

A COMPARISON OF PLASTER OF PARIS MADE FROM CEMENT AND WATER
SATCHET WITH BRITISH STANDARD PLASTER OF PARIS

BY

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2008/2/31622BT

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUTION

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA,

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF INDUSTRIAL AND
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CERTIFICATION

I **AGBOZUADU AIGBOKHAODE SUNDAY** with matriculation number 2008/2/31622BTan undergraduate student of Industrial and Technology Education Department, do certify that the content of this project report is original and has not been submitted in part or full for any other Diploma or degree in this or any other university.

Name

Sign-Date

APPROVAL PAGE

This project has been read and approved as meeting the requirement for the award of B.Tech degree in Industrial and Technology Education, School of Science and Science Education, Federal University of Technology, Minna.

Supervisor

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Head of Department

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External Supervisor

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DEDICATION

I dedicate this project to God almighty the author and finisher of my faith for his faithfulness, guidance and protection all through my period of study.

ACKNOWLEDGEMENT

I want to acknowledge my creator, God almighty for his grace, guidance and mercy throughout my program because I could never have made it without him, whatever I am today is by his grace, my profound thanks to the head of the department Dr Ohize and the entire staffs for spending their time to prepare me for the great task ahead.

Most importantly I want to say thank you to my supervisor Mallam Idris Abubakar Mohammed for his kind and useful suggestion toward the accomplishment of this research work, the project coordinator, Mr. Saba.T. M is also not left out as this would never had been possible without his spectacular contributions toward achieving an expected end.

ABSTRACT

This study is designed to compare plaster of Paris made from cement and water sachet and the British standard plaster of Paris. The researcher observed that it is difficult for the poor and some low income earners to afford the imported ceiling materials due to high cost of these materials. The purpose of the study is to compare the plaster of Paris made from cement and water sachet with British standard plaster of Paris and see how these foreign material can be replaced with our locally sourced materials. Four research questions where used to guide the study and review of related literature was carried out to guide the researcher on the main focus of the research work and a sample of both the locally made plaster of Paris and the British standard plaster of Paris was constructed and taken to the laboratory for analysis and the result reveals that the British standard plaster was not better both in strength and aesthetics and therefore the researcher recommends that the locally made plaster of paris should be used instead of the imported types.

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CHAPTER I

INTRODUCTION

Background of the study

Plaster of Paris is a type of plaster which can be used in art, architecture, fireproofing and medical applications. When people think of “Plaster,” They are often speaking specifically of plaster of Paris, although there a number of different types of plaster in the market including cement and gypsum plaster which is our main focus in this research. Comparison on the other hand is an examination of two or more items to establish similarities and differences, or judging between the physical qualities of two or more things. This became necessary because the primary purpose of any shelter is for the comfort of man but if the material required to provide this comfort is only within the reach of the well to do and the middle class then this purposes have been defeated. This research when completed will help us to compare the cost and the quality of British standard plaster of Paris which is already circulated in the building industry with plaster of Paris made from cement and pure water sachet which is an innovation in the industry and see the possibility of substituting this foreign material with locally sourced materials.

The use of British standard plaster of Paris (gypsum plaster) predates the founding of the city of Paris the gypsum compound is commonly referred to today as plaster of Paris because gypsum was found in abundance on Montmartre hill in Paris. It was first used in 1700 in Paris, the capital of plaster for the coating of wooden houses for the prevention of fire. It was also used by the ancient Egyptian to plaster the pyramid at Cheops. In Britain research being carried out by Claire Gapper a Phd student at the court auld institute shows that considerable quantities of plaster of Paris were being imported from France during Henry VIII reign for works of royal

properties. However, Claire Gapper's research shows that it was being used in the 16th century with lime in floors, walls and ceilings but decorative plaster works which was previously assumed to contain only minute traces; the sort of level at which one would find it as an impurity in lime stone. This contrast with the use of gypsum over the last 200 years, when predominantly used for casting decorative elements and for gauging lime when running moldings.

In the history of building construction in Nigeria there has been a periodic discovery and replacement of foreign material with locally made ones. Economic recession has brought us to a position of appraising our method of solving societal problems Aribisola (1990) pointed out some factors which can help us to review the cause of persistent rise in foreign building materials, thereby mapping a strategy for charting a new course of replacing foreign building materials with local ones in the industry in tune with the natural or artificial material which are readily available in our country. Technological advancement has brought about a shift from the use of locally sourced material to the mentality of importing building materials which has made it quite difficult or even impossible for the poor and low income earner to afford these imported materials this is why it is very important for Nigeria citizens to compare our locally sourced material with these foreign building materials.

