Nanotechnology effects on furniture product

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Abstract
The whole world considers that we are now living in the nanotechnology century, where the new technology has entered all fields of science and its applications and caused the amazing rapid development of the machines and devices we currently use.
Nanoscience and nanotechnology are concerned with handling and controlling materials at a nanometer, One nanometer is a billionth of a meter, one millionth of a millimeter, or10^{-9} of a meter.
At the nanoscale , the properties of the substance (mechanical, chemical, electronic, electrical, etc.) are much different than they were in their normal state. The atoms of the substance can be rearranged to form other known substances or materials that have not been seen before, as the atomic arrangement changes as the material changes largely.
By improving the properties of materials or by imparting unusual properties and functions; Nanotechnology offers huge areas that can be exploited and applied in the furniture sector.
This research explains the most important applications of Nanotechnology in the field of furniture in our time.
Key words: Nanotechnology -Nanomaterials -Nanoscience - Fifth Generation technology

Introduction:

As the atomic and molecular order of the material changes, the properties of the material change greatly, producing materials with distinctive chemical, physical, mechanical, magnetic and electrical properties. Hence, scientists can avoid some undesirable characteristics of some traditional materials or add other properties that increase their performance .
The research was chosen to highlight the role of nanotechnology in improving the properties of furniture materials and in treating or resisting the various damage factors (biological, climatic, and human) that the product undergoes during the use period .

Statement of the problem:

Furniture has a unique case, Because of its several components and material that have various physical, mechanical and chemical properties.
Furniture product may consist of many organic components or materials (wood, textiles, natural leather, glue, organic color materials… etc) and inorganic (such as plastics, metals, cement, glass ... etc)
This diversity in components and production methods make it exposed to various damage factors available in the surrounding environment, which in turn affect its external appearance and performance.

Importance:

In our time, there have many researches and studies on the concept of nanotechnology, the manufacture of its materials and its use in different fields.

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The importance of research stems from how nanotechnology applications are exploited and applied in the face of damage factors that threaten furniture product and affect the appearance and performance of it.

Objectives:

- Study and analysis of how nanotechnology could improve furniture product characteristics.
- How to take advantage of nanotechnology in the face of the various damage factors, which the furniture product is exposed to while using it.

Hypothesis:

- using nanotechnology applications in the furniture field will contribute to improving the performance of the furniture product and maintain its external appearance in the face of damage factors ,Which is exposed during the usage process.

Methodology:

The research is based on the analytical descriptive approach as the most appropriate methods that are consistent with the nature of this research**.**

Limits :

- The research focuses on nanotechnology and its impact on the furniture product in the face of the damage factors(biological, climatic, and human).

Contents:

After discusses the definition of Nano , Nanometer, Nanoscience, Nanotechnology, the research contains two main parts, as follows:

(1) Nanotechnology :

(1-1) Brief History . (1-2) Nanotechnology Benefits. (1-3) Nanomaterials.

(2) Factors that lead to furniture damage, and how to treat with Nanotechnology:

this part explain every Factor that lead to furniture damage, and the most or which furniture material will be affected with that factor , and Suggest Naonomaterial or Nanotechnology application that can help in treating or resist that factor , and then suggest in which places we could use this treated furniture.

(2-1) Biological factors :
Insects, microorganisms and fungi

(2-2) Environmental / Climate factors:
(2-2-1) Dust.
(2-2-2) Sunlight/ UV ray.
(2-2-3)Humidity/water.

(2-3) Human factors (Man-Made Deterioration)
(2-3-1)Soiling and dirty (stain).
(2-3-2) fire .
(2-3-3) Scratching and breaking.

