

REVIEW PAPER: BRICK MAKING USING INDUSTRIAL WASTE

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ABSTRACT

Globalization, Modernization and Industrializations had lead to the development of modern world in which we live today. In this continuously developing society there has been a great pressure on raw materials. Problem of waste generation and environmental blunders caused due to construction and several other development works is cause of concern. Increasing population is also a big factor in causing the chronic shortage of construction and building materials. Today, civil engineers and researches are exploring way to use waste as building materials, so as to tackle dual problem of shortage of resources and waste management. In this review paper we will study and analyze these factors and try to explore its application in context of Brick Klin'. This reviewed approach of using waste in Brick making would be aimed to provide sustainable, potential and eco-friendly solution.

1. INTRODUCTION

In precious few decades there have been mismatches in demand supply management of construction materials. Major reason for this mismatch is continuously increasing population and limitation of natural resources which has not been used effectively and efficiently. This problem had to lead to the need to design and develop the sustainable alternative solution for construction material

Most accommodating masonry unit of building material is 'Brick'. Conventionally bricks are produced using clay with high temperature firing in Kiln or form OPC i.e. Ordinary Portland Cement concrete. Due to its making methodology it has high carbon footprint but it thus contains high embodied energy.

Today, there is hike in popularity of using sustainable eco-friendly, cheap and light weight construction materials in Building Industry. Civil Engineers have challenge before them to achieve this purpose of environment friendly construction as well as 'standard' building.[1]

Using recycled waste from agriculture and industrial activities in building material appears to be good solution (Perez JA et al,1996).Several researches have been done to incorporate various waste material in Brick-Production such as wastewater slug, PC & TV waste , fly ash , steel dust, silica frame, granite & marble waste, fly ash slag, perlite , granite sawing , foundry , textile laundry waste , sugar cane baggash ash , structural glass waste , organic residue etc. we will have a look of various researches done in this field.[2]

2. WASTE MATERIAL FOR DEVELOPING BRICK

Granite and marble waste of different sizes were recycled by (Rania et al., 2011) to be used in manufacturing of concrete bricks. Tests on the kind of bricks were successful as these bricks qualified in mechanical and physical properties as non-load bearing materials. All cement bricks were tested using 'Egyptian code requirements' [3].

Technology of reusing the paper sludge in brick industry was introduced by (Chin et al., 1998) this technology also used cogeneration ashes generated in industries of paper for brick making , in this technology brick are required to be fired at 1000°C temperature, bricks developed from this technology has distinct properties such as [4]:

- ✓ These kinds of bricks have compressive strength more than 150kg/cm.
- ✓ Water absorption rate of these bricks came out to be less than 15%.

These properties qualify them to be used as non load bearing spacing construction material. In different case, earthen brick from straw course and fibers were produced through manual compaction by (Quintilio et al., 2011).Combined theoretical and experimental approaches were incorporated to check its mechanical properties [5].

Waste glass from structural glass walls were recycled and used into clay mixture by(Vorrada et al.,2009).For bricks containing 20%-30% of glass(by weight)and fired at 1000°C following properties were noticed. [6]

- ✓ Water absorption as low as 3 % ($\pm 1\%$).
- ✓ Compressive of bricks were 25-40 MPa.

However when this composition of mixture was increased from 20-30% to 45% apparent water absorption and porosity was increased.

Panel and funnel glass of PC&TV glass waste wire utilized by mixing with clay by (Dondi et al.,2009).Sample was first dried at 100°C and then was fired at 900°C. It was experimentally observed that addition of 2% of glass did not brought about any significant changes in regular properties but adding more than 5%of glass waste may have deleterious efflorescence and other

mechanical properties. Demonstration of 'Leaching test' proved that there was no major emission of environmental pollutant. [7]

Utilization of Tionite as potential coloring agent in clay bricks was thought off by (Michele et.al.,2010). Samples were dried at 100°C before getting fired at 1000°C. Addition of 5% tiotine resulted in following properties. [8]

- ✓ Increment in water absorption and working moisture.
- ✓ Decrement in binding strength and bulk density.

