DEPARTMENT OF MECHANICAL ENGINEERING TECHNIQUES OF POWER

خلاصات البحوث المنشورة والمستلة من اطاريح طلبة الماجستير في قسم هندسة تقنيات ميكانيك القوى للعام الدراسي ٢٠١٧-٢٠١٩

NO.	Names of researcher	Title of puplish paper	Abstract
1	**Mmohammed Jasim Obaid, Dhafer Manea H. Al-Shamkhee, Assaad Alsahlani**	**Experimental Study of the Performance of A Flat Plate Solar Water Heater**	Flat Plate collector is the most common type of solar water heater, due to its low price, easy installation, and long life. The efficiency of a solar collector is key to evaluating its performance in thermal facilities, especially applications requiring low or medium temperatures. The most important factors affecting the efficiency of the solar collector are the weather conditions, the design of the collector, the type of working fluid used. A Flat plate collector tested experimentally in solar heating system worked by direct flow and closed system to heating space in Najaf, Iraq (32° 1' N / 44° 19' E). Experimental results showed that the overall daily efficiency of the collector reached 37.16%. Moreover, the maximum temperature of hot water for collector reached 57.1oC.
2	**Ali Sh. Baqir1, Hameed B. Mahood2,* and Ahmed R. Kareem1**	**Optimisation and evaluation of NTU and effectiveness of a helical coil tube heat exchanger with air injection**	Air bubble injection has recently been confirmed as a beneficial technique for enhancing the thermal performance of a heat exchanger. The normal vertical motion of the bubbles due to buoyancy force leads to the entrainment of fluid from the shell side, thereby raising its velocity and turbulence level whilst improving the mix within the shell. Consequently, the thermal boundary layer that formed around the outer surface of the coil is disrupted, thus reducing heat transfer resistance and enhancing the heat transfer rate. Despite relatively considerable attention that has been given to assess this technique, numerous investigations have concentrated on only a few operational conditions. This consideration will be insufficient to understand the influence of air injection entirely on the thermal performance of a heat exchanger. Thus, this study aims to fill this gap by performing experiments over numerous operational conditions for hot and cold fluids and the injected air in a vertical counter-current coiled tube heat exchanger. The optimal air flow and the shell-side flow rates of the vertical coiled tube heat exchanger are determined, thus leading to the economic operation of a heat exchanger. Therefore, the implemented shell-side flow, air flow and coilside flow rates were changed from 2 LPM to 10 LPM, from 0 to 10 LPM and from 1 LPM to 2 LPM, respectively, with three temperature differences (i.e. 20 °C, 30 °C and 36 °C). The number of heat transfer units (NTU) and the thermal effectiveness of the heat exchanger were investigated intensively. Results showed that the NTU and the effectiveness are influenced significantly by the injected air flow, shell-side flow and coil-side flow rates without noticeable effect on the temperature difference. In addition, the positive role of the injected air flow rate was diminished, and no further enhancement of NTU and effectiveness was observed when Qa > 6 LPM. The most effective shell-side flow rate was also 6 LPM. The maximum augmentation in the NTU and the effectiveness were 1.93 and 0.83, correspondingly, whilst the minimum value of the NTU and the effectiveness were 0.66 and 0.63, respectively.
3	1Jameel Al-Naffakh, 2Mohammed Al-Fahham and 1Qahtan A. Abed	Experimental study of The effect of the burner shape on flashback in Gas Turbines	The purpose of this paper is to conduct an experimental study of a swirl burner with different lengths for a fixed diameter. Three models of rim length (5 cm, 10 cm and 15 cm) were taken. The results show that any change in the ratio of length to diameter will affect the flame position and structure of the downstream. It turns out that the flame settles near the edge as the rim length increases. The result indicates that increasing the length of the burner neck will reduce the structure of the swirl and weaken it, thus increasing the incidence of flashback phenomenon. The operating window of three burner neck models was studied above. It was found that the 5 cm rim has an equivalent ratio of (0.38-0.82) and for the 10 cm rim that is equivalent ratio (0.39-0.84), as well as for the rim 15 cm in equivalent ratio (0.4-0.83) with air velocity stabilization. For the above three models. Through the equivalent ratio of the above models. It was found that the 10 cm rim gave a larger operating window and therefore higher stability than the other two models.