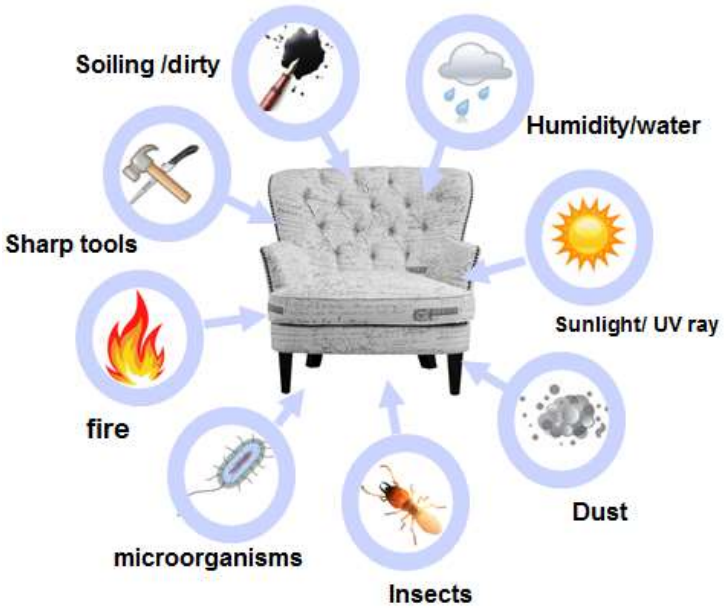

Figure (1) some factors that lead to furniture damage

The research deal with all the above factors in detail. The following is brief example:

(2-1) Biological factors :
Insects, microorganisms and fungi.

One of the most important biological factors that is effect on organic furniture materials (Wood - leather - textiles - paper - .. etc) are insects (such as Termite…) and microorganisms (such as fungi and bacteria).

Biological agents are the most dangerous factors in the presence of moisture as they provide a suitable environment for the growth and presence of microorganisms and their reproduction. the most serious is insect infections on furniture materials because it may lead to destroy materials after a very short period.

(1)Termite lead to wood damage

(2) leather mildew

(3) White Mold On Wood

▪ **Material exposed to damage** : The organic materials of furniture product (wood, leather, textiles, paper,… etc.) Are subject to damage due to biological agents (photo 1:3) , but all furniture materials, whether organic or inorganic are surfaces that stick to microbes or bacteria and then transferred to human.

▪ **Suggested treatment:** Use of so-called antibacterial nanomaterials. Such as nano silver - known for its resistance to bacteria and fungi and preventing it from growing. When bacteria contact with the coated surfaces, the silver ions suppress the respiration of bacteria, adversely affects bacteria's cellular metabolism and inhibits cell growth. (Figure2)

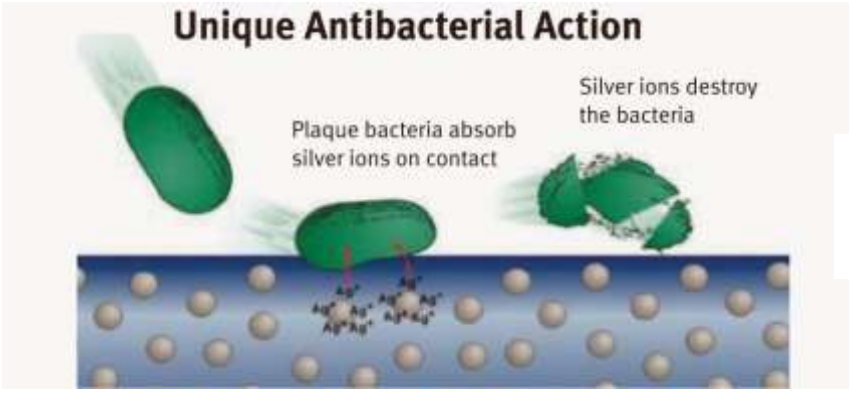

Figure (2) how is silver ions destroy the bacteria .

There are also nanomaterials such as titanium dioxide, which has the chemical symbol TiO2, known as antimicrobial. The conversion of this material into ultra-soft nanoparticles, with a large surface that helps it collect the ultraviolet light coming with sunlight or a light source, significantly increases its photoelectric activity. This feature has made it able to play the role of oxidants, eliminates the bacteria, microbes and viruses that hang on the surface of the material (Figure3).