In 1996 the structural adjustment program (SAP) and government commitment towards self reliance was introduced to make us rely on our self using whatever material that is available to us in a manner that favors our economic background. At a special exhibition on building and construction technology organized by the Nigeria institution of architects (NIA) popularly known as archy building 96 reveals the presence of certain raw materials in the country. It further stated that Nigerians are trying their hand on the construction of building from locally sourced materials. In Niger state for instance local bricks molders are improving periodically on

the quality of the popularly known baked clay brick which is fast substituting for the use of blocks in the state. Therefore government at all level must promote the use of locally sourced material for the construction of public buildings both at state and local government level rather than using the imported ones which the common man on the street cannot afford. The Nigeria building and road research institute had embark on an important discussion with the various state government in the country with a view to erecting a model of made in Nigeria houses in all the State of the federation. In 2005 the Nigeria Television Authority (NTA) reports that the then President Olusegun Obasanjo lunched some 500 housing unit of locally sourced, materials in Ekiti State. The development was in a bid to promote the use of our local building material.

Statement of the problem

The importation and use of foreign building material in our country has made it quite difficult if not impossible for the poor and some low income earner to be able to afford these foreign building materials which British plaster of Paris is one, this difficulty may be attributed to the economic situation of our country and the persistence increase in the price of these imported materials. Bassey (1989) stated that the effort made so far by research institute and other individuals to improve on local building material seem to lack recognition therefore this research has been undertaken not only because of high cost of importing building materials but also to promote or encourage the use of locally sourced building materials and face out the problem of sagging often faced with British standard plaster of Paris (gypsum plaster) when allowed to come in contact with moisture and replace it with a locally sourced material which will go a long way in restoring hope to the poor and some low income earner.

Purpose of the study

The purpose of this study is to compare the plaster of Paris made from cement and pure water sachet with the British standard plaster of Paris (gypsum plaster). Specifically the study seeks to:

1. To determine the moisture absorbing capacity of both the locally made plaster of Paris and the British standard plaster of Paris.
2. Determine the relationship and differences between the qualities of British standard plaster of Paris and plaster of Paris made from cement and water sachet.
3. To determine the strategies for promoting the use of plaster of Paris made from locally sourced materials (cement and water sachet) in Nigeria.
4. Find out how these locally sourced building materials can be made to replace the imported material.

Significance of the study

This research when completed will be of great significance to instructor (teachers) in the class room activities and organization of workshop, students in the area of additional skill acquisition and entrepreneurship development; and the society at large as this will not only build in us a recycling attitude but will also remove environment degradation resulting from indiscriminate dumping of this water sachet; more also it is going to restore hope to the common man and the low income earners in our society who cannot afford the imported plaster of Paris(gypsum plaster) or even other types of ceiling materials. It will also serve as source of employment to our unemployed youths out there and the government will also benefit greatly from this research because the huge sum of money spent on importation of this foreign building material will definitely be redirected into developing other aspect of our infrastructure or even savings, interior design plays a vital role in the aesthetics appeal of a home hotel or any other

interior space, attractive color or patterns. Some ceiling as a design element have being somewhat low in design agenda, plaster of Paris plays a vital role within an interior space as they offer maximum view in a room and thereby never fails to catch the eye. All services like wiring, ducting and insulation are concealed in the ceiling, light are insect on the ceiling which prevent having to dust them. Level surface below plaster of Paris ceiling offer a smooth finish surface which improve on the light reflection of the ceiling. Pop ceilings are amongst the most common choice that is recommended as a part of ceiling design.

Scope of the study

The study will focus mainly on comparing the plaster of Paris made from a locally sourced material (cement and pure water sachet) with the British standard plaster of Paris (gypsum plaster), it may also go a long way trying to see how we can learn this trade as an occupation thereby impacting the student and helping them to develop skills which will be of great importance to them even after leaving the institutional environment and also restoring hope to the common man and the low income earners. We must also dispute the fact that research is taking our building industry to a greater height.

Limitations

As at the time of carrying out this research there was no equipment for testing for the brittleness of a material in civil engineering laboratory I therefore wish to advice that in subsequent projects research, brittleness test should be carried out on the two plaster of Paris

Assumption of study

The following assumptions were made concerning the study:

1. The methods used for constructing locally made plaster of Paris and that of constructing British standard plaster (gypsum plaster) are the same.
2. There is no significant difference in the qualities of locally made plaster of Paris and that of the British standard plaster.
3. When the locally made plaster of Paris ceiling (made from cement and water sachet) absorbs water it gets stronger.
4. When the gypsum ceiling (the British standard plaster) absorbs water it gets weak and sag or even collapse.

