31. Cemented Diatermal Block

Soto- Gomez, Wilfredo[1,*]

(*1) TECNOLOGICO NACIONAL DE MEXICO. Instituto Tecnológico de Tijuana.
Departamento Ciencias de la Tierra

Resumen
The use of block’s diathermics cemented, allow to reduce and dampen the flow of heat through walls in the construction of houses and buildings, which decrease the cost in the consumption of conventional energy such as electricity that comes from petroleum, up by 50%, in the operation of systems of heating in winter and air conditioning in the summer.
The block' diathermics are designed to be built with a mixture of using conventional materials, such as sand, gravel and cement, as well as a mix of materials with characteristics of waterproofing and low conductivity thermal, in three different moulds, lightweight and resistant to compression efforts.
The cost of this diathermic block is more of a conventional cementation block, but allows cushioning thermal inertia when the climatic conditions are extreme: low temperatures in winter and high temperatures in the summer, as a result provide us conditions of thermal comfort in a House room

Palabras clave Diathermic block, heat flow, comfort conditions, building materials.

1 Introduction

The use of insulation blocks in the construction of walls reduces the flow of heat through them, which translates into a decrease in the cost of conventional energy such as electricity. This also has an impact on the reduction of the use of non-renewable energies that come from petroleum derivatives to operate heating systems and air conditioners.

The elaboration of hollow cemented blocks vibro compressed in Mexico are made under the norm NMX - C - ONNCCE - 2005. C, and generally present high percentage of permeability, high thermal conductivity and low mechanical resistance. The effect of moisture from saturated air and rainwater, causes problems of deterioration of the material and propagation off union the walls.

2 Methods

The cemented diathermic blocks were designed to be constructed with a mixture of materials of conventional use, such as sand, gravel and cement, as well as a mixture of materials with characteristics of high impermeability and low thermal conductivity, in three different sizes, Low weight and resistant to compression stress.

Figure 1 shows a mixture of materials in the construction of the cemented diathermic block.

Fig. 1 Mixing materials of the cemented diathermic block.

Figure 2 shows the sample preparation of the cemented diathermic block.

The moisture mixture is introduced into the molds (according to size) of the vibro-compressor machine, the blocks are removed from the back, classified according to the percentage of their components and allowed to dry in the sun, following a treatment of spraying water to prevent them from drying out quickly and at night covered with a plastic tarp to prevent them from absorbing moisture.

Fig. 2 Elaboration of samples of the cemented diathermic block.

Initially, the cost of this diathermic block is greater than that of a conventional cemented block, but by damping the thermal inertia when the climatic conditions are extreme; Low temperatures in the winter and high temperatures in the summer, and as a consequence, provide conditions of thermal comfort in a house room. The savings are much greater and therefore the actual cost of the block is attractive.

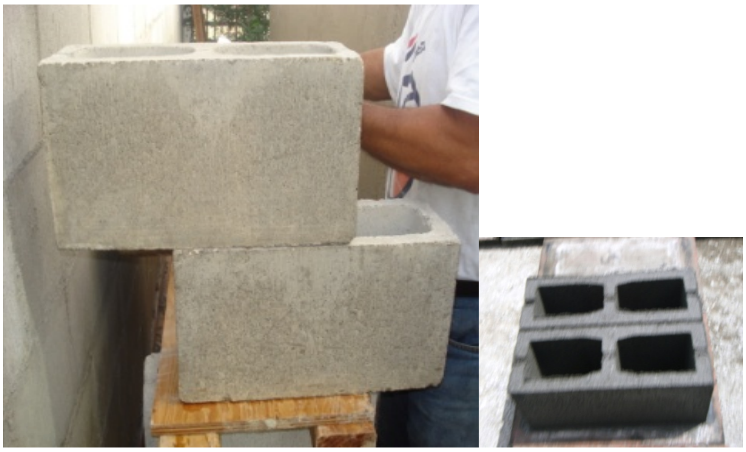

Figure 3 shows on the left side a commercial cemented block and on the right side a cemented diathermic block.

The cemented diathermic block, in three different dimensions (15 x 20 x 40, 10 x 20 x 40 and 20 x 20 x 40), is cemented, hollow and compressed vibro, following in its elaboration the tests of impermeability and mechanical resistance of the C - ONNCCE - 2005. C, in addition to a thermal conductivity test, made with a heat flow equipment.

Figure 4 shows the impermeability test of the cemented diathermic block, which consists of weighing the dry block, introducing it, introducing it completely into water for a period of 24 hours, then weighing it and measuring the percentage of water absorbed.

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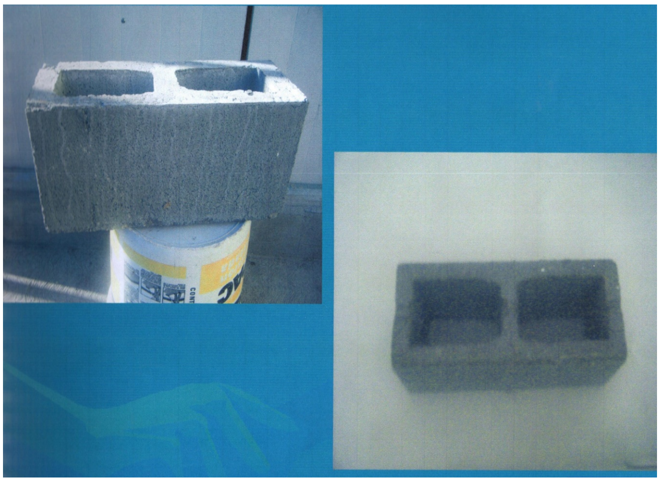

Fig. 4 Test of impermeability of the cemented diathermic block.

