AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Architecture Department

The Application of Nanotechnology Finishing Materials on Hygienic Properties in The Interior Design of Hospitals

A Thesis submitted in partial fulfillment of the requirements of a Master of Science degree in Architecture Engineering Architecture Engineering and Architecture Department

by

Reem Ahmed Ahmed El-Abbasy

Bachelor of Science degree in Architecture Engineering

Architecture Engineering and Architecture Department

Faculty of Engineering, Ain Shams University, 2014

Supervised By

Prof. Dr. Yasser Mohamed Mansour

Prof. Dr. Ahmed Atef Faggal

Cairo, 2019

Faculty of Engineering – Ain Shams University

Architecture Engineering Department

Thesis title: **"The application of Nano materials on hygienic properties in the Interior Design of Hospitals"**

Submitted by: **Reem Ahmed Ahmed El-Abbasy**

Degree: **Master of Science in Architecture Engineering**

Examiners' Committee:

Prof. Dr.Ahmed Fareed Hamza
Banha University ,
Faculty of Engineering,
Architecture Dept. .....

Prof. Dr. Shaimaa Mohamed Kamel
Ain Shams University,
Faculty of Engineering,
Architecture Dept. .....

Prof. Dr. Yasser Mohamed Mansour
Ain Shams University,
Faculty of Engineering,
Architecture Dept. .....

Prof. Dr. Ahmed Atef Faggal
Ain Shams University,
Faculty of Engineering,
Architecture Dept. .....

Statement

This thesis is submitted as a partial fulfillment of Master of Science in architecture Engineering, Faculty of Engineering, Ain shams University. The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

Reem Ahmed Ahmed El-Abbasy

Signature

.....

Date: 9/9/2019

Researcher Data

Name: Reem Ahmed Ahmed El-Abbasy

Date of Birth: 16/11/1992

Place of Birth: Cairo, Egypt

Last academic degree: Bachelor of Science

Field of specialization: Architecture Engineering

University issued the degree: Ain Shams University

Date of issued degree: 2014

Current Job: Demonstrator, Architecture Dept., Faculty of Engineering, Ain Shams University

Abstract

Faculty of Engineering – Ain Shams University

Architecture Engineering and Architecture Department

Thesis title: **"The application of Nanotechnology finishing materials on hygienic properties in the Interior Design of Hospitals"**

Submitted by: **Reem Ahmed Ahmed El-Abbasy**

Degree: **Master of Science in Architecture Engineering**

Abstract

Interior finishes are important aspects of the healthcare facilities environment. Floors and walls coverings are the major elements that play an essential role in keeping a healthy environment inside various spaces of hospitals. Thus, it is necessary to give a priority to the selection criteria of finishing materials during the design process. In other words, healthcare facilities require special specifications for interior spaces and finishing materials to prevent problems such as moisture penetration, water infiltration, and the growth of mildew and mould that is considered one of several elements responsible for occurring Hospital-Acquired Infections

(HAIs). Therefore, the purpose of this research is to evaluate the influence of using Nano-materials in providing healthy, comfort environment for both patients and workers in healthcare facilities.

The research was conducted based on visual observations and interview with managers of four hospitals in Egypt to collect data about the existing conventional used materials and the problems they are facing, followed by aggregating the results of evaluation studies conducted on these materials to select the best materials in terms of six criteria. Based on the analysis of the evaluation results, it was found that the materials used in these hospitals showed the best performance in comparison with other materials; however, these materials face some observed defects such as craks, tire marks, peeling, and scratchings. Therefore, the results of different laboratory tests conducted on nano-materials in previous studies were analysed to prove the using of nano-technology in improving the characteristics and the performance of the traditional materials against bacterial inhabitation on surfaces of various spaces through coating some materials with specific nano-materials or mixing nano-materials with the components of some used materials. As an example of applying such technology in interior design, data about five hospitals in other regions were obtained from government agencies and web pages as hospitals in Egypt did not apply this technique yet. Those hospitals apply nano-materials on finishing materials in their interior design to evaluate their impacts in term of environmental impact and

thermal comfort. The evaluation data emphasized that nano-materials significantly improve the functionality of the existing materials when added to them through coating or mixture.

Finally, it was concluded from the various data mentioned in the study that nano-materials can solve the problems appeared on the existing conventional materials because they can change their components and increase their resistance to infection transmission and bacterial inhabiting. Also, applying nano-materials on the used ones can generally provide a healthy environment which is not suitable for the growth of bacteria or fungus. Therefore, it is recommended to implement Nano-materials in Egyptian hospitals as a solution to the occurred defects and increase the awareness of interior designers and architects about the benefits of these materials to encourage them use the nano-technique.

Keywords: Public Health, Antimicrobial,Air-transmitted micro-organisms, Hospital-Acquired Infections, Nanotechnology, hygienic properties, Healthy Environment.

Acknowledgment

All praise is due to Allah, most Merciful, the Lord of the Worlds, Who taught man what he knew not. I would like to thank God Almighty for bestowing upon me the chance, strength, and ability to complete this work.

I wish to express my gratitude to my supervisors, Prof. Dr. Yasser Mansour and Prof. Dr. Ahmed Atef for their guidance, encouragement, insightful thoughts and useful discussions. Dr. Yasser has always been a role model for me with the highest level of morals. I am deeply grateful to Dr. Ahmed for his guidance and follow up this work. I learnt from Dr.Yasser and Dr. Ahmed a lot on the technical side.

Finally, I want to thank the Examiners' Committee. I want to thank Prof. Dr. Ahmed Fareed and Prof. Dr. Shaimaa Mohamed for their time and effort while reviewing this thesis.