Research question

1. What is the moisture absorbing capacity of plaster of Paris made from locally sourced material (cement and pure water sachet) and the British standard plaster of Paris?
2. What are the relationships and differences between the qualities of the British standard plaster of Paris and plaster of Paris made from cement and water sachet?
3. What are the strategies for promoting the use of plaster of Paris made from locally sourced materials (cement and water sachet) in Nigeria?
4. How can these locally sourced materials be used to replace the imported ones?

Hypothesis

For the purpose of this study the following null hypotheses were formulated and tested
 $\rho; 0.05$.

HO₁ There is no significant difference in the qualities of British standard plastic of Paris and plaster of Paris made from cement and sachet water.

HO₂ The size and volume of plaster of Paris does not reduce as it dries. HO₃ The drying time of plaster of Paris cannot be affected by letting the mixture rest for some minutes before it is mixed.

CHAPTER II

REVIEW OF RELATED LITERATURES

This chapter deals with the view of relevant literatures pertinent to the study under the following headings:

1. Brief history of plaster of Paris.
2. Market survey of plaster of Paris.
3. advantages and disadvantages of plaster of Paris
4. Uses of plaster of Paris.
5. setting and hardening
6. Effective ways of promoting locally sourced building materials.

Brief History of Plaster of Paris

The use of plaster of Paris predates the founding of the city of Paris. The gypsum compound is commonly referred to today as plaster of Paris because gypsum was found in abundance on Montmartre hill in Paris. It was first use in 1700 in Paris, the type of plaster for coating of wooden houses, for prevention of fire. It was also used by the ancient Egyptian to plaster the pyramid at Cheops. In Britain research being carried out by Claire Gapper a Phd student at the court auld institute reveals that considerable quantities of plaster of Paris were being imported from France during Henry VIII reign for works of royal properties. However, Claire Gapper's research shows that it was being used in the 16th century with lime in floors, walls and ceilings but decorative plaster works which was previously assured to contain only minute traces; the sort of level at which one would find it as an impurity in lime stone. This contrast with the use of gypsum over the last 200 years, when predominantly used for casting decorative elements and for gauging lime when running water trapped in lagoons. According to

the nature of its impurities, gypsum can show various colors ranging from white to brown, yellow grey and pink. Gypsum selection and preparation are key factors to produce the best plaster. The chemical reaction is $\text{H}_2\text{O} + \text{heat} \rightarrow \text{CaSO}_4 + 1/2\text{H}_2\text{O}$. Several processes are available to calcinate gypsum into plaster of Paris. We can distinguish two categories.

1. Calcinations under atmospheric pressure to produce alpha plaster.
2. Calcinations under elevated pressure to produce beta plaster.

Controlling some critical calcinations parameters is very essential to master the growth of the plaster crystals. And the performance of the plaster depends a lot on the crystal size and shapes. Plaster of plastic is a calcium Sulphate hemi hydrate: $(\text{CaSO}_4, 1/2\text{H}_2\text{O})$ by firing this minerals at relatively low temperature produce different types of anhydrite (CaSO_4) gypsum plaster is not a modern invention like Portland cement, as some people might suggest.

Plaster of Paris is a type is type of plaster which can be used in art, architecture, fireproofing, and medical applications. When people think of “plaster,” they are often thinking specifically of plaster of Paris, although there are a number of different types of plaster in the market including lime plaster and cement plaster. Many art and construction supply stores sell plaster of Paris, and it can also be ordered through special companies. This plaster is made by calcinating gypsum, a process which involves exposing the gypsum to very high temperatures to create calcium sulphate and then grinding it into a fine white powder. When water is added to the powder to make slurry, the slurry can be molded in a variety of ways, and as it sets, a firm matrix is created, creating a solid shape which is also very smooth. One advantage of plastic of Paris is that there is no volume loss, so casts made with this plaster are true to size of the mold. History seems to indicate that, despite the name, plaster of Paris was invented by the Egyptians. It was used as an artistic decoration in many Egyptian tombs, and the Greeks picked up the

technique, using plaster in their own homes, temples, and work of art. Paris became synonymous with this type of plaster in the 1600s, thanks to a large deposit of gypsum which made it easy to produce plaster of Paris. The substance was also used extensively in fireproofing, giving Persian homes a distinctive appearance. In art, plaster of Paris can be used to make sculpture, and test molds for bronze and other metal castings. Plaster can also be used to make molds which will be very dependable while withstanding high temperature. Plaster of Paris can also be used as an architectural feature, as for example in the case of plaster moldings mounted on doorways and window frames.

