

## **Nano treatments for wood materials and their use in interior design technology**

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### **Introduction:**

The connection between science and art is of great importance to the common relationship between them, which was a reason for building the foundations of modern artistic trends upon which new scientific and philosophical theories have depended on it has a great role in the formation of thought and modern design technology, which is based on the structural and structural foundations of the shape, and in turn affected the applied arts In general, and furniture technology in particular, understanding the science of nano-science and its applications opens up human promises and prospects for improving everything it produces. As this technology seeks to develop raw materials and treat them, through the use of new technology and advanced scientific methods provided by this technology, nanotechnology is one of the main components in nanotechnology. Nano has gained great importance during the past ten years to introduce alternative materials and materials and become environment friendly, and we produce nanoparticles in all fields.

These superior technologies, especially nanotechnology, have dominated various areas of life in this era. Naturally, architecture specialties are affected as one of the basic areas of life, which is the most recent and most important thing that modern technology has produced, giving the field of interior design multiple and varied capabilities to form and design distinctive products for space The interior space, and interacting with the environment through the use of improved materials and treatment with nanotechnology, and wood is one of the most valuable and beneficial natural resources for humanity. Where it plays an important role in various human activities such as building, construction and internal furnishing, and therefore many methods of wood preservation have been developed to increase the service life of wood, reduce the costs of wood treatments, and reach more efficient use of wood in many applications.

### **Key words:**

Nanotechnology, wood protection, treated wood, nanoparticles

### **Research problem:**

The scarcity of research that dealt with wood processing with nanotechnology, or dealt with it superficially, which affected the lack of knowledge of the reality of this technology and its dimensions and its impact on all aspects of specialisation. And increase the gap between the Arab world and the developed world in the light of nanotechnology, in order to maximise the benefit from this technology.

**Research importance:**

Nanotechnology is one of the most important scientific developments that have a major impact on many areas, including the field of interior design, as it provides materials and systems with a new technology that will affect all materials of interior design, which comes at the forefront of wood. Therefore it is necessary to study the relationship of this technique to the development and treatment of wood.

**Research aim:**

The research aims to get to know nanotechnology and its applications, study the effect of nanotechnology on changes in wood materials, study the methods of different nano-structures, and define the different applications of nanotechnology in the field of wood processing, and how it contributed to improving the properties of wood to suit manufacturing and the environment.

**Research methodology:**

The research relied on the descriptive analytical method.

**Changing the characteristics of materials using nanotechnology:** The idea of using nanotechnology is to rearrange the atoms that make up materials and raw materials in their correct position. The more the atomic arrangement of matter changes, the greater the output of it. The properties of nanoparticles depend on how these atoms are arranged, so if we rearrange the atoms in coal we can get diamonds. If we rearrange the atoms in the sand and add a few elements, we can manufacture computer chips. If we arrange the atoms of the wooden cells, we can reach wood closer to the steel, and what the science is working on now is to change the arrangement of the method based on the nano. For physics, electronic point of view, nanotechnology is the fifth generation that appeared in the world of electronics whose technological revolutions can be classified on the basis that it has gone through several generations that formed the reasons for its existence. And nanotechnology literally means techniques made with the smallest unit of measurement for the dimension that a person has been able to measure up to now (nanometers), that is, dealing with very fine objects of nanoscale dimensions (1 meter = 1000,000,000 nanometers), that is, one billionth of a meter, so nano is the most accurate unit of measurement. A metric is known to date, the size of nano-scopes is about 80,000 times smaller than the diameter of a hair, and the word nanotechnology means microscopic technology.

**The importance of nanotechnology in interior design:** The integration of nanotechnology with interior design technology has opened a wide door for designers who seek to renew and overcome the design problems that were facing them sometimes, through the design of nano-materials and materials has become impossible, and that the ability of designers has become easy to control the exploitation of new raw materials and the exact details. And controlling its characteristics that contributed to the development of many applications of interior design technology, which had a great impact on changing the design thought that was difficult to apply previously. The nanotechnology has enabled a new world of materials and advanced materials that are more efficient and capable of responding to all ideas of the designer to improve the interior environment. In addition, the nanotechnology presented the highly intelligent

technologies that increase the efficiency of space design and expand the services inside it. As a result, the atmosphere has been created to increase work productivity and comfort for employees.

