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A REVIEW ON THE PHASE CHANGING MATERIALS IN BUILDING BASED ON MICROENCAPSULATION

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ABSTRACT

Energy demand increased day to day and the building sector consume about 28% shear from all the energy consumption. Therefore, for the energy storage the phase changing material method is advanced energy storage technology. Therefore, it's need or necessary to focus or study on suitable and advanced methods to incorporated phase changing material into the building materials. Nowadays, different kinds of method are used for incorporation of phase changing material and building materials. Also there are different merits and demerits. Most used and new method is the microencapsulation for the combination and incorporation of phase changing materials and building materials. In that paper we comparatively study on the previous research work on the microencapsulation technology used for the phase changing material incorporate into the building material.

Keywords: Coting, Polymerization, Building Construction, Temperature

I. INTRODUCTION

In recent year, development increased and also the energy requirement is also increased, to fulfil all requirement natural resources used are also increased and some nature resources are in limited quantity. Therefor for the future the natural resources are not sufficient, only the energy from the sun have no limit. The phase changing materials used sun energy therefor, by using phase changing materials in building we can reduced the use of natural resources which of them are in the limited quantity. And also by use of other nature resources many kind of pollution occurs, it omit the harmful gases, harmful chemical, etc. and by the increased pollution many of problem are create like disease are occurs, climatic change are occurs, etc. by using the phase changing materials in building material it help in reducing the pollution. Therefor, the phase changing materials used in building construction is most important for future.

Phase changing materials have different type and different uses. There are several method to incorporation of phase changing materials to the building materials. And all the methods have their own merit and demerit. But this paper is on the study of incorporation of phase changing materials to the building materials by used of microcapsules. by the use of microcapsules method there are environmental, economical, social benefits. By the incorporation of phase changing materials and building materials we achieved the demand of cooling comfort and heating comfort also. The main principal of the phase changing materials is simple its change its state from solid to liquid, liquid to solid, etc. by changing atmospheric temperature and it give the revers cooling heating effect into building. Microcapsules is best method to incorporation of phase changing material.

II. LITERATURE REVIEW

2.1 vineet Veer Tyagi, D. Buddhi "PCM thermal storage in buildings: A state of art"(2005) this paper is based on various system of phase chaning material used. In the building construction how phase change materials are used is explain in this paper. In this paper we study about the various type of phase change material and many of uses. Future scope of phase change material are study. How phase change material are beneficial for energy demand which increased day to day. How it will help to reduce the pollution and deficiency of natural resource. Main is how its application reduced the cooling and heating effects.

2.2 Luis Pe'rez-Lombard, Jose´Ortiz, Christine Pout "A review on buildings energy consumption information"(2007) the global warming effects are day to day increased. the 20% is of resident ad 40% of commercial energy are used in that sector And day by day it will increased. By this energy demand also increased and by this many of problem are occurs like pollution, deficiency of natural resource. Their for HVAC system energy are used. In that paper details of consumption of energy in building and its relation to HVAC system. too much questions arise information available.

2.3 Fan Tie-lin, Zhao Feng-qing "Application of Phase Change Materials in Buildings"(2014) gypsum board, concrete and mortar are explain in this paper. All this paper are on the detailed study and detail research of application phase change material. The pollution are increased and natural resource are also increased. And in that paper explain the details of merits and demerits of the phase change materials and how it used to building. How phase change materials application used for building construction and help in reduction of natural resource and pollution. All the review of application of phase change materials in building are explain in this paper.

2.4 V.V. Tygi, S.C. Kaushik, S.K. Tyagi, T. Akiyama, " Development Of Phase Change Materials Based On Microencapsulation Building: A Review"(2011) in this paper explain the phase change material. This paper explain the detailed study of previous paper of microencapsulation technology. Its is the review paper. In that explain how the energy will be stored in building and reduced the used of nature resources consumed application. By only the use of sun phase change material gives the cooling and heating effect. This paper detail study of micro-capsule and its application. How microencapsulation are good for building construction, food industry, medical application,etc.

2.5 R. Parameshwaran, S. Kalaiselvam, S. Harikrishnan, A. Elayaperumal "Sustainable thermal energy storage technologies for buildings: A review"(2012) greenhouse gas is most important subject for international level. For which how to reduced the green house effect the phase change material is the pathway for reducing it. And the day by day energy consumption also increased and most of the energy is used in the building sector. For reducing energy demand thermal storage energy are important. The thermal energy storge in the building are moer important , there for the engineer and architects are gets attracted to them. Thermal storage gives the cooling and heating effect to building. In this paper we study about the details of energy storage in the building which are beneficial to environment and building construction.

IV. PHASE CHANGE MATERIAL

To achieved the demand of cooling comfort and heating comfort into the building phase changing materials are the best solution. Phase changing materials are the materials that change it's state from solid to liquid or liquid to solid, etc. and also the function with the change of atmosphere. When the temperature increased the phase changing materials absorb the heat from the atmosphere and give the cooling effect to building and at that time it change it's phase from solid to liquid. Vice versa when the temperature decreased the phase changing materials release the heat which store into the materials which absorbed by atmosphere and give heating effect to building and also it change it's phase from liquid to solid, etc. phase changing materials are divided accordingly component. Organic component, organic-inorganic component, inorganic component of phase changing materials all of the component have their merits and demerits. And also all the component have their own physical and chemical properties therefore, in the incorporation of phase changing materials with the building materials and to from phase changing building materials occurs many of problems such as corrosion, leakage, etc. therefore, its necessary to study the methods of incorporation of phase changing materials and building materials. By the previous paper study there are 3 types of method which of direct mixing method, immersion method, and last one is capsule blending method. All the method have there different use and application. Also all of have some merits and demerits there for it used in different application as per there properties. But in this paper we study about the capsule blending method and it also have 2 type of micro-encapsulation and macro-encapsulation. In that macro-encapsulation are failed because required large volume containment. And second is of micro-encapsulation in this paper we study the micro-encapsulation.