As a building material, plaster of Paris can be used to increase the fire resistance of a structure. It is often applied as a coating over other construction materials like metal and wood. Doctors have historically used plaster of Paris to make smooth, hard casts for broken limbs. This material can also be utilized in criminal investigations, with plaster of Paris being used to make molds of footprints, tire tread, and other markings. Because the plaster will not shrink as it dries, it can be used to create a court-admissible cast as well as a reference which can be used in an investigation.

Advantages of Plaster of Paris

They offer maximum unobstructed view in a room and thereby never fail to catch the eye. But apart from decorative lighting, plaster of Paris as a ceiling material serves a dual purpose within an indoor space:

Aesthetic:- the design patterns are concealing of electrical wiring.

Functional:- light reflectance, sound absorption, thermal insulation and support to fixtures.

All these play a vital role in creating the environment within a room. It is no surprise that decorative ceilings are slowly forming an integral part of any interior design for new and old

constructions. Plaster of paris ceilings offer excellent insulation against heat thereby helping to cut down our spending on air conditioning, all your service like wiring, ducting and insulation can be concealed within the ceilings, which prevents having to dust them by providing you with a clean, level surface below.

Gypsum boards (plaster of Paris board) are also higher on stability and impact resistance and are very strong in comparison to other types of ceiling. This is one reason why gypsum boards can be made larger in size and hence have fewer joints suspended on a metal or wooden grid and less number of joints and thereby forms a strong ceiling design.

Other advantages of plaster of Paris include:.

1. It is cheaper in construction than other ceiling material
2. The gypsum plaster does not cause cracking of surface thereby giving the ceiling a very fine finishing
3. It does not require the use of nails and batting for the finishing touches.

Disadvantages of plaster of Paris

1. it has a very low sound absorbing ability
2. the gypsum plaster is very susceptible to water damage and as such not good for external use and bathroom

Market survey of plaster of Paris

A market survey of construction of plaster of Paris generally, shows that it is cheaper in construction than other ceiling installation. Although a bag of ABS-gypsum plaster for the construction of British standard plaster of Paris sells for #3500 and that makes the foreign product to be quite more expensive than the local cement which is sold for only #1750 per bag, but the demand for the product is very encouraging because of its advantages over other types of ceiling materials thereby making it a very lucrative business one can venture into as a young graduate or an artisan.

Uses of plaster of Paris

The various use which plaster of Paris can be put include fireproofing and giving our homes a distinctive appearance. In art, plaster of Paris can be used to make sculpture, and test molds for bronze and other metal castings. Plaster of Paris is also used to make molds which will be very dependable while withstanding high temperature. Plaster is also used as an architectural material, for moldings mounted on doorways and window frames.

As a building material, plaster of Paris can be used to increase the fire resistance of a structure. It is often applied as a coating over other construction Materials like metal and wood. Doctors have historically used plaster of Paris to make smooth, hard cast for broken limbs. This material can also be utilized in criminal investigations, with plaster of Paris being used to make molds of footprints, tire tread, and other markings. Because the plaster will not shrink as it dries, it can be used to create a court-admissible cast as well as a reference which can be used in an investigation.

Setting and Hardening

The setting and strengthening of gypsum are due to intergrowth of very fine and poorly soluble crystals of hydrated gypsum as they precipitate from a solution which remains oversaturated as long as the hydration of the gypsum proceeds. Following are the two theories of setting of gypsum.

According to the crystallization theory proposed by Le-clatelier when water is added to gypsum, the latter dissolves forming a saturated solution of hydrate gypsum. Since the solubility of semi hydrate gypsum is about 3.5 times more of dehydrated gypsum, the solution that is saturated with respect to the semi hydrate gypsum causes dehydrated gypsum to crystallize. In this process the concentration of semi hydrate is reduced causing more of it to dissolve until again the solution is oversaturated and again yielding crystal of dehydrate gypsum. The process continues until all the semi hydrate gypsum is hydrated and crystallized.

According to colloidal theory when water is added to gypsum the semi hydrate gypsum goes into solution until the latter is saturated. In an oversaturated solution, the interaction of water with the solid semi hydrate continues on their surface due to high mutual chemical affinity

Effective ways of promoting local building materials

To develop and promote the use of local building materials other than conventional ones requires the encouragement of the research institute, the government, industries and the general public. According to Pillaick S. Rohagi, (1981) the bulk of work depends on the researchers' effort to research, discover, processed and sell out to the industry.

