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Potential Use of Dredged Material from Wular Lake with Surkhi as Stabliser

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Abstract- *Due to the dredging of Wular Lake, a lot of dredged material is generated which imposes a challenge for its proper disposal. The disposal of Dredged Material faces opposition from environmental point of view and there is increasing unavailability of suitable disposal sites. One of the best alternatives is to use this dredged material in construction industry. This necessitates to investigate its characterization and to access the most probable methods for improvement of its properties for its application in construction industry. Stabilization is one such technique to improve the properties of dredged material using different methods.*
This study presents the analysis of dredged material in three phases. The first phase involves the sampling of dredged material from Wular lake. The samples were collected from three different locations and mixed thoroughly. The second phase includes the characterization of samples with regards to its physical and strength properties. In the third phase the dredged soil is stablised with different percentages of Surkhi (Brick-Dust).The Strength Parameters of Surkhi Stablised dredged samples are determined at their respective OMC and MDD in unsoaked condition. The results are tabulated for thorough and meticulous understanding. It has been established that addition of surkhi to dredged material improves its Strength. So the combination of two wastes generate an environment-friendly resource that can be used in different construction projects.

Keywords: *Wular Lake, Dredged Material, Surkhi, Stablisation, Strength Parameters, OMC, MDD.*

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I. INTRODUCTION

Wular Lake is one of the largest fresh water lakes of Asia. It is located in Bandipora district of J&K, 34 Km northwest of Srinagar city. The lake is largest flood basin of Kashmir valley and forms a part of River Jhelum which itself is a sub basin of Indus River. The Lake was recognized as a wetland of international importance under the Ramsar convention in 1990. Wular Lake with its associated wetlands supports rich bio-diversity and provides important habitats for migratory water birds within Central Asian Flyway. The lake is the largest fisheries resource in the vale of kashmir supporting livelihoods of large human population living along its fringes. But every year thousands of tons of silt are deposited in the Lake which is constantly decreasing its depth and hence water holding capacity. So dredging the heavily silted Wular Lake is a key to save it and to increase it's water holding capacity for flood control. But it generates Dredged Material in abundant quantities which poses serious health and environmental problems.

Therefore, initiative must be taken to utilize this waste. Due to rapid urbanization and increase in population, there is scarcity of good construction sites for the construction of various engineering projects. But the Dredged Material cannot be used directly in different construction projects due to its less strength than natural soils. Therefore, investigation for characterization of dredged material and methods for the improvement of its properties for its application in construction industry are of immense necessity. In the present study, the Geotechnical characteristics of Surkhi Stablised dredged soil have been determined.

It has been established that surkhi-a waste from Brick-kilns, improves the Geotechnical properties of Dredged Material. So it can be used in different construction projects. The use of Surkhi Stablised dredged material in construction industry is a step towards sustainable and environment-friendly development as it will reduce the quantities of primary resources needed for construction. Moreover, its use in construction does not pose any threat to environment as is the case with disposing Dredged Material in dumping sites.

II. OBJECTIVES

The present study is a step towards sustainable and environment friendly development. The two wastes viz. dredged material and surkhi are mixed to generate an eco-friendly resource. The different objectives of this study are as:

- To study the various geotechnical parameters of dredged material of Wular Lake.
- To stablise the dredged material of Wular Lake to improve its engineering properties.
- To explore the influence of Surkhi on the strength characteristics of the dredged material.
- To explore the potential application of dredged material of Wular Lake with Surkhi as stabliser.
- To determine the feasibility of the dredged material of Wular-lake for different uses like filling, embankment and foundations.
- To determine the suitability of the dredged material of Wular-lake for use in road construction.

III. SAMPLING AND EXPERIMENTAL WORK

The samples were taken from three different locations with GPS coordinates (34.348976N,74.640521E), (34.327830N,74.660799E) and (34.348945N,74.640299E) and were mixed thoroughly to have a sample of average properties. The tests were carried out as per relevant Indian Standards. The first phase of testing includes characterization of Basic Properties of Dredged Material and the second phase includes determination of its Strength Parameters and their variation with different percentages of Surkhi. The results are tabulated below:

A. Basic Geotechnical Properties

S. No.	Geotechnical Parameter	Plain Dredged Material	Surkhi	4% * Stablised D.M.	8% Stablised D.M.	12% Stablised D.M.
01	**Specific Gravity**	2.40	2.65	2.416	2.425	2.431
02	**Organic Content (%) ****	12.13	-	-	-	-
03	**Liquid Limit (%)**	34	-	-	-	-
04	**Plastic Limit (%)**	27.66	-	-	-	-
05	**Plasticity Index**	6.34	-	-	-	-
06	**Soil Classification (ISC)**	CL	-	-	-	-
07	**Maximum Dry Density (g/cc)**	1.63	-	1.73	1.91	1.98
08	**Optimum Moisture Content (%)**	22.5	-	18.08	12.68	9.26

***** 4% of Surkhi by weight was added to Dredged Material (D.M.)

** No allowance has been made for loss of structural water in muffle furnace (if any).

B. Strength Parameters and their variation with surkhi Content

S.No.	Strength Parameter	Plain Dredged Material	4% Stablised D.M.	8% Stablised D.M.	12% Stablised D.M.
1	**Unconfined Compressive Strength (Kg/cm^2)**	5.13	7.10	8.86	12.46
2	**Angle of Internal Friction (Φ)**	20^o	23^o	28^o	31^o
3	**Cohesion (KN/m^2)**	65	67	70	72
4	**California Bearing Ratio (CBR)**	4.38	5.12	6.57	9.12

IV. OBSERVATIONS AND DISCUSSIONS

1. The dredged material of Wular Lake is low compressible and highly-organic.
2. The Specific gravity of dredged soil is lower than the natural soils.
3. The dredged material consists of large amount of organic content, which increases it's water holding capacity and can hence be used to enhance marginal lands to elevate the productivity of fruits, vegetables et cetera.
4. The value of specific gravity of surkhi is in the range of other coarser materials like silt, sand.
5. Since the dredged material is mostly composed of Fines (Silt, Clay) so a coarser material was chosen fot its stablisation.
6. The value of MDD of dredged material is low with a high value of OMC, due to high organic content.
7. The Strength Parameters have low to medium values. So, it is not feasible to use the dredged soil directly in foundations, embankments, sub-bases and sub-grades etc.
8. The Strength Parameters like Unconfined Compressive Strength, CBR value, Cohesion and Angle of Internal Friction increase with increase in percentage of Surkhi.
9. So, by adding suitable percentage of Surkhi, the dredged material is likely to meet the specifications for a particular beneficial use.

V. CONCLUSIONS

From the above discussion, it is established that Surkhi improves the engineering behavior of Dredged Material. Hence, it can be used in different construction projects like:

- As a Sub-grade material,
- In construction of sub-base,
- As a foundation material,
- Construction of earthen dams and embankments,
- For filling of low lying construction sites.

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