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Mechanical Resistance to Compression Poured Earth, Mixed With Natural Latex Obtained From *Tabernaemontanaalba Mill Apocynaceae.*

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SUMMARY: *Pouredearthis presented as an environmentally friendly alternative for building. This technique uses hearth components and stabilizers, plus some natural additives or chemicals that can alter mechanical strength characteristics.Current studies show that concrete has higher value in terms of compressive strength and durability according to dosages of these components, but it is necessary to analyze other stabilizers that reduce building cost. In this study, samples of soil denominated Champayán containing sand, clay and coarse aggregate were obtained from the bank"El Fuerte"in Altamira, Tamaulipas. Samples of the specimen Cojon cat. (Tabernaemontanaalba mill apocynaceae) used as stabilizer were also obtained from Altamira, Tamaulipas, Mexico. In this study,samples were stabilized with a solution of natural latex extracted from the Cojon cat. plant. Standard construction mixtures of cement and lime were not added. The soil/stabilizer mixture achieved a compression similar to samples with 5% and 6% cement lime. It was also found that there is a considerable difference between the compressive strength with and without added bulk, allowing it to be used as a construction system. Thus this system is proposed as an alternative development of elements for poured earth construction that only requires stabilization with natural latex. Other alternatives such as the addition of organic fibers are possible for the modification of properties. Finally, the extract was found to act as naturalwaterproofing and adherent which reduced by 7.2% moisture absorption on porous surfaces and can be used as an ecological waterproofing for load bearing poured earth walls.*

I. INTRODUCTION

Pouredearth is a technique catalogued within monolithic walls [1] capable of supporting such efforts to enable use as load-bearing walls. It is definedas plastic fluid containing fine and coarse aggregates, up to the size of gravel, and can perform the same function as lean concrete [2].Poured earth is an environmentally friendly alternative for building. This technique uses soil components and stabilizers.[6]

Currently, various additives such as biopolymers or cactus mucilageare used to improve the properties of poured earthand increase mechanical compression or abrasion resistance[3].The relationship between the density of dry material and mechanical strength can be observed. Coarse aggregate in material with greater quantity of gravel has high mechanical strength. The same applies to the soil called Champayán. In these cases the stabilizer density is lower.[4]

Stabilization is used as a physico-chemical mixing process, reducing the amount of cement and reducing the volume of space between soil particles.[5]

This paper aims to show the results in terms of compressive strength of mixtures of natural materials and polymers in poured earth.In nature there are various polymeric materials which can be used in construction. There are living organisms whichare able to synthesize polymeric molecules joining themby cellular activity in macromolecules.

Commonly used in some building systems are lighteners in roofing which use polystyrene, polyurethane foam injection in walls or beams, polycarbonatepanelling, PVC pipes, bricks with phenolic resins, and resin-based melanin paints.

II. COMPONENTS.

Coarse-textured soil with rocks (Champayan). It was found that the size of coarse aggregate of this soil passes through size 4 screen, and is classified as sandy clay whose content is 7.7% clay, 16.9% silt and 75.4% sand.

sample	Determination	Result %		
	Texture	clay	slit	sand
Champayán	(NOM-021-SEMARNAT-AS-09)	7.7	16.9	75.4

Table 1.-The table shows the results of soil texture by the Bouyoucos method according to Borja-Martinez et al. 2015.

The Tabernaemontanaalba Mill known as cojón cat belongs to the family of Apocynaceae (Apocynaceae); within the genus Tabernaemontana. It is 2 to 7m high, with long, thin leave. When cutting any part of the tree, a white milk (latex) is produced. It grows wild in cow pastures and paddocks. [7].It is a species native to tropical America that is easily found in various parts of Central America, especially in Nicaragua. The plant is adapted to dry tropical forest and is easily identifiable by the particular shape of its fruit. When ripe, the fruit is open and the seeds surrounded by red pulpcan be seen.

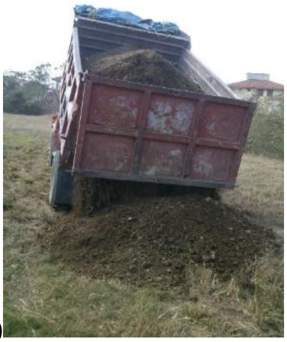
A)

B)


Figure 1.- A) soil discharge Champayan, and B) .- batch of soil denominatedChampayan

Tabernaemontanaalba mill apocynaceae. It is obtained from the thorny deciduous forest in the city of Altamira, Tamps.