**Nanotechnology is the technology of the future:** And nanotechnology still carries to us daily many surprising surprises in all areas of life, in all fields, including construction and building, where many international scientific research centres began to arrive at low-cost building materials with nanotechnology, and with many unique specifications and features that contribute. This technology is used to produce building materials with unique thermal, electrical, physics, chemical, and mechanical properties and characteristics, so the "nano" housing will be able to resist high temperatures, harmful radiation, fire protection, and the ability to self-clean, and the buildings will be able to maintain and treat any cracks and cracks early, and fix it directly and automatically. Nanotechnology has been able to produce building materials to improve its properties and functions, such as materials used in paints (coatings), additives for concrete mixtures, cement, gypsum, tiles, and ceramics, and to improve the glass and woodworking industry, etc., to make it lightweight, more robust, durable, and resistant to cracks, cracks, and corrosion, And to benefit in protecting surfaces and walls from sticking dust and pollutants, maintaining colour fastness, heat insulation, UV resistance, and moisture resistance, in addition to environmental characteristics, which is to help building materials reduce the amount of carbon dioxide emissions into the environment, and thus Maintaining the integrity of the ecosystem.

**Nano-materials in nature:** Many of the installations, devices, and systems that God created in nature work in the nanoscale, and scientists have benefited from imitating them and using them. Nano-lotus leaves that create water-repellent surfaces have been used to produce many materials, including nano-paints that have contributed to the radical solutions of furniture And wood products and preserving them, with raw materials in paints. These paints are characterised by their ability to resist scratching, corrosion, crushing and water repellency. In other attempts, a team of scientists imitated the strength and elasticity of spider webs reinforced with nano-crystals, as well as our bodies and animal bodies use natural nano-materials, devices and systems such as protein, membranes, etc., and nano-materials around us in nature.

**Wood material:** Wood is a multi-use raw material, for a long time, due to many reasons, including its fibrous nature, different colours, and density, and it is considered a raw material in construction and external applications, due to its high strength with low weight and some durability. Wood is an easy and suitable raw material in interior construction and furnishing if handled efficiently. However, wood has two major drawbacks that restrict its wider use, namely the biodegradability of microorganisms and dimensional instability when the wood is exposed to a variety of moisture content. As most types of wood degrade rapidly under biological factors; And the dangers of fungi. Therefore, researchers and those interested in the field of wood treatments have resorted to modern technologies, which are nano-structures.

**Chemical Composition of Wood:** Natural wood is a chemically complex substance, and carbon, oxygen and hydrogen are the basic elements of the cell wall material with small amounts of nitrogen.

Swelling and Shrinkage: Wood is a hygroscopic material due to the presence of free hydroxyl groups on cellulose and lignin chains, and these groups are the ones that cause scientific swelling, but if the opposite happens and water is lost from the wood, the wood shrinks.

**The change in the Anisotropic dimensions of wood:** The changes in the dimensions of the wood resulting from the expansion and contraction of the wood are not equal in the three directions of the wood within the wood (tangential, longitudinal and diagonal), which means that the wood is an anotropic substance. The lignin is affected by the water just 16%, and this indicates that the increase in the lignin in the wood leads to a decrease in the processes of stretching in the woods (swelling), as the fetus impedes the expansion of the wood.

**Microbiological damage:** microbiological damage plays an important role in the destruction of many organic raw materials such as wood, and microbiological damage is "fungal decomposition" which is a heterogeneous microorganism that results in different types of fungi, as the fungi consume the contents of the wood cells. Unlike other races working to demolish the cellular wall, that is, cracking cellulose in wood, which leads to weak strength and weak mechanics until the wood eventually becomes brittle, lightweight and easy to break.

**Wood treatment and maintenance:** There are many ways to treat wood and diversified in order to reach a strong wood that is resistant to fungi and volatile atmospheres. One of the most important types of wood treatment is drying. Reinforced chemicals, which are easy-to-leak materials in the pores of wood, are an "organic solvent" that replaces the water inside the wood without causing shrinkage or diminishing dimensions of the wood after drying out.