Figure 5 shows the mechanical strength test of the cemented diathermic block, consisting of a mechanical compression test, until the block is destroyed. In the test of the cemented diathermic block, the walls of the block only cracked. Giving the possibility that they serve for seismic zones.

Fig. 5 Test of mechanical strength of the cemented diathermic block.

The thermal conductivity test is not included in the standard NMX - C - ONNCCE - 2005, in the elaboration of hollow vibro compressed blocks, but we do it because one objective of this project is to design, elaborate and commercialize cemented block low thermal conductivity, which corresponds to sustainable materials, high energy efficiency, which in its use in building construction reduces electricity consumption of heating appliances in winter and air conditioners in the summer.

With this test of thermal conductivity in cemented diathermic blocks, we will propose an annex to the Mexican standard NMX - C - ONNCCE - 2005, with the purpose that the buildings that use this material, save electrical energy and reduce the consumption of hydrocarbons in the Electricity generation, since in Mexico more than 90% of electricity generation is through the use of non-renewable energy that comes from petroleum derivatives.

Figure 6 shows the thermal conductivity test in diathermic cemented blocks, which consists of introducing the block into the back of a machine, passing heat through the cross-section (A) of the diathermic cemented block, from An electric resistance (Q), induced by two fans, by measuring the temperatures (ΔT), and by the formula:

$Q = A\ U\ \Delta T$ (1)

Clearance U corresponding to the overall coefficient of heat transfer.

This value indicates to us, that high or low is the value of the heat transfer conductivity through its cross section, of the diathermic cemented block. The lower this value, the lower heat transfer exists in the cemented diathermic block.

Fig. 6 Test of thermal conductivity of the cemented diathermic block

3 Results and discussion

Figure 7 shows a table (logbook) of the data collection, of the thermal conductivity test, of a mixture with a defined percentage of aggregate, where U (global coefficient of heat transfer).

Fig. 7 Data log of the thermal conductivity test.

Tiempo	Voltaje V	Amperaje A	Potencia W Q	Área Secc. Transv m^2 A	Coef.Global de Transf. de calor W/m^2 K U	Temperatura Ambiente k T_{amb}	Temperatura Interior k T_{int}	Temperatura Exterior k T_{ext}	Dif. de Temp K ΔT	Observaciones
15:30	46.5	1.15	53.475	0.005026	257.7108	294.6	337.9	296.6	41.3	
15:35	46.7	1.13	52.771	0.005026	255.5496	294.6	338.1	297	41.1	
15:40	46.7	1.11	51.837	0.005026	249.8168	294.6	338.3	297	41.3	
15:45	46.8	1.16	54.288	0.005026	274.1818	294.6	338.6	299.2	39.4	
15:50	46.8	1.12	52.416	0.005026	263.3969	294.6	339	299.4	39.6	

In Figure 8, a graph of thermal conductivity with different percentages of aggregate, with a (3% by weight) of the cemented diathermic block, is shown, has the lowest thermal conductivity (9 W / m2 K)

Fig. 8 Thermal conductivity graph with different percentages of aggregate

Figure 9 shows the waterproofing graph with different percentages of aggregate (with 3% by weight) of the diathermic block, which has the lowest impermeability of (3.5%).

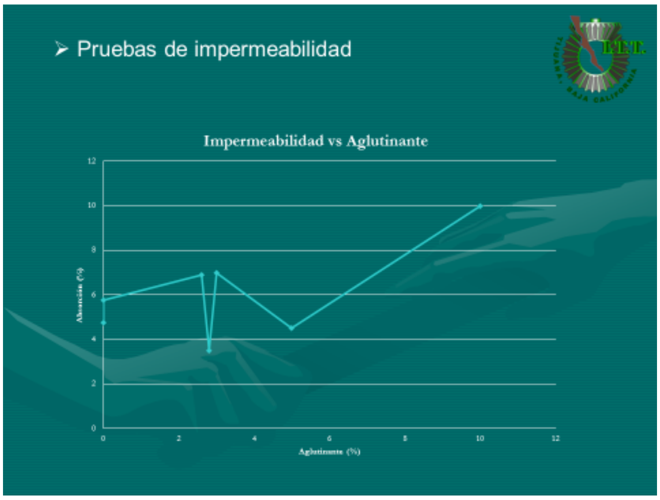

Fig. 9 Graph of impermeability with different percentages of aggregate.