These researchers are available in the research institute and in tertiary institution even as others are informally established. In polytechnic education the research institute work take through series of experiment in the laboratory and workshop requiring huge investment for a high standard and acceptable material to be discovered. Ministry of education should be ready to invest by making funds available, as she formulate policies that will encourage the industry and the general public to patronize the new materials. Based on the background, the following should be considered for the effective ways of promoting local building materials.

Research works on local building material in Nigeria:

In Nigeria today there are about two research institutes, that is raw materials institute (RMRI) and Nigeria building and roads research institutes (NBRRI) is presently sourcing for all functional material Modedor, (2002). Its major role has to do with the sellout of information through material seminars, conference and workshop s, where as NIBRRI is specially required to research into all form of construction materials. He further stated that, this institute should be made functional through training and retraining of staff, adequate funding should also be provided exchange between NIBRRI and tertiary institutions should be introduced, meaningful research funding can be promoted with incentive to such researchers. Nigeria building road research findings can be experimented through the necessary agent. All findings should be publishing immediately they are tested and found suitable. Close participation between research institute, and ministries of works and housing should be work together so that research findings can be experimented through the necessary agent. Close participation between research institute, and construction country in Nigeria. It is the duty of the research institute to make public their research finding. This should not be done only at conference and pages of newspaper but go further by approaching the construction industry and encourage them to experiment on the

newly discovered material Asaolu and Madedor.(2003). Feedback should be expected from the industry on the performance.

In Nigeria most manufacturing industries prefer to carry out their own research institutes. This should be discouraged by allowing exchange of staff between research institute and the manufacturing industry. The manufacturing industry should also bring in construction industry as its role is implementation is necessary and from their feedback is obtained (Opoko, 2000).

Effort of government in developing locally sourced building materials

According to Olateju, (1997) later developments in the country are positive pointers towards effort made by government to encourage the use of locally available building materials. The establishment of the raw material research development council (RMRDC) by the Babangida administration was a turning point in development of the commissioned studies the following project will be embarked on in collaboration with private sector.

1. Material characterization and performance characteristics.
2. Material pilot production testing field demonstrations.
3. Popularization and commercialization of such materials.

In 1995, the RMRDC finished the documentation of various materials deposits which could be effectively harnessed for the building industry. This deposit would attract small and medium scale industries that would mass produce the building materials. In Egypt, India, Portugal, and Brazil, burnt clay bricks are produced by small and medium scale industries (United Nations 1990). These result availability of affordable and durable building materials. Similar industries have been identified for Nigeria for the production of burnt clay brick and tiles cement stabilized brick. Line and Pozzolana cement decorative stones etc in area where the technology makes this approach economically, the following are to be considered immediately.

1. Evolving a policy that makes it mandatory for the designers and executors of government projects to recommend and used indigenous building materials wherever applicable.
2. Provide comprehensive information on the type, location and extent of the various locally available materials.
3. Establishment of more forest plantation to support wood and raw materials for construction industry.
4. Design a package of incentives to attract small and medium scale enterprises to the commercial production of such materials
5. Demonstration from time to time project and prototypes using local materials in various states.
6. Organization training programmed for artisan and craftsmen to upgrade their skills in the use of indigenous building materials. And
7. Increase the level of funding for R&D for the sector.

Organized private sector

Udoh (2003) stated that a number of construction materials from indigenous resources developed through R&D effort of our institution and universities need to be commercially produced. The commercial production in these materials can be achieved through the assistance of the organization private sector (OPS). The private sectors also participate actively in the viable venture of forest holdings and plantations for supply of wood for holding industries.

Professional associations

According to Obasi (1990) professional associations like the Nigeria Institute Of Quantity Surveyors; Nigeria Institute Of Builders (NIOB); Nigeria Institute Of Architects (NIA) etc could assist with:

1. Generating data on local building materials needed for the realistic cost of planning of building or monitoring projects predominantly based on indigenous building materials.
2. Disseminating information that is provided by RMRDC to their Member, to assist them with cost monitoring and better site management of on-going projects and also in the cost planning of future projects.

Mass media

The media (TV, Radio, Print media) must increase the aspiration and expectations of Nigerians to the use of local building materials. (Obiegbu, 2001)

Standard performance

For a building to be functional it is necessary that the material used perform the required function without which failure will occur within the shortest possible time. Availability in a large quantity does not guarantee durability, strength aesthetic and weather resistance. Test must be carried out to determine their properties. Market digest (1999) report that for long lasting thatch stern characteristic must conform to certain appropriate requirement. Airapetous (1986) in his book stated that the general properties of building material and product may be divided into three basic groups, namely, functional properties, aesthetical properties and economical properties. He went further to say that into three basic groups namely, physical properties, mechanical properties and chemical properties.

