The Use of Calcareous Materials in the Vernacular Architecture of Iran, Password Protect the Environment

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Abstract. Materials used in traditional and local architecture in Iran derived from their deployment environment and are provided the necessary compatibility with the environment. Therefore, the use of such materials in buildings, on the one hand reduce the natural resources use and other energy resources saving during the production process materials, traditional buildings and the construction and maintenance stages of protection and restoration of such buildings will provide. Indeed, the absorption of CO2 by lime is one of the main approaches of this article that by itself would be help to reduce the greenhouse gases. This article is thoroughly compatible encoding used traditional materials in Iran, the vernacular architecture of limestone and lime-based mortar, including the cheap materials, easy collection, availability, and would reveal durable building. Thus, in this research, with study on the related experiences of others and the results of mechanical tests on clay soil mixed with lime and analysis of the mentioned results; technical, economic or executable practice of using lime in the construction of new buildings and even local Iran has been approved. Patterns can be as a result from getting the technical message predecessors and taking advantage of new technologies associated with new products industries causing lime to make optimal rate consumption of natural resources and energy saving. Then we are able to material produced reversible resorting in nature unlike cement industry, even with the capture carbon dioxide from industrial production of construction can the greenhouse effect of air pollution in the environment and to reduce the damaging effects of acid rain as well as related We prevent.

Keywords: iranian vernacular Architecture, lime materials, greenhouse effect, acid rain, materials and energy saving, environmental protection.

1. Introduction and the Integral Use of Lime Mortar

In the industrial production of lime, in order to release water and carbon dioxide, the lime stone should be heated at a temperature between 950-600°C. However, for the industrial production of cement a temperature in the range of 1100-1400 C would be required. On the other hand, unlike lime the production of cement consumes 1.5-2 times more fuel energy and an excessive increase of pollution would be resulted in the environment. Nevertheless, the early strength of concrete which is made with industrial cement would seemingly be adequate during 28 days, yet the late strength of concrete or other materials which are made with lime stone would be durable within 48 days. Also in terms of stability and sustainability of ancient and monumental buildings this phenomenon has been apparent during these years’ cause of the stable apparent quality and the transparency of the surfaces in proportion to new industrial buildings.

In this regard we could easily discern the stability of many Iranian monumental buildings against earthquake, the corrosive influence of water, coastal floods, moisture and extreme heat. In other words, the need of refinement and clearance of veneer dirt on new building has encouraged humanity to invent self cleaning materials in help of lime materials and nanotechnology to resolve the industrial problems of buildings.
Thus, after reviewing the evidence and researches done by others in this realm we would be ensured that by decoding the arterial production of building materials used by traditional architectures of this land and by consuming energy in a reasonable manner we will be able to improve our environment. For instance, using indigenous materials such as brick, gypsum, limestone, concrete, gas and foam are cases that are all in need of being technically, operationally, environmentally and economically reviewed. (fig.1)

Fig. 1: Some of the lasting images of monuments in danger of damaging environmental factors

2. Environmental Records of Lime Mortar

2.1. The technical and mechanical properties of lime mortars

In assessing the role of lime based mortars in terms of making historical and monumental building water proofed, retaining their quality and the possibility of repairing exposed building surfaces in aspects of colour quality and the providence of necessary amount of gloss, it has been determined that these types of mortar are a sufficient replacement for industrial mortar such as industrial cement and could be used against environmental pollution in historical buildings.

This alternative would make it feasible to repair and fill the surfaces which have been worn out or damaged. Moreover, we would have the ability to remove stains in order to preserve the colour and provide the necessary sparkle. According to the investigation that was carried out in Spain and Italy on some historical buildings about the advantages of using restoration mortars with lime that were integrated with materials such as brick and plaster a signification reduction in the amount of water permeability, corrosive salts was discerned. These mortars are considered as the main materials in the reparation and refurbishment of monumental buildings surfaces, because by the help of these materials permeability would diminished so rapidly and we would be able to excretion the water that causes corrosion. Moreover, we could obviate the factors that may case weathering and the corrosion cased by acid rains. This claim could be confirmed by the help of non-destructive heating ways such as the thermal detecting testing on buildings that have been restored by a lime-based mortar. In other words, lime-based mortars could be a mixture of white cement, lime, silica, cement or steel and it could easily recover the shine of monumental buildings and enhance their gloss. Furthermore, we could reduce the rate of water absorption in monumental buildings in order to in increase the durability and sustainability of theses type’s buildings. The gold tower in Seville Spain shown as figure 2 is on of these kind of buildings.
Fig. 2: View from the Tower of Gold in Southern Spain

As discussed, if the mechanical characteristic of lime mortars, namely the strength of these mortars, could provide the necessary stability and sustainability the use of lime mortar would be merit. Therefore, in order to measure the mechanical strength and durability of these features in a life-time of a building made with lime mortar, we could use prosperity as an indicator for measuring quality, durability and a quantities assessment for the technical features of calcareous materials. On the other hand, the porosity of lime mortars would gradually be reduced by aging, yet the minimum criterion of age would be a period of 60 days. Thus, the 60 day porosity would be a good criterion for determining the quality of our design and would give us an insurance to use the lime mortar or not. [1]