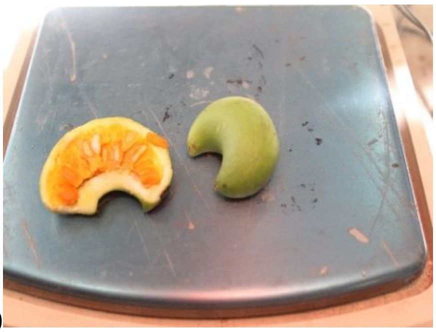
A)

B)


Figure 2- A) 4 weighing and extraction of natural latex B plant “cojon” cat

III. DEVELOPMENT OF EXPERIMENTS.

Grading test was developed according to the Official Mexican Standard NMX-C-111-ONNCCE-2004. Champayan is obtained naturally or by crushing rocks, blast furnace slag, volcanic slag, recycled concrete or a combination of these or other materials. Itis retained by 4.75 mm sieve (mesh No. 4) and passes through a 90 mm sieve (mesh No. 3 1/2 ").

weight retained	**% retained**	**% ret.accumulated**	**% passes mesh**	**total**
2”	0	0	0	100 %
1 ½”	790	17.0	17	83 %
1”	450	9.0	26	74 %
¾ “	380	8.0	34	66 %
3/8”	770	16.0	50	50 %
# 4	620	13.0	63	37 %
Pass # 4	1730	37.0	100	0

Table 2.-The table shows the percentage of test Champayán grain size.

The bulk density corresponds to the material called Champayán according to Mexican Official Standard NOM-021-RECNAT-2000, which has passed through the mesh number 4, using a steel mold height 30 cm and 15 cm in diameter.

A regional soil called Champayán was mixedwith the stabilizer according to the following proportions by weight, as shown in Table 3.

Sample	**Champayán**	**Lime**	**Water**	**Latex solution**	**Adhesive**
M-1	90%	-	10%	-	-
M-2-A	80%	6%	14%	-	-
M-2-B	75%	15%	10%	-	-
M-2-C	70%	20%	10%	-	-
M-3	80%	-	-	10%	10%
M-4	80%	-	-	20%	-

Table 3.-Table indicates the percentage of the dosing of samples.

The material corresponds to all material from the local sample that passed through the No. 4 mesh.Solids were mixed by mechanical stirring for 10min. Once material was homogenised according to the percentage of water presented in Table 1, it was then dosed and mechanically stirred for 10 min more. The slurry obtained was poured into the corresponding steel cylindermolds 15cm in diameter and 30cm in height.

Samples were demolded at 24 h. Mechanical compressive strength at 7, 14 and 30 days respectively was determined following the method established by the NMX-C-486-noma ONNCCE-2014 and NMX-C-003-ONNCCE-2010.

The water absorption of samples where probed introducing them completely in this liquid during 24h. The final weight is taken before and then of the immersion.

IV. RESULTS AND DISCUSSION

Averaging the bulk density of Champayan was 2.725 cm.

Using an appropriate ratio was observed in the processed samples using natural latex being compared with previous samples for color, acquire shades of brown and green, so also in weight has been notorious over previous samples, where this it has decreased by up to 20%.

Its porosity can be visibly perceptible, highlighting an aspect of rustic finish with white flecks ashes. Acquiring an appearance of being recently developed even more after the 28 days period were these are discharged.

Samples utilizing natural latex stabilizer were compared to a blank specimen without added latex. The samples with added latex acquired a brownish green color and the weight diminished by up to 20%. Porosity was visible perceptible as well as a rustic finish with flecks. The samples treated with latex had the appearance of recently poured blank samples, even after a period of 28 days.

Mechanical compressive strength (kg / cm2)	
COMPOSITION	**AVERAGE (KG/cm2) +/-**
M-1-Whites	11.60 +/- 0.59
M-2-A-Lime 6%	2.90 +/-0.37
M-2-B-Lime 10%	3.02 +/- 0.96
M-2-C-Lime 20%	11.43 +/- 2.08
M-3-Solution Latex & Adhesive	14.15 +/- 0.48
M-4-Natural latex solution	21.66 +/- 0.30

Table 4. Average compression results of groups of samples

A) 

B) 

Figure 3- A) Compression of cylinder with natural latex. B) Compression of blank cylinder.

Figs.3 A and B, show the behaviour or cylinders with added natural latex as compared to the blank cylinder.

In Figures 3 A and B, both cylinders were subjected to mechanical compressive loads. The blank sample is white and shows cracks at the top of the model, demonstrating a distinct behaviour under compression. Table 4 summarizes the reactions of various samples with different stabilizers, and the natural latex stabilizer shows greater mechanical strength.The sample made with natural latex has a darker color and flecks of green and white tones, suffered fissures and cracks at the bottom, behaving in a different way.

Showing different reactions regarding the dosages and employed stabilizers being subject to compression loads, with the model supported latex which has greater mechanical strength.

The qualitative results observed in experimental may be possible because of polymeric compounds have different humidity absorption.

The results of water absorption showed that there was found a percentage average of difference of 7.2±0.1% less weight than those samples without treatment.

V. CONCLUSIONS

Mixtures stabilized with lime in various dosages does not show an increase of compressive strength, but also allows having a better consistence and molding. When a natural latex obtained from *Tabernaemontana alba mill* is added, it is found an increase of resistance to compression, which can be enhance to reduce inorganic stabilizers reduction. It was found also a porous surfaces reduction and a subsequent reduction of water absorption.Being an important factor not having had the use of cement, these dosages may be altered taking several results in terms of strength and permeability.

In further work it can be possible to introduce organic or inorganic fibers to increase traction resistance and hence the compressive resistance.

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