INTRODUCTION

Nanotechnology has become at the forefront of the most important and exciting fields in engineering. It has given great hope to scientific revolutions soon that will change the direction of technology in many applications. It is, therefore, essential to provide a general and concise idea to non-specialists about this technique. The extensive care of nanotechnology dates back to 1996 when the American Global Technology Assessment Center (WTEC) conducted a calendar study of Nanoresearch and its importance in technical innovation. The study concluded to the most essential points that nanotechnology has a great future in all fields of medical, military, informatics, electronic, computer, petrochemical, agricultural, bio, etc., and that nanotechnology is multi-background, it depends on the principles of physics and chemistry (Hussien et al.2017, Sossien et al., 2014, Hussien et al.,2014, Hussien et al., 2018, Hussien, 2017). Electrical and chemical engineering, etc., as well as the specialization of biology and pharmacy. Researchers in one field must, therefore, communicate with others in other areas in order to gain a broad background on nanotechnology and active participation in this exciting field. The relevant administrators and supporters of this research should be briefly briefed on these areas. The concept of nanotechnology is based on the fact that particles less than 100 nanometers (nanometers are part of 1,000 million meters) give new properties and behaviors to the material that enters their composition. This is because these particles (which are smaller than the characteristic lengths associated with certain phenomena) are emerging new physical and chemical concepts, leading to new particle size behavior. It has been noted, as an example, that both electronic composition, conductivity, reactivity, fusion and mechanical properties of the material all change when particle size reduced to Nano value. The adoption of the behavior of the substance on its size enables us to control the engineering of its properties, and accordingly the researchers concluded that this concept has excellent technical effects involving a wide variety of technical areas including the production of light and strong materials and reducing the time of delivery of Nano-medicine to the human circulatory system and increasing the volume of Magnetic absorption strips and making quick computer keys... Etc. In general, nanotechnology is one that deals with multiple
structures of materials with nanometer dimensions (Hussien et al., 2013). Although nanotechnology is relatively recent, the presence of Nano-devices and Nano-dimensional structures is not new, and in fact, their existence dates back to the age of the Earth and the beginning of life there. Where it is known that the biological systems in the living body manufacture some tiny devices that reach the limits of the nanoscale. Living cells are an essential example of natural nanotechnology, as the cell is a repository of a large number of Nano-sized biological machines, and proteins are manufacturing within them in the form of combined Nano-sized lines called reprimands and then formed by another Nano-device called Kolji. Rather, enzymes are a Nano-machine that separates molecules or collects them according to the need for relativity. Therefore, manufactured Nano-machines can interact with them and perform the desired goal, such as analyzing the contents of the cell, delivering the drug to it, or exterminating it when it becomes harmful (Saidur et al., 2011). One of the most important forms of carbon nanoparticles is spherical, which belongs to the category of photons, of substance (C60) but they differ slightly from the composition as they are multi-crust, and they are empty center, unlike nanoparticles, while there are no gaps on the surface as is the case between nanotubes Multi-cover. They can be likened to onions, as scientists have named onions and nanoballs may have a diameter of 500 nm or more (Abitbol et al., 2016).

Experimental Work

The origin of the test was built for the experiments as shown in Figure (1) which consists of two rooms similar to technical specifications and measurements, as the two rooms of metal panels are built stuffed with the insulating material of foam (Sandwich panel) from all sides except the south side is wrapped in a layer of aluminum with a thickness of 1mm, the door erected on the north side contains 4mm glass, the external measurements of the two rooms were (1.5 Length x 1 width x 1.5 height) m. A separate 1-ton cooling system has been installed in each room, and the organizer has provided an electric arbitration panel for each system separately to arbitrate the compressors. The arbitration panel for system 1 contains high-pressure measures 2 and low-pressure gauges' number 2 and system 2 includes three measurements of high pressure and the same number of low pressure, while the arbitration panel for each room includes six thermocouples distributed in different places within each room, as The test rooms are equipped with a voltage meter and voltage difference, with the purpose of monitoring the operational capacity of each system for comparison in the power discharge. The air conditioning system that was installed in the first room was identified in the basic system without the change of the pressure oil, and it works with the quality of oil that was packaged by the manufacturer. The second system, installed in the second chamber, was equipped with another additional compressor as well as the system's original compressor with the same horsepower and quality, one equipped with TiO2 Nanooil and the other with Al2O3 Nanooil, prepared in the laboratory. The two compressors work separately alternately through the control valve between them. For high pressure, it will be determined by the degree of condensation within the exchange, and the condensing temperature called condensing temperature is approximately 12-15°C higher than the outside atmosphere temperature. As for the low pressure its value is determined by two factors: (1) the type of Freon or gas, as each gas has a specific characteristic of different chemical compounds. (2) The temperature of the evaporation of Freon or gas in the evaporator varies by application. High-pressure gauges and low-pressure gauges are attached to the evaporator exit for both chambers, and the high-pressure gauge and low-pressure gauge connected to the compressor exit for both chambers. Figure (2) shows the distribution of digital thermocouples in symmetry in all different places in the two rooms. The electrical parts of the test facility are equipped by the Electrical Power supply board, which installs two key keys such as a mean-switch and controls the work of compressors, switch operation and extinguishing cooling devices, and a socket for the prognosis. Four control valves have been attached between the compressors, and the benefit of them is that when using one compressor, the other compressor is locked.