2.2. Lime mortar problems

One of the main problems of natural soils is the presence of plants in these type of soil. Moreover being contaminated by organic matters is another issue that we would encounter too. On the other hand, the inexpensively and availability of this soil and the necessitation to adjust with the environment in order to provide sustentation, has submitted us to use natural soils in the condition of rectifying their disadvantages. According to the researches carried out in Netherlands on soils such as soli with organic matter or soils that are deficient in sand it has been determined that by using ash from industrial cement plants, lime and sand with a size between 2-5 mm we could effectively provide the necessary alkalinity needed in these mixture mortars. In addition, we could diminish the permeability and water absorption while saving costs. [2]

Also the researches have shown that compounds such as CaO, SiO2 and CO 2 could robust the alkaline calcareous past and reduces its pores. Therefore, the chemical weathering and erosion would have an incisive reduction in air Pozzolanic lime mortars. Thus, the carbonate factor world provides their durability in terms of brittle failure. [3](fig.3)

Fig. 3: Plants in the presence of organic matter and soil pollution

2.3. The reform and use of lime mortar

The oldest method of fixing loose fine-grained soils, stone columns of a calcareous soil with the lime combined around inside the earth that has a natural advantage. Laboratory studies and determine the mechanical resistance of these materials, the most efficient use of the combined 20 percent limestone and clay in the vicinity of 22% maximum mechanical strength of the samples have been obtained. This method is based on the construction of the base of the calcareous stone bridges and walls of old dams and water wells and water-walled warehouses, dock, the old pool in baths and water channels has been used in Iran. The water storage tanks as columns or columns with square sections, rectangular and square or octagonal and circular limestone to have been made. The lime concrete base stone must not only bear the weight of the upper floor were responsible, but sometimes Large volume of soil accumulated dust on the job and prevent the passage of water from the reservoir have been undertaken[4](fig.4)
The best way to improve the mechanical properties of loose fine grained soils, using lime mortar to the concrete are combined with the soil. It also loosened the soil bearing capacity, as materials will reduce administrative costs. Best of mixing lime to mix concrete mixtures composed of gravel, sand, clay and soil above the 20% has been detected. Saturation and flooding, but the early compressive strength of test samples; they have shown good performance [5].

The use of carbon black and silica sand in the fine grained wind blown lime mortars lime or hydrated lime mortars can improve the initial strength during the short period of 28 days instead of 60 days to help. The lime mortar with silica soot pozzolanic while simultaneously increasing the solid volume and reduce the permeability of the body are affected, in contrast to the initial resistance and durability are upstream [6].

The research regarding the concrete style of calcareous sponge, which is specified using a scale based on each of the components of this material, gauge mode, the mixing method and the expected properties of fresh and hardened concrete, calcareous sponge, such as quality, economical, Compatible entrainment mechanism of the chemical aspects with other components of mortar, reliability and durability properties of concrete engineering practices such as foam manufacturing, mixing, transporting, pumping and final payments are observable and measurable brought [7].

3. Rationalization and Interpretation of the Results and Benefits of Lime Mortars

During the past fifty years in Iran the usage and utilization of sand lime brick has maintained its valuation and resistance in comparison with other new building materials and products. Furthermore, this subject matter could illustrate the amount of indigenousness capability of Iran in the realm of construction and lime products such as Shaft and Sarooj mortars. Thus, the ability of being pioneered in the field of standardization and the development of technical knowledge in new compound material or lime based
mixture would be feasible. Based upon the matters discussed monumental buildings in the world and Iran are mainly from lime based mortars made of indigenous material belonged to the area which the buildings are built. Moreover, the maximum heating point in reaching the glass phase in these materials is between 900-950 Celsius degree. Indeed, this matter by itself would give the ability to recycle these materials to the lap of nature inasmuch as for the exploitation of metals and the production of cement, ceramic and glazed ceramic the temperature that would be required would exceed the precedent temperature. Hence, the consumption of fuel and energy for the provision of this temperature would be increased 1.5-2 times more than the traditional building materials.

On the other hand what is certain is that the more we consume energy, the more we will produce carbon dioxide. This issue by itself would cause an increase in the green house gases on the earth and would case a warmer environment. However, although the production of lime would require a consumption of energy and would produce carbon dioxide according to the following chemical equation, yet we know that this process could be recycled.

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\text{CaCO}_3 \rightarrow 900 \text{C} \& 753 \text{Kcal} \rightarrow (%56)\text{CaO} + (%44)\text{CO}_2 \uparrow + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + 275\text{Kcal} \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}
\]

Therefore, the values of (CO2) produced in the lime manufacturing process, after the water absorption phase, would again be converted to limestone in the carbon dioxide absorption phase in order to make them harder and convert them to a durable and environmental friendly rock.

4. Conclusion

The discussion and interpretation of the information provided can be concluded that the principle of protecting the natural environment, reduce consumption of industrial materials poses costs, reduce administrative costs and more easy than the preparation and production of building materials, use of lime Building materials will be very useful as a complement. The building material, especially for the reversible reduction of greenhouse effect resulting from the production of industrial materials and prevent large increases in atmospheric carbon dioxide in Earth’s environment, as well as we learn from our traditional buildings. Therefore, decoding the ultimate goals of such constructions in order to protect the more stable endemic nature around. Research results on the other hand, argued that using only 50% of similar amounts of energy in the natural environment in a factory production line limestone building products cheaper and more resistant and durable can be made.

The final conclusion that the ancestors of this land code of engineering heritage in building the ancient Iranian lasting, economical, high performance, environmental and ecological use of materials containing lime is being made.

5. Reference