Gravel, clean sand, granite, zinc and other such materials have satisfied prospective user and has been the reason for continuous patronage. More so, there have been no alternative. According to Udoh (2003), posited that materials used in the construction or maintenance work should be of good quality. This ensures that such utility will last long in use. Again Okah, (1996) maintain that the materials used in construction equipments in terms of quality and manufacturing process determine its useful and efficient life. Material sourcing should be aimed at nothing but good quality. There should be quality assurance bearing in mind that no individual or group of persons would want to go for inferior items.

Funding of research proposal

Research functions rely solely in adequate funding and without it no tangible achievement could be recorded Olateju (1997). This is because not all research findings would yield expected results, this which may be referred as a waste of time and labour whereas this is not so. This might have caused the delay in injecting enough funds into institutions carrying out researches. According to Udoh (2002), funding of research institutions should be a serious business in which government and the private sector invest heavily. Within the polytechnics system 2% of the total budget is allocated to researches. He further stated that special fund should be crested to cater for researches generally, whereby industries are made to contribute certain percentage of the annual profits to research. And where positive findings are made, should be sent to the industry for test run. And when prove useful should be highly publicized through series of avenue already mentioned.

CHAPTER III

MATERIALS AND METHOD

This chapter describes the research design and the procedure to be adopted in the construction of plaster of Paris ceiling.

Area of the study

The research work was carried out within civil engineering laboratory of federal university of technology minna, main campus (Gidan kwano campus)

Research design

The research work is an experimental study. This study was used to examine the relationship and differences between plaster of Paris ceiling made from a locally sourced material (cement and water sachet) and the British standard plaster of Paris ceiling.

MaterialS/apparatus

1. Gypsum cement and local cement
- ii. Water
- iii. Range
- iv. Wood fibre (fillers)
- V. lubricant (bop tin)
- VI. water sachet
- vii. mould/glass

viii. pail/plastic

gypsum cement: there are various types of gypsum cement in the market but ABS gypsum is normally preferred by artisans and professional involved in the construction of pop ceiling because of its rapid hardening ability thereby making your work to be very fast and neat.

Local cement: there are also various types of our local cement in the market but DANGOTE cement is chosen not because of quality but because is the most common type of cement in the country today.

Range: the range is used to give the plaster of Paris ceiling a uniform thickness and length it is usually made of wood plastic or metal and approximately ten(10mm)

Wood fibre: since cement is known to be very strong in compression but weak in tension, the tree fiber is used as re-enforcement to the cement paste in order to increase the tension force.

Water: Almost any natural portable water that has no pronounced taste or odor is acceptable for the two mixes. Many sources of water unsuitable for drinking may also be used. In case of a doubt, water samples should be tested for suitability. Excessive impurities may affect setting time, and strength.

The effect of impurities in water is mainly expressed in terms of setting time of cement. The initial setting time of the mixes with impure water and that with the pure water are obtained.

Lubricant (bop tin): this is normally made from mixture of soap, oil and water and it is used to break the force of adhesion between the casted ceiling and the mould or glass.

Water sachet: this is cut into pieces using a plasticizer or scissor and it is used to perform the same function as that of the wood fibre in the gypsum paste.

Mould/glass: this is normally constructed to the size of the ceiling to be constructed.

Procedures for casting the gypsum (pop) ceiling

The first step in casting of the gypsum plaster of Paris ceiling is separation/loosening of the wood fibre, then using your brush lubricate or oil the mould ensuring that you do the lubrication of the mould in one direction and not zigzag or random movement of the brush to give the ceiling a very fine finish. With your pail, measure out a quantity of water according to the size of ceiling to be constructed. into the water you have measured out add your gypsum cement to form a past then arrange your range on the mode also according to the size of ceiling to be casted, then turn the paste into the space formed by the range, and add your tree fiber to spread uniformly on top of the cement paste; then make another lighter paste and turn it on top of the tree fiber that is spread over the initial paste; fold in any excess into the space formed by your range and do not trim if there is any excess. Allow it to set for 20-40 minute then remove the range and lift the ceiling of the mould using a scraper. And keep in a suitable position for final use or hanging.

Procedure for casting the local ceiling

With your plasticizer or scissors cut the water sachet into tiny pieces; then carry out the lubrication process as stated above and place the range on top according to the size of ceiling you desire to construct; with your pail, measure out some quantity of water capable to give you the required size of the ceiling you are about to cast then add your cement to the water to form a cement paste and lubricate the mould using your brush before you turn the paste into the space formed by the range you have arrange on top of the mould, mix another quantity of cement with

the water sachet you have cut into pieces then turn it on top of the cement paste and spread it with your trowel to fill all the available space provided by the range then add additional water if necessary and allow to set for sometime depending on the nature of the temperature of the environment where the construction is taking place. Then remove the range and lift gently with your scraper or hand trowel.

