Experimental Study On Embankment Slope Protection Using Plastic Wastes, Marble Sludge Powder And Crusher Dust

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Abstract:

Slope can collapse easily by shear if the soil is nearly saturated and high pore pressure can be built up rapidly. Besides, highly decomposed rock in a slope may behave very similar to soil. Slope protection includes increasing the weight bearing capabilities, permeability reduction, performance of in-situ subsoil, sand and other waste material in order to strengthen the embankment. A Plastic material is one of the wide range of synthetic or semi-synthetic organic solids that are mouldable. Plastics are typically organic polymers of high molecular mass, but they often contain other substances. They are usually synthetic, most commonly derived from petrochemicals. Most plastics contain organic polymers. These materials pose environmental pollution in nearby locality because they are non bio-degradable. Marble sludge powder is a solid waste material generated from the marble processing and quarry dust are used as a filler material in this slope protection method to achieve economy and environment saving.

Keywords— Embankment, Shear, Marble sludge powder, Plastic material, quarry dust, environmental pollution.

I.INTRODUCTION:

Properly designed slope protection and stabilization has to include two components: a vegetational - biological and a mechanical-structural component. For maximum effect, both components must be integrally planned prior to road construction. Properly designed and planted vegetative covers play a significant role in preventing surface erosion and shallow mass failures. The function of root systems of live plants on shallow soils on steep slopes is that of a binder for individual soil particles or aggregates. They act in several ways to increase slope stability they bond unstable soil mantles to stable sub soils or substrata, they provide a cover of a laterally strong fine root systems close to the surface, and they provide localized centers of reinforcement in the vicinity of individual trees where embedded stems act like a buttress pile or arch-abutment on a slope. The structural-mechanical component can consist of conventional retaining walls, either the gravity or cantilever type, or a reinforced earth structure. Structural-mechanical stabilization techniques are called for in cases where the potential for deep-seated slope movement or high, lateral earth stresses exists.

Objective

- To protect the embankment slope using plastic wastes, marble sludge powder and crusher dust.
- Usage of waste materials is more economical compared to the concrete
- This can be adopted for water logged area

Scope

- Environmental friendly

- Ecologically appropriate
- Cost effective material
- Appropriate technologies in Slope protection
- Eliminate up to 98% of soil stability problems at the source.

II.MATERIALS AND DESCRIPTION:

1.Marble sludge powder

Fig 1: Marble sludge powder

Marble is a metamorphic rock resulting from the transformation of pure lime stone. Marble sludge powder is an industrial waste containing heavy metals as constitutes. Chemically, marbles are crystalline rocks composed predominantly of calcite, dolomite or serpentine materials. The other mineral constituents vary from origin to origin.

Table 1: Physical properties

Properties	Result
Specific gravity	2.857
Fineness modulus	2.04

Table 2: chemical properties

Characteristics	Result
Loss on ignition,	3.33
SiO_2	69.21
Fe_2O_3	4.40
TiO_2	Nil
Al_2O_3	13.48
CaO	8.40
MgO	0.81
Na_2O	0.26

2. Plastic waste

Today the availability of waste plastic is enormous, as the plastic material have become part and parcel of daily life. They either get mixed with municipal solid waste and/or thrown over land area. If not recycled, their present disposal either by land filling or by incineration. Both the processes have certain impact on the environment. Under this circumstance, an alternate use for the waste plastics is also needed.

Thinner polythene carry bags are most abundantly disposed of waste. Which do not attack the attending rag pickers for collection for onward recycling. For lesser value again this polythene/ polypropylene bags are easily compatible with bitumen at specified condition the waste polymer bitumen blend can be prepared a study of the properties can throw more light on their use for embankment laying.