Preparing Nano oil

The Nanooil, which is a solid nanoparticle of Al2O3-TiO2, is made suspended in type 4GS and technical specifications. In the beginning, the amount of oil to be used in the device was made suspended in type 4GS and technical specifications. In the beginning, the amount of oil to be used in the device was calculated, and the amount of solid nanoparticles was calculated by using Equation(1).

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m_p = \frac{\varnothing \times \rho_p \times \frac{m_s}{M}}{(1-\varnothing)}
\]

(1)
After calculating the amount of solid nanoparticles, they are combined with cooling oil in two ways:

**Mechanical method**

An electric mixer, described in Figure 3, was used to mix oil with solid nanoparticles in quantities calculated in equation (1) by operating the blender for a certain period ranging from (30-45) minutes to appear completely homogeneous.

**Use of ultrasonic**

The oil mixed with Nanofluid is placed in the mechanical method in three flasks, as shown in Figure 3, and the device is operated for a certain period ranging from (45-60) minutes.

**RESULTS AND DISCUSSION**

**Energy consumption**

Figs. 3-8 illustrate the energy consumption of the conventional air conditioning system, which uses pure oil for lubrication in the compressor corresponding to other systems that have added nanoparticles to its lubricating oil. From these forms, it noted that the oil mixed with nanoparticles gives good advantages in energy saving. It is also pointed out from these figures that the effect is evident in increasing a mass fraction of the nanoparticles to the lubricant oils. Figs. (3 to 5) details the energy consumption of the two systems, which lubricated them with pure Nan oil Al₂O₃ oils with the accumulation of the mass fraction (0.001 to 0.005) for eight hours in operation. The total energies consumed by systems that work with (pure and mixed) oils are (5465 - 4168), (6322 - 4816), (6623 - 4932) W. hr, respectively, while for other types of mixed oil (TiO₂) with the same fractional mass and run time, it provides good improvement in energy saving against the ordinary system as shown in Figs.(6 to 8) where the total energy consumed in pure oil and mixed oil with each mass fraction of TiO₂ nanoparticles (0.001, 0.003, 0.005) is (6356 - 5353), (7017 - 5280), and (5743 - 5048) W. hr, respectively. This improvement in energy consumption caused by the change in the viscosity of lubricating oil due to the addition of nanoparticles to the lubricating oil in refrigeration compressors, which leads to increased oil viscosity and reduced energy consumption, and this result is consistent with other studies (SS et al, 2008, Kwangho et al, 2009, Lee et al, 2008, and Yu et al, 2008)

**Energy saving**

The results of these two types of Nano oils used in the study showed good energy savings, which are consumed by a split air conditioner as shown in Fig.9. Indicates that the type of lubricating oil Al₂O₃ provides higher energy savings than TiO₂, and it increased when the mass fraction increases. TiO₂ nanoparticles behave vs. Al₂O₃ nanoparticles in the opposite when the mass of TiO₂ increases.

**CONCLUSION**

The results of this study concluded that when Nanoparticles are added to the lubricating oil in refrigeration compressors, they
provide the best advantage of the heat transfer behavior in air conditioning units and can be summarized as follows:

1. The use of nanoparticles in cooling oils provides an excellent energy-saving benefit, as the use of Al₂O₃ and TiO₂ in this study contributed to saving energy by about 32.5% at 0.005 fractions of mass and 24.3% at 0.001 portions of mass respectively when compared to the natural system (pure oil).

2. The results showed that the performance of nanoparticles of Al₂O₃ is better than the performance of nanoparticles of TiO₂ for all three blocks and increases when mass fracture increases, unlike TiO₂ which behaviors inversely.

References


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