Determination of their functional properties and moisture absorption capacity

A. Specific gravity

According to American society for testing and material (ASTM) C127-84, specific gravity is defined as the ratio of mass or weight in air of a unit volume of material to the same volume of water at the stated temperature. Specific gravity of a material depends on the amount of void and the specific gravity of the various components of that material. Specific gravity is used to determine the weight of material is represented mathematically as:

$$\text{Specific gravity} = \frac{a}{a-b}$$

Where

a = weight of the dry plaster of Paris ceiling

b = weight of the plaster of Paris inserted in water

Properties of plaster of Paris ceiling includes:

1. White in color
2. Setting time is 20-40 minutes
3. Require re enforcement with wood fibre

4. Get weak when it absorbs water
5. Specific gravity 2.27

Properties of locally made ceiling includes:

1. grey in color
2. Setting time 45-60 minutes
3. Requires a re -enforcement with water sachet
4. Gets stronger when it absorbs water
5. Specific gravity of cement 3.15

The water absorption capacity of a material according to (IS: 2690) is denoted mathematically as:

$$\text{Water absorption in\%} = \frac{W2-W1}{W1} \times 100$$

Where, W1 and W2 are the respective dry weight and immersed or wet weight respectively

APPARATUS

1. A Sample of locally made ceiling
2. A sample of gypsum ceiling
3. A beam balance or weighing balance
4. Water, a pail and a stop watch

CHAPTER IV

DISCUSSION OF RESULTS

This chapter presents the result and the analysis of data obtained from the Experiment carried out in chapter three (III) of this research.

Research question one: what is the moisture absorbing capacity of plaster of Paris made from cement and water sachet and the British standard plaster of Paris.

Comparison of their moisture absorbing capacity was carried out in three

Consecutive bays of five(5) minutes interval and the results obtained are as shown below:

| Locally made plaster of Paris | British standard plaster of Paris | Time |
|-------------------------------|-----------------------------------|----------|
| 1.695 | 1.425 | 5minute |
| 1.800 | 1.430 | 10minute |
| 1.810 | 1.430 | 15minute |
| Dry weigth(g) 1.570 | Dry weigth(g) 0.70 | |

| Percentage moisture absorbing Capacity of locally made pop Plaster of Paris | Percentage moisture absorbing Capacity of British standard plaster of Paris | Time taken in minutes |
|---|---|-----------------------|
| 7.26 | 103.571 | 5 |
| 14.65 | 104.290 | 10 |
| 15.29 | 104.290 | 15 |

The results obtained from the comparison of the moisture absorbing capacity above reveals that the locally made plaster of Paris is better in terms of moisture absorbing capacity and can be used externally in a building.

Also the comparison of their weight reveals that the locally made plaster of paris is heavier in weight than the British standard plaster

Determination of the specific gravity of locally made plaster of paris

$$\text{Specific gravity} = \frac{a}{a-b}$$

Where

a = weight of the dry plaster of Paris ceiling

b = weight of the plaster of Paris inserted in water

$$= \frac{1.570}{1.570 - 1.625}$$

$$= \frac{1.570}{0.125}$$

$$= 12.25$$

Research questions two:

What are the relationship and differences between locally made plaster and the British standard plaster of Paris?

The method of construction as we have seen in the casting procedures in chapter three for both locally made and the British standard plaster reveal that the same method of casting is adopted for both the locally made plaster of Paris and the British standard plaster of Paris are the same except for the differences in the separation of the wood fibre and the cutting of the pure water sachet.

They both require the use of the following equipments and materials in the casting process:

1. Mould, range. Re-enforcement,(water sachet and wood fibre), cement (gypsum cement and local cement, lubricant(bop tin), pail. And water

Aesthetic quality

The comparison in their aesthetic qualities reveals that there is no difference in the aesthetic qualities since they both take the shape of the surface on which they were casted

Research Question three

What are the strategies for promoting the use of plaster of Paris made from a locally sourced materials (cement and water sachet) in Nigeria?

Considering the report presented by Opara (2001) on the effective ways of promoting the use of local building materials as shown in the second chapter of this research reveals that through adequate funding of research institute, establishment of small and medium scale industries and provision of training programs for craftsmen etc, we can promote the use of our locally sourced materials and ideas.

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of the study

This chapter presents the summary of the study, implication of the study, conclusion and recommendations of the study.