Fig 2: Plastic waste

Table 3: Properties of plastic waste

	Polystyrene	Polypropylene	Polyethylene
Density g/cm³	1.05	0.90	HD-PE 0.95 LD-PE 0.92
Flammability	Inflammable	inflammable	Inflammable
Ignition temperature	300 - 400°C	300 - 360°C	350 - 360°C
Humidity absorption	<0.1%	<0.1%	<0.1%
Density g/cm³	1.05	0.90	HD-PE 0.95 LD-PE 0.92
Flammability	Inflammable	inflammable	Inflammable

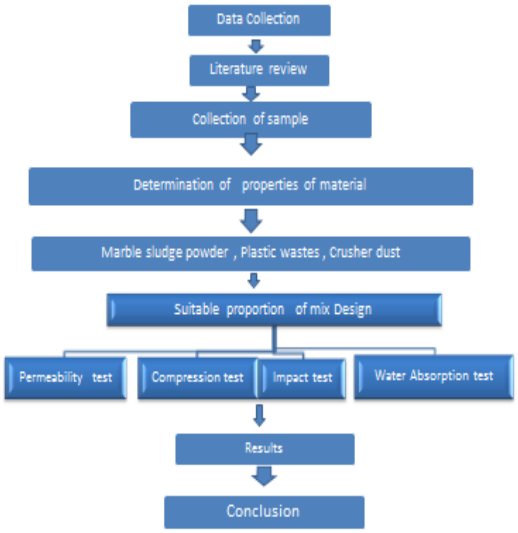
3. Quarry dust

Primary crusher produced 1- 10% fines, secondary crusher produced 5 – 25% fines and tertiary crusher produced 5 – 30% fines. Similarly Limestone contains 20 – 25% fines; sandstone contains 35 – 40% fines and igneous and metamorphic rocks contain 10 – 30% fines.

Table 4: Properties of quarry dust

Properties	Result
Specific gravity	2.765

III.METHODOLOGY:



IV MIX PROPORTION

Table 4: Mix proportion

Marble Sludge Powder %	Crusher Dust %	Plastic Wastes %
50	50	20
		30
		40

Fig 3: Specimens

V.RESULT AND DISCUSSION

1. Water absorption test

Table 5: Water absorption test

S.No	Plastic wastes %	Water absorption %
1	20	0.22
2	30	0.25
3	40	0.39

2. Melting point value

Table 6: Melting point value

S.No	Plastic waste %	Temperature C
1	20	180
2	30	170
3	40	170

3. Density test value

Table 6: Density test value

S.No	Plastic waste %	Density Kg/m^3
1	20	2035.829
2	30	2087.549
3	40	1614.114

4. Compression test value

Table 7: Compression test value

S.No	Plastic waste %	Compression value KN/m^2
1	20	13
2	30	17
3	40	26

5. Impact Test Value

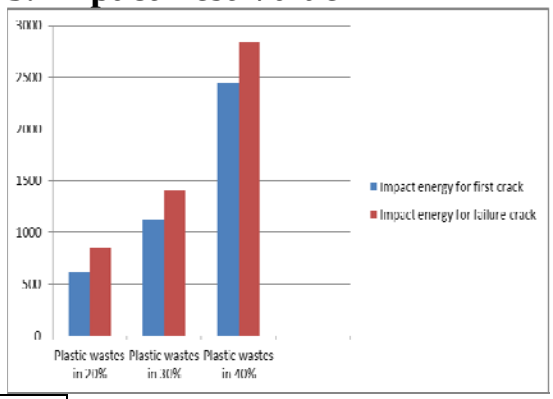


Fig 4: Impact Value

V. CONCLUSION

The following conclusions are made from this experimental study,

1. The compressive strength of the mix with 50% marble sludge, 50% of crusher dust and 40% of plastic waste attains the maximum values of 26 kN/m^2.
2. The absorption of water is lesser for the mix 50% marble sludge, 50% of crusher dust and 20% of plastic waste when compared with other min proportions.
3. The impact test shows better results for the mix 50% marble sludge, 50% of crusher dust and 40% of plastic waste
4. As the waste materials such as plastic, marble sludge and crusher dust is not water absorbent and its has less voids, the permeability of water through them is arrested.
5. Hence based on the results layer coating with these waste materials will protect further failure of a weak soil embankment and also prevents water loss from due to permeability.

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