

## News (Attachment 1)

The Summary of November 2022

**1- Title: KISR Organizes an International Training Program in the Field of Isotope Uses and Techniques Related to Irrigation Management and the Addition of Fertilizers and Nutrients for the Production of Date Palm Trees in Cooperation with the IAEA**

**Summary:**

As part of KISR activities, the Environment and Life Sciences Research Center (ELSRC) at KISR, in cooperation with the International Atomic Energy Agency, is organizing an international training program titled: “Irrigation and Nutrient Management for the Cultivation of Date Palm Trees”, during the period from 6 November to 10 November 2022.

**2- Title: A New Patent for KISR for Direct Osmosis Technology for Water Desalination with Simultaneous Cooling and Air Conditioning**

**Summary:**

The Water Research Center of KISR obtained a patent granted by the United States Patent and Trademark Office, as a result of achieving a pioneering scientific achievement and inventing an innovative technology that desalinates water, with simultaneous cooling and air conditioning.

**3- Title: KISR Completes a New Research Project in the Field of Waste Management and Addressing Environmental Pollution in the State of Kuwait**

**Summary:**

KISR recently completed a research project that is considered a paradigm shift in the field of waste management and addressing environmental pollution in the State of Kuwait, titled: “The Study of Thermal Chemical Decomposition of Used Rubber Tires with the Aim of Extracting Their Chemicals at Different Levels.”

## News (Attachment 2)

The Detailed News - November 2022

**Title:** KISR Organizes an International Training Program in the Field of Isotope Uses and Techniques Related to Irrigation Management and the Addition of Fertilizers and Nutrients for the Production of Date Palm Trees in Cooperation with the IAEA



### News:

As part of KISR activities, the Environment and Life Sciences Research Center (ELSRC) at KISR, in cooperation with the International Atomic Energy Agency, is organizing an international training program titled: “Irrigation and Nutrient Management for the Cultivation of Date Palm Trees”, during the period from 6 November to 10 November 2022. Trainees from the State of Kuwait, the Kingdom of Saudi Arabia, the Hashemite Kingdom of Jordan, the Syrian Republic, and the Iraqi Republic will participate in the program.

Dr. Sameer Al-Zanki, Acting Executive Director of ELSRC, explained the importance of this training course as it summarizes the results and recommendations of one of the most important research projects that ELSRC successfully completed in cooperation with the IAEA. In this regard, Dr. Al-Zanki reviewed the areas of cooperation between ELSRC and the IAEA during the past years, and the important role played by the Agency in supporting scientific activities and

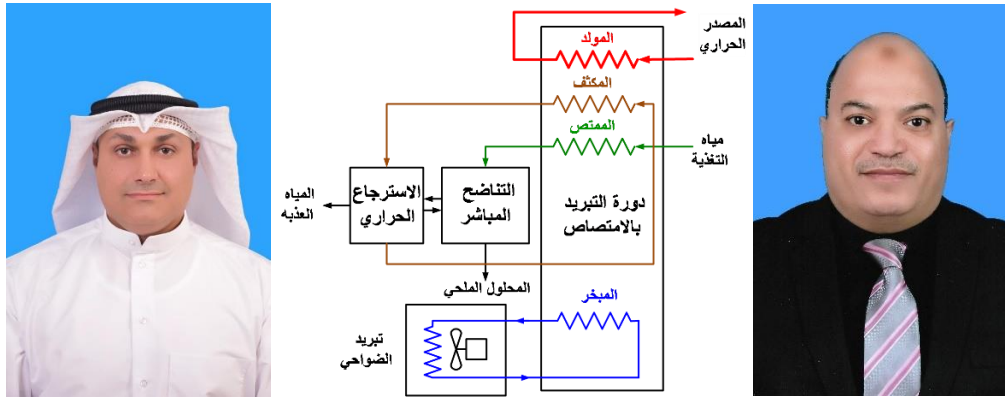
research projects implemented by KISR. He also expressed his hope that this cooperation between the two parties will continue to serve those in charge of scientific research in the future.

Dr. Hamy Saeed, Technical Official at IAEA, expressed his appreciation for the efforts made by KISR in general and ELSRC in particular in addressing issues related to isotope applications in agricultural sciences. He pointed to the importance of the existing coordination between IAEA and KISR to transfer knowledge and science in various fields to neighboring countries in the region.