Therefore 3% was discovered to be an optimum proportion of Tionite. Potential utilization of granite saving waste as alternative ceramic raw material was discovered by (Romualdo et al.,2005) for the purpose of producing ceramic tiles and bricks. Sample were uniaxially pressed and then fired at 850°C. Experimental tests were done on product having waste composition with 20-30% of granite. Results showed that mineralogical and physical properties were similar to that of conventional ceramic raw materials. Water absorption was as low as 3%, Hence it proved that producing ceramic tiles and bricks using recycled slug was feasible. [9]

A full scale pilot experiment was carried out by (Kay and Volkes, 2002), for purpose of recycling the harbor sediments mixed with clay to produce bricks. Methodology of 'German Industrial Std' was used for production purpose. Brick-Leaching was non-hazardous to ground water and soil. [10]

In other context, the (SBAW) Sugarcane Bagasse Ash Waste was recycled by (Faria et al., 2014) for replacing natural clay [11]. Samples were produced by first uni-axial-pressing at 21 Mpa, then was dried at temperature of 110°C and lastly fired at 1000°C SEM (Scanning Electro Microscope) was used for the purpose of testing.SEM testing found that SBAW was mainly composed of crystalline silica particles and due to which it can be used as a ' filler' in clay bricks. Recycling and reusing of SBAW showed positive result in terms of sustainability, environmental protection, lesser raw materials exploitation and management of waste.

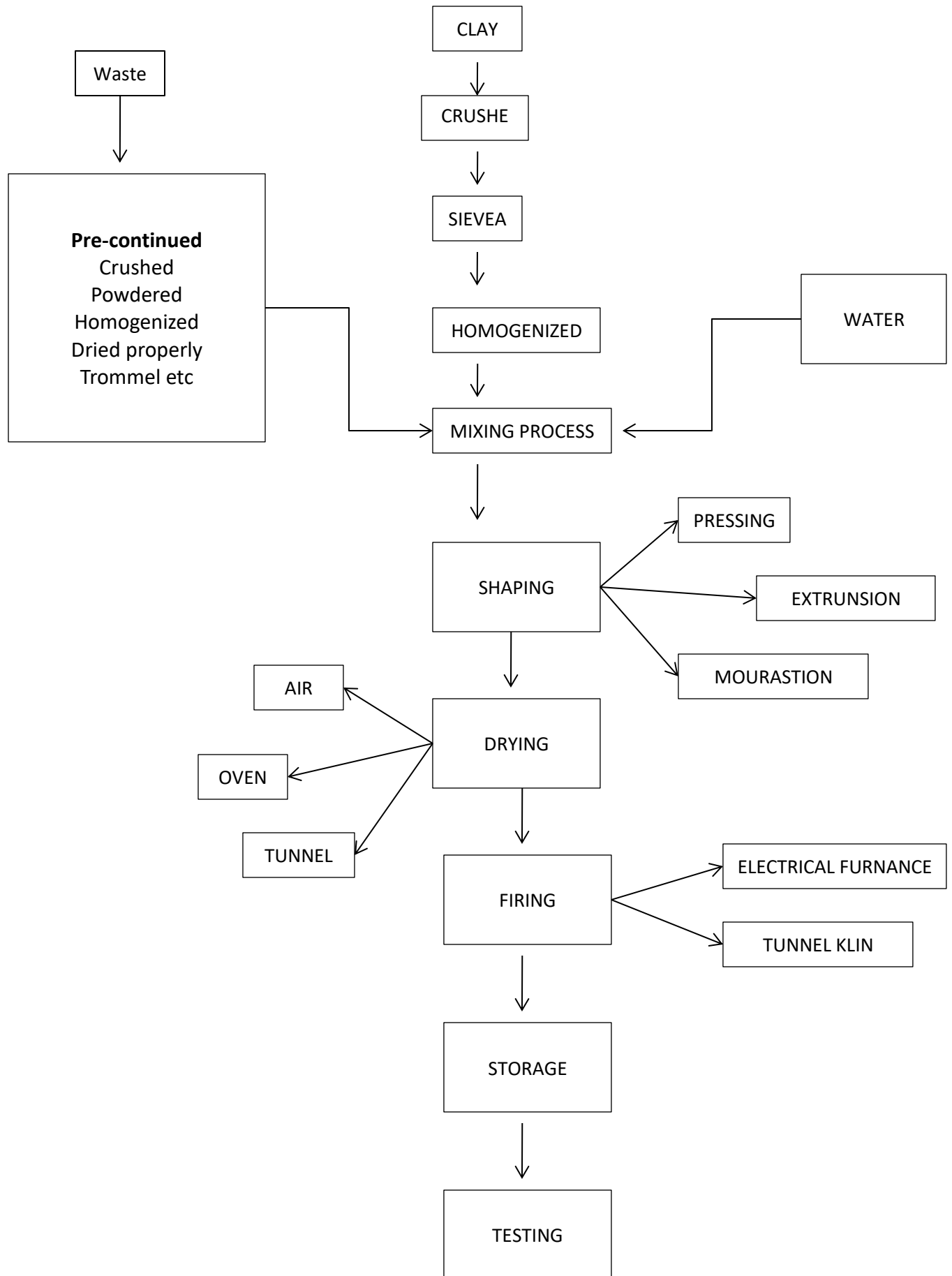
Addition of 2 natural fibers pineapple eaves (PE) and oil palm fruits (OF) to clay water mixture with non baked & baked condition easy experimented by (Chee Ming,2011).Mechanical properties ere explained through(British standards) BS3921:1985 and MS 76:1972 (MALAYSIAN STANDARDS) for Efflorescence for non-backed ones were deteriorated while testing, where as was found to be feasible for backed once. Compressive strength for brick requirements was fulfilled as per British standards, which is 5.2 MPa for conventional Bricks [12].