It was observed that the importation and use of foreign building material in our country has made it quite difficult if not impossible for the poor and some low income earner to be able to afford these foreign ceiling materials in which British plaster of Paris is one, due to the economic situation of our country and the persistent increase in the price of these imported materials. Therefore this research was been undertaken not only because of high cost but also to restore hope to the poor and some low income earner.

Implication Of The Study

This research has provided information's that will be of great significant to instructors (teachers) in the class room activities and organization of workshop, students in the area of additional skill acquisition and entrepreneurship development; and the society at large as this is not only building in us a recycling attitude but will also remove environmental degradation resulting from indiscriminate dumping of this water sachet; more also it has restored hope to the common man and the low income earners in our society who cannot afford the imported plaster of Paris(gypsum plaster) or even other types of ceiling materials. It serve as source of employment to our unemployed youths out there and the government will also benefit greatly from this research because the huge sum of money spent on importation of this foreign building

material will definitely be redirected into developing other aspect of our infrastructure or even savings.

Conclusion

Having compared the qualities of the locally made plaster of Paris with the British standard plaster of Paris and found that the British standard plaster is not in any way better both in strength and aesthetic value except the fact that it is lighter in weight, the professional association in the industry such as national institute of builders (NIOB) and national institute of architects in collaboration with the government should help in enlightening the general public on the need to use our local cement in the construction of ceiling rather than the imported cement.

Recommendations

The following recommendations are made based on the research findings for consideration.

1. There should be adequate enlightenment campaign by the government and the society in general on the benefits of using this locally sourced material.
2. Government should establish small scale industries for the production and construction of local building materials.
3. Young researchers in our various institutions should be encouraged by the government through funding of research proposals.
4. Government should also encourage and finance local artisan who are willing to produce local machines such as plasticizer to facilitate the construction of this locally made plaster of Paris.

Suggestion for further study

1. A comparative study of plaster of Paris made from local rapid hardening cement and British standard plaster of Paris.
2. Comparative study of plaster of paris made from cement and water sachet with british standard plaster for final setting time.

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APENDIX

Moisture absorbing capacity of locally made plaster of Paris in percentage (%) for the 1st five minutes

$$\begin{aligned} &= \frac{w_2 - w_1}{w_1} \times 100 \\ &= \frac{1.695 - 1.570}{1.570} \times 100 \\ &= \frac{12.5}{1.570} \\ &= 7.9618 \\ &= 7.96\% \end{aligned}$$

Water absorption capacity in % in 10 minutes of the same locally made plaster of paris,

$$\begin{aligned} &= \frac{w_2 - w_1}{w_1} \times 100 \\ &= \frac{1.8 - 1.57}{1.570} \times 100 \\ &= \frac{0.23}{1.57} \times 100 \\ &= 23/1.57 \\ &= 14.6497 \\ &= 14.65\% \end{aligned}$$

Water absorption capacity of locally made plaster of paris in 15minutes

$$\begin{aligned}
&= \frac{w_2 - w_1}{w_1} \times 100 \\
&= \frac{1.81 - 1.570}{1.570} \times 100 \\
&= 24/1.570 \\
&= 15.29\%
\end{aligned}$$

Average absorption capacity of locally made plaster of paris is obtained by summing up the three result obtained divided by three ie

$$\begin{aligned}
&= \frac{7.96 + 14.65 + 15.29}{3} \\
&= 37.9/3 \\
&= 12.63\%
\end{aligned}$$

Water absorption capacity of the british standard plaster of paris for the 1st five minutes

$$\begin{aligned}
&= \frac{w_2 - w_1}{w_1} \times 100 \\
&= \frac{1.425 - 0.70}{0.70} \times 100 \\
&= 0.725/0.70 \times 100 \\
&= 72.5/0.70 \\
&= 103.5714\%
\end{aligned}$$

Absorption capacity for the 1st 10minutes

$$= \frac{w_2 - w_1}{w_1} \times 100$$

$$\begin{aligned}
&= \frac{1.43-0.70}{0.70} \times 100 \\
&= 0.73/0.70 \times 100 \\
&= 73/0.70 \\
&= 104.2857 \\
&104.29\%
\end{aligned}$$

Absorption capacity for the 1st 15minutes

$$\begin{aligned}
&= \frac{w_2-w_1}{w_1} \times 100 \\
&= \frac{1.43-0.70}{0.70} \times 100 \\
&= \frac{0.73}{0.70} \times 100 \\
&= 73/0.70 \\
&= 104.2857 \\
&104.29\%
\end{aligned}$$

Average absorption capacity = $\frac{103.57+104.29+104.29}{3}$

$$= 312.15/3$$

$$= 104.05\%$$