**Wood modification:** The properties of wood can be improved by modifying cell wall polymers. Modification methods usually produce non-toxic materials and are easily disposable at the end of the product's life without any environmental risk. The methods of modification developed can be classified as methods of temperature, chemical, surface and impregnation adjustment.

#### **Nanotechnology to protect wood:**

Adjusting wood through previous conventional treatments can usually improve resistance against fungal attacks and mechanical properties of wood, while most do not provide adequate long-term protection against harmful insects of wood and changing its dimensions. Therefore, different treatment and protection methods were used to preserve wood for a longer period, and wood treatment technology developed until a new emerging technology emerged that saw great potential for the development and treatment of wood, a nanotechnology that is used in wood preservation, a technology that has many features and applications developed to protect wood. Nano processors provide a good perspective for controlling water expulsion, scratch resistance, durability, surface self-cleaning, and biodegradation resistance of wood, and can also improve wood resistance to weathering, as well as improve the capabilities of manufactured wood panels as nanotechnology has added innovative high-tech methods for making these panels. In general, nanotechnology will play an important role in the next generation of wood protection.

**Nanotechnology expands wood preservation:** Nanotechnology has become a popular topic recently, with more posts on Scopus' search engine, as wood processing research has increased nanotechnology, and this indicates that this field is receiving more attention from researchers in many countries. As the nanotechnology shows great potential for inclusion in wood preservation to overcome the problems associated with previous traditional methods of wood

preservation. Nano-materials have many advantages, such as the ability to handle large effective surface area, high dispersion stability, and the presence of an effect capable of providing long-term protection.

**Nanotechnology for transparent wood:** The University of Maryland researchers have converted a block of a woody material into a transparent block, and they think it will be useful in future building materials and in light-based electronic systems. The research team, with the participation of the Energy Research Centre scientists, succeeded in removing the lignin from the wood, while they retained the colourless cellulose cell structures and then filled it with adhesive to produce a semi-transparent version of the wood. The lignin removal process is considered a kind of change in the colour of the wood into white.

**Modification of nano-treated wood:** The use of nanotechnology can modify wood by coating treatment, by performing coating treatment through a physical or chemical approach. Pre-synthesized nano-materials can be used directly or added to existing wood paint. And put them on the surface of the wood by spraying paint, brushing or dipping, and the nano-materials can act as a water repellent (controlling the rate of water absorption) or as dimensional stabilisers (controlling the wood swelling from moisture absorption, and from the nano-materials to preserve the wood (polypropylene Nano-modified) it interacts with wood polymers and increases the wood's surface strength and lifetime as a product. Nano-technology coatings are free from any negative effects on users, they maintain user safety and protection first, and they also provide external protection for wood, easy to operate and use.

### **Results:**

- Wood preservatives can provide biological resistance, while modifying wood with nanotechnology enhances the physical and biological properties of wood, and gives it high properties and resistance that help extend its life as a product.
- Ensure that nanotechnology has great potential for wood preservation applications, by using nano-material preservatives that transform into nanoparticles that are able to penetrate deeper and absorb more homogeneous particles in the wood. In addition to that pesticides are safe and do not cause any harm or risks to humans and the environment.
- Nanotechnology is likely to have a major impact on the future wood protection industry, with the development of nano-material technology with unique properties to enhance wood preservative performance and extend the service life of wood products.
- Wood treatment technology contributed to overcoming many of the obstacles that were causing loss of wood, in addition to the modifications made to the structural form of wood, which resulted in many new features for interior design.
- The nano-coating technology contributed to the improvement of the performance of wood materials, preserving them from climate factors, self-cleaning of water and dirt, and saving maintenance.

**Recommendations:**

- It has become imperative for Arab societies to allocate research and development budgets for expenditures on research and development of this technology.
- The necessity of keeping pace with the technological progress of nanotechnology with awareness and its importance to align with scientific progress and move forward with development, and direct scientific and applied research to nanotechnology sciences to find out the latest findings of the world.
- The need to increase the awareness of specialists about everything related to this technology and put it from the curriculum priorities.

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