Few other studies are mentioned as follows:-

Waste material used	Benefits	Feasibility	Experiment by
Cramb rubber concrete combination	*Low cast *Light weight composite *Improved thermal resistance *Improved thermal insulance.	✓	Paki at al 2012 [13]
Textile laundry waste slug	*Satisfactory flexwal strength	✓	Luciana C.S et al.,2012 [14]

	<ul style="list-style-type: none"> * Satisfactory water absorption * Safe and inert acc to 'Solubilization tests 		
Two foundry sand: core sand and green sand	*cost saving and effective	✓	Alonso et al.,2012 [15]
Sewage slug Forest Debris	<ul style="list-style-type: none"> *Lighter *More thermal *Acoustic insulating 	✓	J.A Cusido et al.,2018 [16]
Paint Remnants. Cement Robs sand and Fly Ash	<ul style="list-style-type: none"> * Increased compressive strength *Sustainable and Eco-friendly 	✓	B Dhanlaxmi etal.,2019 [17]

Flowchart to represent the methodology followed in using waste materials for the purpose of brick making.



4. RESULT AND OBSERVATION

In this review paper we tried to show some light on utilization of several raw materials in brick manufacturing. We have already noticed that in few cases basic mechanical properties such as efflorescence, comprehensive strength and waste absorption remained almost constant but in few cases these properties also seems to be showed improvisation when compared to conventional bricks made of clay.

5. CONCLUSION

When we consider on ground realities, especially in Indian context we observed that although there as several researches done in field of using industrial waste material in brick manufacturing process and methodology in India remain aloof. Study throughout the world must be adopted and tested in Indian fields with pragmatic and proactive approach. When these method and techniques will be adopted in full strength only then India can aim to achieve Sustainable development goals SPG of 2030 and realize the dream of Swatch Bharat.

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