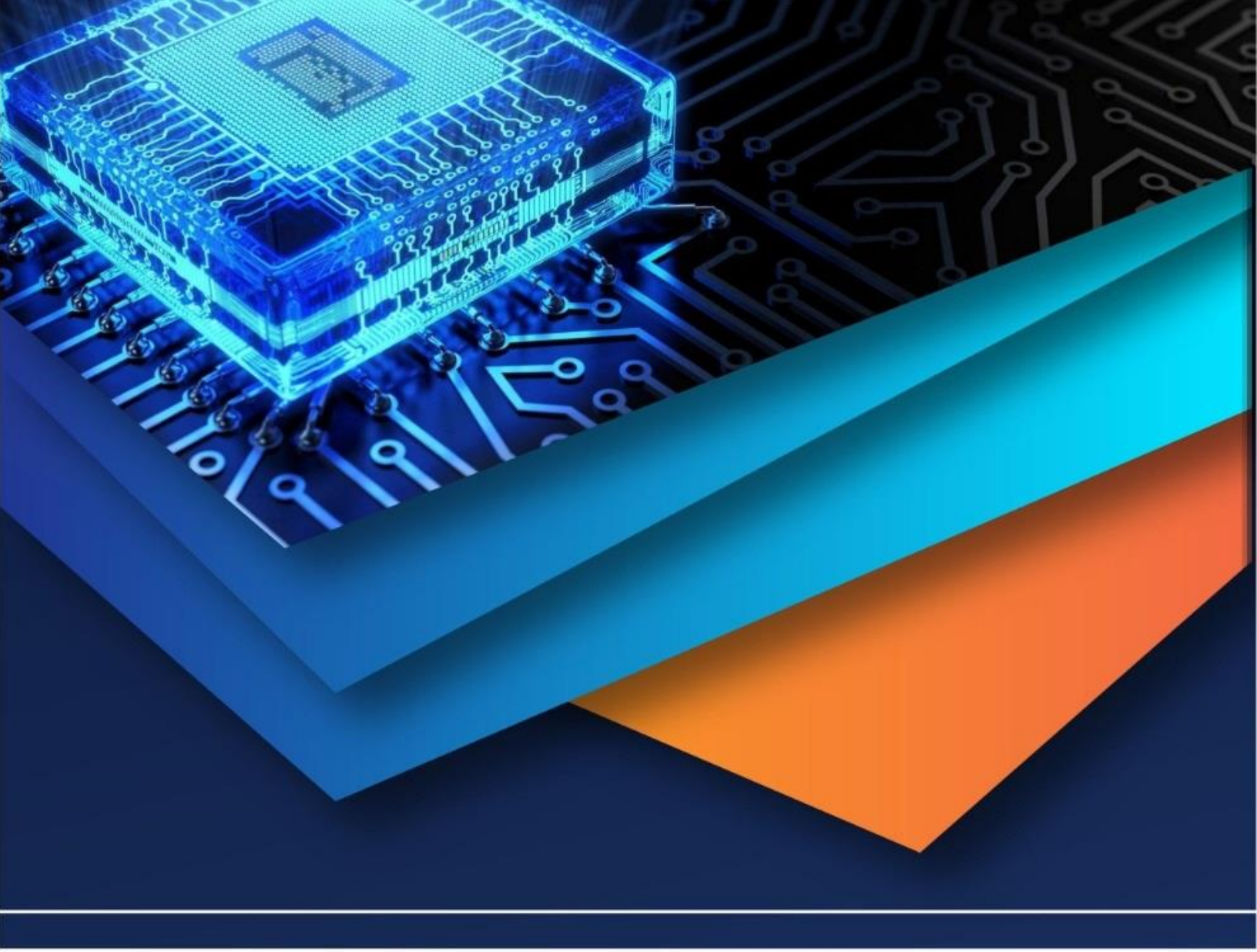
C. The increasing MD and SF in contents percentage the DFS is decreasing.

D. The CBR value is increasing in both Marble dust and Silica fume.

E. The increasing of contents Marble Dust and Silica Fume the UCS is increasing.

REFERENCES

[1] Chen, F.H.;1988,"Foundation on Expansive Soil, Development in Geotechnical Engineering",Journal of Elsevier,Sciencedirect,pp.436.
[2] Cokca, E;1999,Electronic journal of Geotechnial Engineering.4,pp1-4
[3] Wilson, C.R.; Davis, J.G; and Meja, N;2001,"Landscaping on Expansive Soils",www.ext.colostate.Edu,
[4] Goodarzi, A.R.;2016,"Enhanced stabilization of highly expansive clays by mixing cement and silica fume",Journal ELSEVIER.
[5] Bharathan, R ;2017,"Soil stabilization using silica fume and cement",SSRG International Journal of Civil Engineering.
[6] Tiza Michael;2016,"A survey of literature onimpact of silica fume (SF) and Swa dust ash (SDA) on expensive soil"International Journal for Research in Applied Science and Engineering Technology,(IJRASET),Vol. 4,Issue no.,8 August 2016.
[7] Kalkan, E; and Abulut, S;2004,"The Positive Effects of Silica Fume on the Permeability",swelling Pressure and compressive strength of Natural caly lines Journal of Engineering Geology,Vol.73.
[8] Varghes, Bincy k; and John Tellma;2018,"Soil stabilization usung silica fume",Internatonal Reserch Journal of Engineering and Technology,(IRJET).
[9] Negi, Chhaya;2013,"Effect of silica fume on engineering properties of black cotton soil"Internatinal Journal of Computational Engineering Reserch,Vol.,03.
[10] Punamia. B.C.;Book on Soil Mechanics and Foundation.
[11] Arora, K.R.;Book on Soil Mechanics and Foundation.
[12] Okagbue, C.O., Onyeobi, T.U.S.1999,"Potential of Marble Dust to Stabilise Red Tropocal Soils for Road Construction Engineering Geology"53.
[13] Sreekumar. V. Babu; and Mary Rebekah Sharmila.S;2017,"Soil stablizaation using Marble Dust",(IJCIET)Vol.8,Issue 4.
[14] Shukla, Vikas; and Trivedi, M.K;2020,"Improment of Pavement Soil Subgrade using industrial waste: Cement Kiln Dust and Brick Kiln Dust",Springer Nature Switzerland AG.
[15] Mohile,Priyanka; and Tiwari, Sanjay;2019,"Improvement in the Engineering Properties of black cotton soil using lime and silica fume".Internatinal Journal Reserch Applied Science and Engineering Technology,(IJRASET).
[16] Goswami, R.K.;and Singh. B;2005,"Ground Improvement",9, 175-182.



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