Ms. Mona Al-Failakawi, Department Manager of the Manpower Development Department, stated that this program is part of a training plan to develop the human cadres working at KISR. She also stated that a number of trainees from outside Kuwait are joining by attending and through online platforms, in order to benefit from KISR's expertise in various science fields. She pointed out that KISR welcomes cooperation with international organizations and institutions in holding training programs and workshops to exchange knowledge and transfer scientific expertise.

Ms. Majda Khalil, Program Manager of Desert Agriculture and Ecosystems Program at ELSRC, praised the efforts made by the project team, which was successfully completed, titled: "Promoting sustainable production of date palms in member states through precise irrigation, and fertilizer and pest management." The project resulted in the scientific content of this training program, hoping that the experiences gained by the project team would be transferred to the participants in the course.

**Title:** A New Patent for KISR for Direct Osmosis Technology for Water Desalination with Simultaneous Cooling and Air Conditioning



**News:**

The Water Research Center of KISR obtained a patent granted by the United States Patent and Trademark Office, as a result of achieving a pioneering scientific achievement and inventing an innovative technology that desalinates water, with simultaneous cooling and air conditioning. The patent was registered in the names of Dr. Hassan Abdul-Rahim and Dr. Mansour Ahmed.

The two researchers at KISR’s WRC developed an innovative technology to meet the challenges of providing fresh water, and cooling and air conditioning, which face most countries in the world that are located in arid and dry climates and suffer from high temperatures, such as the State of Kuwait. The research team was able to achieve this scientific precedent by developing an innovative system through integrating the direct osmosis technology and the cooling cycle that operates in the vapor absorption method. The idea of the innovative system is based on the direct osmosis system for water desalination, which uses an aqueous solution with a high salt concentration, meaning it has a high osmotic pressure, making it able to withdraw fresh water from seawater through a semi-permeable membrane. This aqueous solution has thermal properties and they were able to separate it from fresh water through the thermal effect later, in order to produce fresh water with the recycling of the aqueous solution. The heat required for the

fresh water separation process is provided by recovering waste heat in the vapor absorption cycle, which in turn produces highly cold water that is used in cooling and air conditioning.

The research team presented conclusive scientific evidence to prove the effectiveness and efficiency of the innovative technology using mathematical modeling and computer simulation. The team designed the innovative system with an estimated production capacity of 130 cubic meters of fresh water per day, and consuming 1.4 kilowatt in an hour per cubic meter of fresh water produced, while generating 50 tons of refrigeration for air conditioning. This innovative system is one of a kind and like no other in the world. The results proved that this technology is technically and economically feasible in the applications of seawater and groundwater desalination, while cooling and air conditioning at the same time.

This invention is a distinguished scientific progress in the field of developing combined technologies for water desalination while cooling and air conditioning simultaneously, due to the multiple advantages of this combined system. The most prominent advantage is the reduction of the total energy consumed for water desalination and air conditioning. It is also environmentally friendly due to the low temperature of the brine reflux, and has the possibility of linking this technology to solar energy systems, or benefiting from the energies dissipated in thermal power stations to produce energy. This system requires the injection of chemicals in smaller quantities than the reverse osmosis system currently used in water desalination. This innovative technology also has the possibility of implementing it at varying capacities, whether on mobile or fixed units for the applications of seawater and groundwater desalination with air conditioning simultaneously, according to customer needs. It can be assembled locally for the ease of manufacturing most of its components, which enhances the localization of this innovative technology in the country with the possibility of marketing it locally, regionally and globally. All of these advantages are in addition to the ease and flexibility of operation, as it can be operated as a combined unit for water production and air conditioning together or separately. This innovative system can be applied to meet the challenges of water security, and natural crises or disasters.

The most important outputs of this invention are the contribution to achieving water security, and sustainability of fresh water production and air conditioning, in order to meet the challenges of the scarcity of natural fresh water resources and high climate temperatures, in addition to reducing the economic and environmental costs of desalination, and cooling and air conditioning operations. The Water Research Center looks forward to pursuing the actual application of such innovative technologies across the public and private sectors in the country, which will significantly reduce the cost of production and the harmful emissions resulting from desalination plants.