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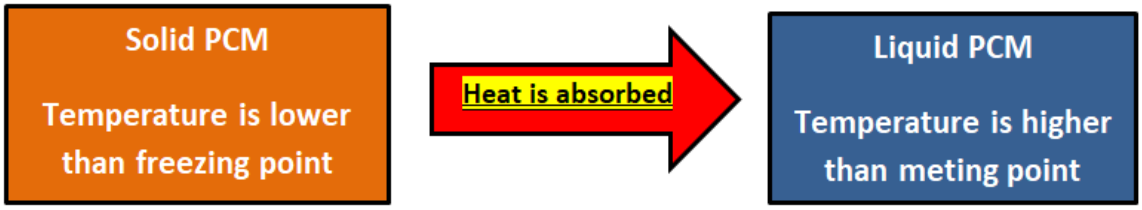

Fig.1 THE COOLING EFFECT OF PCM

FIG.2 THE HEATING EFFECT OF PCMS

V. MICROENCAPSULATION

In the processes of incorporation of phase changing materials with building materials microencapsulation is best processes. In the processes the particle of the solid or droplet of the liquid are coted with continuous film of polymeric material all around the surface of solid or droplet and formed the capsule micrometer into the millimeter capsule rang. Polyuria, polyurethane and polymethylmethacrylate are the polymer used and it should respond some demands of operation. Microencapsule are in the both shape spherical and variable shape. In the spherical shape the particle of solid or droplet of liquid are spherically surrounded by the continue film of polymeric material. And in the variable shape it not spherically surrounded it be unsymmetrically surrounded to the particle and droplet. It cover the particle or droplet between the 1µm to 60µm. microencapsule have the many of properties it required small container for the packaging of particle and droplet. It allows the phase change from solid to liquid, liquid to solid it allows the volume change. the type of microcapsule depend upon the particle of solid or droplet of liquid and how the shell is deposit on it. There are 3 type mononuclear, poly-nuclear and matrix. In the mononuclear particle of solid or droplet of liquid are surrounded by the microcapsule of the particle of solid or droplet of liquid shell. In the poly – nuclear many of the particle or droplet are into the shell. And in the matrix capsulated particle or droplet are allocated homogeneously in the shell.

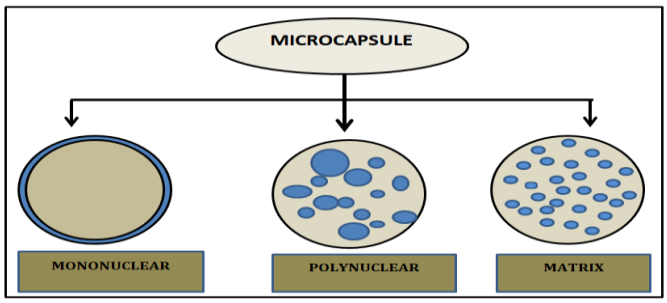

Fig.3 Type Of Microcapsule

For the manufacture of capsule there are many method developed physical method and chemical method.

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Chemical method:-

1. Matrix polymerization
2. Interfacial polymerization
3. In situ polymerization

Physical method:-

1.. Centrifugal extrusion
2.. Vibrational nozzle
3.. Air-suspension coating
4.. Spray drying
5. Pan coating

VI. APPLICATION

- Reduce air-conditioning cost in building industry
- Reduced the heating room application cost
- Passive storage systems
  - PCM trombe wall
  - PCM wallboards
  - PCM shutter
  - PCM building blocks
  - Air-based heating system
  - Floor heating
  - Ceiling boards
- Active storage systems
  - Floor heating
  - Ceiling boards
  - Other systems

VII. SELECTION CRITERIA

The selection of phase changing material for the microencapsulation some properties are required which given below:-

- Properties of materials:- 1. Dispersed phase- polymer, solvent, drug
  2. Continuous phase- surfactant, antifoam
- Parameters:-
  - Viscosity of dispersed phase
  - Volume fraction of dispersed phase to continuous phase
  - Quantity of drug in dispersed phase
  - Concentration of surfactant
- Operating condition
  - Geometry of reactor
  - Agitation rate
  - Temperature
  - Pressure
- Properties of microcapsules
  - Average size
  - Size distribution
  - Surface morphology

- Inner structure
- Drug encapsulation efficiency

- Economics
  - Effective cost
  - Large scale availability
  - Abundant
  - Easy recycling in environment

VIII. CONCLUSION

This paper is on the study of previous research paper of phase changing materials in building based on the microencapsulation. Phase changing material are best option for future construction. Phase changing materials absorbing and releasing heat from environment this property are very useful for the storage of energy and decreased the use of limited natural resources. Phase changing materials have various properties therefor for the incorporation of phase changing materials and building materials have 3 different ways and in this microencapsulation is best method for incorporation. Microencapsulation is the coating of shell on the particle or droplet. Microencapsulation allow phase change and it required small container. By the shell deposition it dived. For the manufacture there are different method. Microencapsule have many of application in building like used in the pcm trombl wall, wallboard, shutter, building blocks, etc. it help in giving cooling and heating effect to building. For the use of macrocapsulation in building it required some criteria. And to fulfill all requirement of nature recourse and to store energy the development of microencapsule increased and its used in building also increased.

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