4	Hiba Qasim Mohammed1, Ali Sh. Baqir2, Khwayyir Hasan H.S.2	Effects of Air Bubble Injection on the efficiency of a Flat Plate Solar Collector: an experimental study for the open flow system	This paper aims to study experimentally with and without the effects of small air bubble injection on the efficiency of a flat plate solar collector with tube rises for open flow system. The variation of the thermal efficiency of the solar flat plate collector due to both different of the water flow rate and due to the air bubbles injection with air flow rates are evaluated. A new experimental procedure for injecting small air bubbles into the riser tubes of solar flat plate collector is proposed. The comparison between the effects of forced water flow rates and air bubbles injection on the solar flat plate thermal efficiencies with a variation of solar radiation intensity were investigated. Water and air flow rate were changed between 1.5 LPM to 2.5 LPM with inlet water temperature ranged between (19-23.5) °C. Observations showed that the injecting of air bubbles inside the solar flat plate tubes risers play key roles on the effect of thermal efficiency more than that of using the water flow rate without air bubbles injection. Small air bubbles injecting into the risers tubes of the flat solar collector causes enhancement of the thermal efficiency and it increased (3.5-5.25) % depending on air flow rate.
5	Ahmed R. Kreem1, Ali Sh. Baqir1 and Hameed B. Mahood2	Temperature Distribution Measurements along Helical Coiled Tube Heat Exchanger with Effect of Air Injection	Present paper tries to clarify an important statement that has not been addressed in the literature which is the influence of tiny air bubbles injection on the temperature distribution along a vertical shell and helically coiled tube heat exchanger. Four equal space thermocouples were installed along the shell side of the heat exchange unit in addition to the inlet and outlet thermocouples. Experiments performed with three different shell water flow rates (4, 6, and 8 LPM) and each flow rate was performed with five different air flow rates (2, 4, 6, 8, and 10 LPM). The flow rate of the coiled tube (hot fluid) was kept constant at 2 l/m. The inlet temperature of the fluid (water) in both coiled tube and shell were kept constant at 37 ^{o}C and 17 ^{o}C respectively with invariant inlet air temperature (18 ^{o}C). The obtained results showed that a mutual thermal mixing took place once the air as tiny bubbles was injected in the shell side of the heat exchanger. Hence, a high heat transfer rate was recorded and indicated by the sudden raising of the temperature along the heat exchanger. In addition to the maximum improvement in the effectiveness obtained due to the air bubbles injection was 62 %.
6	Jameel Al-Naffakh1, Mohammed Al-fahham2 and Qahtan Adnan Abed3	Burner rim geometry effect on flame stability	A swirl burner in atmospheric pressure combustion system with different burner length to burner rim diameter ratio L/D were studied. Three ratios of L/D 1,2 and 3 were used to investigate the effect of the burner geometry on the stability window. The results show that the position of the flame front stabilisation changes with L/D ratio. The flame front stabilises closer to the burner rim as the length of the burner increased. The equivalence ratio of the mixture was taken a constant for the comparison sake. The flame stabilises closer to the rim with an increase of the rim length.
7	Jameel Al-Naffakh1, Mohammed Al-fahham2, Qahtan A. Abed3	The blowoff limits and flashback limits for different diameter to length ratio burner	A 129 kWh swirl gas burner was used, where the effect of the burner geometry on the operation window was studied. Using LPG. The length of the burner edge was studied by taking three values of length (5 cm, 10 cm and 15 cm) which represent the ratio (1,2 and 3) to the diameter of the burner respectively. To enhance the combustion stability a swirl vane guide was used to obtain swirl flow and improve the flame structure. The result show that the increase in length of burner neck will decrease the swirl coherent structure and turn the flow to diffusion flow which increase the ability to have boundary layer flashback. However with the limit of burner used, increasing the length of burner neck gives a good result in blowoff side by bush it to leaner limits around ϕ=0.38 but in term of flashback it will bring it to leaner limits too, which is not preferable.. Although, this improvement is linked to the fuel type in first place but the flow structure has a significant impact on flame stability.
8	Mohammed R. Al_Qasab 1*, Qahtan A. Abed 2, Wisam A. Abd Al-wahid2, Jameel T. Al-Naffakh2	Comparative Investigation for Solar Thermal Energy Technologies System	The multiple uses of fossil fuels make them depleted in the coming years. Also, the large amount of pollution produced by the use of this fuel has made the world seriously think of environmentally familiar alternative sources of energy. Universal energy is vast and diverse energy, with the ability to cover the individual's energy needs in various fields in the coming years. The focus of this study was a parabolic dish system. There are different uses solar of parabolic dish applications that can be limited by two main groups: thermal generation and electric power generation. A thermal generation used to generate steam, solar cooking, water heating, and water distillation. The briefly objective is to review and analysis the thermal generation published by taken into considering used parabolic collector system. Also, evaluate solar dish operators in differences covering like, the composition of concentrators, the material of reflector, receiver design, parabolic dish diameter, rim angle, and focal length. These characteristics drive to entire structure possible for a parabolic dish. Finally, this article may be useful for the new research worker to consider the requirement for Thermal solar generation integrated with a parabolic dish.