**Title: KISR Completes a New Research Project in the Field of Waste Management and Addressing Environmental Pollution in the State of Kuwait**



**News:**

KISR recently completed a research project that is considered a paradigm shift in the field of waste management and addressing environmental pollution in the State of Kuwait, titled: “The Study of Thermal Chemical Decomposition of Used Rubber Tires with the Aim of Extracting Their Chemicals at Different Levels.” The project is concerned with renewable fuel production using amounts from a number of worn out rubber tires’ types and comparing them with each other in order to extract the optimal recommendations that can be used in the near future.

Dr. Sultan Majid Al-Salem, the project leader and scientific researcher at KISR, stated that the rubber tire industry is one of the most important industries worth billions in US dollars around the world. The industry has a great economic revenue for countries, especially in North America and Europe, in light of the availability of strict laws to reduce their increasing environmental impact. For example, including but not limited to, Law EC 53/2000 in the European Union pertains to everything related to reducing the accumulation of rubber tires. In particular, it pertains to the development of general legislation that clearly states that any practice that deals with tires must ultimately treat them on a separate basis from other types of solid waste in Europe, as well as cars that have expired (scrap). Thus, this legislation requires that tires be dealt with separately and in a very special way, away from any possibility of mixing with the rest of



waste types, in order to reduce chemical deposits and pollution, and also in special industries with recycling. At this point in time, there are more than four billion worn-out rubber tires around the world, which are either accumulated in the urban environment or in a landfill, a practice Dr. Sultan Al-Salem stressed is useless, or rather must be reduced and eliminated due to its very serious environmental impact. Returning to global statistics, it is found that the rate of production of worn-out rubber tires as solid waste in the European Union is approximately 3.3 million tires annually, and in fact, more than 1.6 billion units of tires are produced globally. Only 100 million units are handled in recycling machinery and technologies in general. By reading the latest statistics on rubber tires in the State of Kuwait, the general situation can be deduced by knowing that the country has one of the highest rates of car ownership around the world, with more than 700 cars per 1,000 persons, and a production rate of nearly 100,000 rubber tires as solid waste annually.

Dr. Al-Salem explained that rubber tires are actually composed of thermoplastics and natural rubber that should be utilized by optimal chemical means as one of the most important recycling technologies in the world. The production of environmentally friendly rubber materials and products can be added to these technologies, in addition to their uses in road paving and so on, in attempt to reduce the environmental impact of waste accumulation.

As for the idea of the project, which ended recently, Dr. Al-Salem stated that it is to exploit the stem of rubber tires in Kuwait through the application of thermal chemical decomposition technology in order to produce derivatives comparable to those resulting from the petroleum industries. Work has been carried out on the scientific tasks in the project through funding from Kuwait Foundation for the Advancement of Sciences (KFAS) and KISR. The work was done by starting laboratory work with the thermal reactor, which previously obtained a patent from the US Patent and Trademark Office (US 10,364,395 B2). A number of worn and new tires' types were studied, as well as their studies and characterization using micro and laboratory scales to know the dynamics of dissolution reactions on the one hand, and to know the mechanism by which such industries are fueled and their products are dealt with in Kuwait, on the other hand. Such chemical techniques are the focus of attention of the whole world because of their



industrial and economic returns as well. All products that result from the process of reactions can be utilized in such reactors that recycle tires and solid waste. Accordingly, more than 40% of oils comparable to diesel, with a chemical fingerprint of more than 70%, were produced, after examining the resulting products with average temperatures between 500 and 800 degrees Celsius. They contained properties similar to market specifications in price value, density, viscosity, as well as the percentage of hydrogen and carbon. The products can also be filtered from sulfuric substances so that the product has superior environmental characteristics. On the other hand, the same reactor, which can handle a feedstock size of 200 grams, emits gases comparable to light gases from the petroleum and petrochemical industries, and carbon black, which has many uses in dyes and road engineering.

Dr. Sultan Al-Salem expressed his hope that the recommendations of this project will be taken into account and considered with the aim of preserving the environment on the one hand, and economic returns on the other hand, especially since such technologies can be one of the most important integrated industries along with oil and environment industries as well.

Dr. Al-Salem thanked the financiers, KISR's management, and the technical team of the project, hoping that the future stages will see the light in raising the pursuit to a standard scale by dealing with 5 kilograms per day, coinciding with Kuwait's announced plans to launch a bio-ethanol plant from worn tires. Accordingly, a number of industries that deal with tires can be launched in the country, with direct benefits to the country and its citizens, especially in preserving the environment from the accumulation of waste.