The mechanical strength graph with different percentages of aggregate (with 3% by weight) of the cemented diathermic block is shown in Figure No.10, presenting

the lowest mechanical strength (20,000 kgf), and with 2.8% having high mechanical strength (120,000 kgf).
In figure No.11, the graph of weight - composition with different percentages of aggregate (with 3% by weight of the cemented diathermic block, has a weight of 12 kg

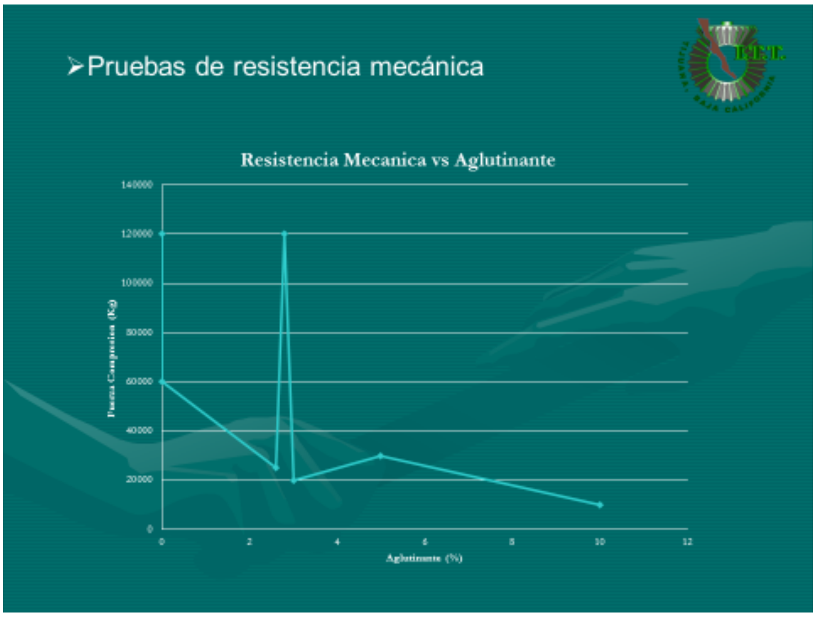

Fig. 10 Mechanical strength graph with different percentages of aggregate

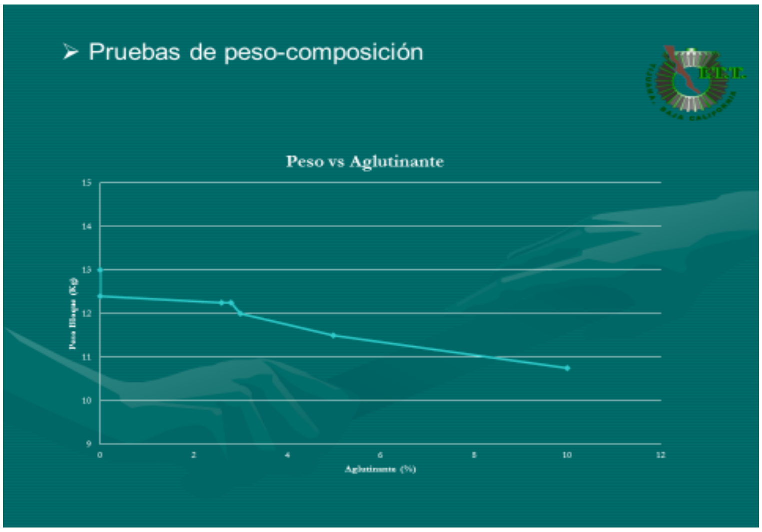

Fig. 11 Weight chart - composition with different percentages of aggregate

4 Conclusions

Based on approximately twelve years of study, theoretical and practical research, empirical and laboratory experiments, with the effort and tenacity of the author who writes this article, as well as setbacks of those who never believed in this project , It was possible to put in the context of a patent registration and soon in the market of the construction industry, a sustainable material that reduces by more than 50% the use of electricity using heating systems and air conditioners.

- Graphs of results obtained, show the feasibility of obtaining a diathermic cemented block, with low thermal conductivity, high water resistance index, high mechanical resistance, possibility of use in seismic zones, low weight in the mass transportation of this product and most importantly, to present to the market of the construction industry, a sustainable material with high index of energy efficiency.

- From this project and based on satisfactory results obtained, we are working in the same way (without financial support) of the Institutions of Higher Education of this Country, in diathermic cementitious plasters, diathermic plaster, diathermic cementitious glue and diathermic concrete.

- This project of diathermic cemented block, gave direction to the need to convert my academic profession to business, as we are working on a business plan, to market this product, and those described in the previous point.

5 References

[1] Soto G, W., "Internal Energy in the First and Second Law of Thermodynamics", pages 561 and 562, from the memoirs of the VIII Latin American Congress on Heat and Mass Transfer, Veracruz, Mexico, August 2000 .

[2] Yunus A. C., "Thermodynamic a heat transfer", Edit WCB Mc Graw Hill, University of Nevada, USA, 2001.

[3] Yunus A. C., "Heat transfer a practical approach", Edit WCB Mc Graw Hill, University of Nevada, USA, 1988.

[4] Ortega H. J.A., Urrioolagoitia G., "Numerical analysis of heat transfer in engineering", Series of Engineering Sciences volume No.14, Instituto Politécnico Nacional, México, 1994.