9	Qahtan A. Abed# , Mohammed R. Al_qasaab*, Wisam A. Abd Al-wahid	Performance evaluation thermal efficiency for the parabolic collector with two types of absorber	In recent years, many research studies focused on enhancing and improving the cost of the solar water heating system. This paper focuses on the development of the thermal efficiency of the solar parabolic dish collector (PDC) with different types of absorber. A spiral coil and helical conical coil receivers in a PDC system are studied experimentally. The experimental system consists of a solar parabolic dish 1.5m diameter, spiral coil, helical conical coil and solar tracking system. The concentrated solar radiation amounting the receiver heats the working fluid (water) flows through this tube (coil spiral or helical conical). The preliminary calculations have been accomplished on the typical winter day in Najaf, Iraq (32° 1' N /44° 19'E). Effect of volumetric flow rates on the useful energy and thermal efficiency of the system has been investigated. They were conducted within 30 L/h and 60 L/h of volumetric flow rates. The experimental results showed that the maximum outlet temperature was obtained from PDC with spiral coil receiver with 30 L/h volumetric flow rate. The PDC with a spiral coil has the potential to supply hot water is about 30.14%, 53.48% more efficient than of a PDC with a helical conical coil at 30 L/h, 60 L/h respectively.
10	Muntadher Mohammed Ali Saeed1,, Dhafer Manea Hachim1, Hassanain Ghani Hameed1	Numerical Investigation for Single Slope Solar Still Performance with Optimal Amount of Nano-PCM	Desalination using solar energy systems is a practical solution for production of potable water and particularly in remote areas, which suffer from lack of drinking water due to poor infrastructure. It is possible for a small distillation system to be a practical and economical solution for current and future demand for potable water with availability water resources and large amounts of solar radiation. Therefore, productivity thatcould be increased by increasing the model's ability to store the heat energy neededto maintain evaporation was discussed using nanoparticles dispersed in paraffin waxbeneath the basin. In this paper, the main objectives of the study are to obtain the optimum parameters of PCM mass, NPCM mass, water mass and solar radiation to give the best productivity of the model inside the atmosphere of Najaf city, a numerical study involving the study of the performance of single-slope solar still using different masses of PCM with and without nanoparticles. Nanoparticles is used to improve thermal conductivity of paraffin wax. The most commonly used paraffin wax (PCM) andAl2O3 (nanoparticles) complements its specific thermal properties with fusion temperature where the main active properties are studied. The numerical solution was done using COMSOL 5.3 software and the results were compared with previous studies and showed that a good agreement. Also, the results showed that the use of 1 kg of PCM represent optimal amount of enhancement, and thus using of 3 Vol.% concentration of Al2O3 nanoparticles dispersed in 1 kg of paraffin wax gives the possibility of improving the traditional single slope solar still daily productivity by about 20%.
11	Hassanain Ghani Hameed1 , Dhafer Manea Hachim 1 , Muntadher Muhammed Ali Saeed1	NUMERICAL INVESTIGATION OF THE EFFECT OF WIND SPEED ON PERFORMANCE OF SINGLE-SLOPE SOLAR STILL	Pure water is a necessary component for humans life and other organisms, as well as for industrial and construction processes. Many techniques were used to produce drinking water. Recently, solar distillation systems have been studied and used for ease of use and low cost. In this study, the influence of air velocity on the accomplishment of a conventional single slope- solar still was investigation numerically. It was found that the productivity of the model will increase by about 16% with increasing air speed to 4.5 m/s.
12	Hiba Qasim Mohammed1, Ali Sh. Baqir2, Khwayyir Hasan H.S.2	Experimental study of effect small air bubbles injection inside flat plate solar collector on efficiency for the open loop	Many previous studies have been prepared to raise the efficiency of the solar collector. The present paper describes the experimental study of effect small air bubbles injection inside a flat plate solar collector on efficiency for open loops. This research was carried out at the department of mechanical engineering in Al-Furat Al-Awsat Technical University in Najaf city (Iraq). The solar system has been instilled with a 45^{o} tilt angle based on the location of experiments, 32^{o} N and 44.3^{o} E latitude and longitude, respectively. The open-loop case was to stabilize the liquid entry temperature to the lowest degree throughout the experimental and install as 19-23o C. Moreover, the mass flow rate in the experiments of single and two-phase flow was constant. The flow rate used in both phases is (1, 1.5, 2 and 2.5) LPM. Also, the inlet temperature is constant. The results show that the performance of a solar collector in two-phase flow is higher than single flow. The maximum enhancement is 10% and 6% for in heat transfer rate thermal efficiency respectively.