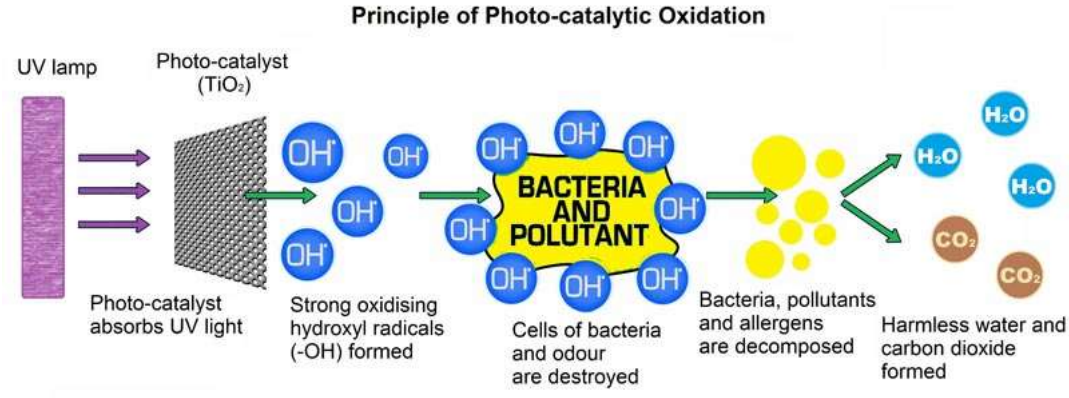

Figure (3) how is TiO2 destroy the bacteria and decomposed to form water and Co2

There is also anti-insect nano paint can be applied on almost every furniture surface in interior and exterior. The new nano coating is effective on ants, aphids, cockroaches, mosquitoes, spiders, termites, ticks and certain other types of pests and vermin, while neither affecting the health of people, pets or livestock, nor harming the environment.

▪ Protect furniture materials against biological agents are not only for protecting the furniture itself, but also to protecting furniture users from spreading epidemics and diseases. Antibacterial furniture materials can be used in hospitals, laboratories, health clubs, In closed public places (such as theaters, shopping centers, ...) and kitchens.

3) The role of nanomaterials in improving the properties of the furniture product to face damage factors can be summarized as follows:

By making the furniture product:

1 - High resistance against the effects of environmental /climatic factors (humidity, heat, ultraviolet light ...).
2 - Increase the rate of stability and hardness and make furniture surfaces anti scratch .
3 - Resistant to biological agents (fungi ,bacteria, and insects).
4 –Water proof.
5- Anti- soiling and self-cleaning.
6 - Resistant to Flame and / fire proof

Results:

- The use of nanotechnology in the treatment of traditional furniture materials not only improves their original characteristics in the face of damage factors surrounding the furniture product, but can give them new functional characteristics or make them multifunctional.
- Use of nanomaterials leads to Length of furniture Product Life, and reduces maintenance and repair costs.
- Nanotechnology and Nanomaterials are among the most important modern concepts that, when introduced in the field of furniture production, will offer products with features and characteristics that are superior to those produced by traditional methods, while saving energy and reducing consumption of materials, especially with Bottom-up manufacturing method .

Recommendations:

- Faculties of applied arts and research centers should study and follow up the latest developments in the field of nanotechnology and determine their effectiveness in the improvement and development of the furniture product**.**
- Industry and investment sector and the major scientific institutions should raise investor awareness, and the whole society that investing in science and technology may have a rewarding financial return and not only to support the future of the country in the field of scientific research and development
- Research centers need international cooperation with developed countries in the field of nanotechnology. This international participation is one of the most important mechanisms in overcoming the low level of laboratory equipment and the low governmental support for financing the projects of nanotechnology, which are often high.
- It is necessary to put the so-called Egyptian code of nanomaterials, because nanotechnology and its materials are use mainly in the developed countries of the world.
- It is necessary to increasing the awareness of specialists in the furniture field about the nanotechnology applications benefits in through conferences, seminars and lectures by scientific and research authorities.
- Research centers and national institute of health should study and follow the possible health and environmental side effects of nanotechnology applications due to the lack of information about them so far.

References:

Arabic References :

1- Al-Habashi, Nahi Alawi Abu Bakr - *Ma hi taqniat Alnnanu* - nuskhat 'ilyktrwnyt 2011 Mutabaqatan linuskhat altabeat al'awalii 2009- fahrsat Maktabat Almalik Fahd alwataniat - Saudi Arabia.

2- Saleh, Mahmoud Mohamed Salim- *taqniat alnnanu waeasir eilmi jdyd* - madinat almalik eabd aleaziz lileulum waltaqniat - faharsat maktabat almalik Fahd alwataniat- Saudi Arabia - 2015.

English References :

3- Asmatulu ,Ramazan - *Nanotechnology Safety*- Newnes, United Kingdom, 2013.

4- Kane ,Deborah M. & Micolich ,Adam & Rabeau ,James - *Nanotechnology in Australia: Showcase of Early Career Research*- an Stanford Publishing, 2011.

5- Management Association, Information Resources - *Nanotechnology: Concepts, Methodologies, Tools, and Applications* - IGI Global, United Kingdom, 2014.

6- Ramsden ,Jeremy- *Nanotechnology: An Introduction* - William Andrew, 2 nd edition, 2016