

**Luay Thabet Abdulqader Al-Rawi. Experimental Study of a Vacuum system to Cold Water as Product. University of Technology. Mechanical Engineering Department. M.Sc. Supervisors Asst. Prof. Dr. Ahmed A. M. Saleh & Asst. Prof Dr. Qussai J. Abdul Ghafour**

**Abstract**

Vacuum cooling system and the parameters which affect on its performance were studied experimentally and theoretically. For the experimental study, two rigs were built up. The first rig was constructed for illustrating the boiling phenomenon under vacuum pump effect. The second rig was built up for studying the performance of cooling system for three cases. These cases are: Cooling water by vacuum only, Cooling water in conventional method and cooling water by vacuum with condensation.

The experimental results show that the addition of a condenser to the vacuum cooling system leads to sweep of largest amount of generated vapor, also the time consumed for the process was decreased. The times required for cooling the same water quantity from temperature 29°C to 10°C for the three test cases were 4375 second, 3535 second and 263 second, respectively. Vacuum cooling with condenser is a fast cooling of three systems test, which is about (13.7 times) faster than the system of natural convection cooling. To work properly, the existence of condenser is very important in vacuum cooling. It normally removes the large amount of water vapor generation (about 94%).

For the theoretical study, a computer program was built up by employing the governing equation to simulate the performance of the vacuum cooling system.

The theoretical results indicate an acceptable agreement with the experimental results. Also, these results show that the decreasing of condenser temperature causes decreasing of cooling time ( $t = 0.2031T_{cd}^4 - 2.8958 T_{cd}^3 + 16.406 T_{cd}^2 - 21.104 T_{cd} + 313.39$ ), and increasing the evaporation surface area leads to decreasing of cooling time ( $t=1/(0.0006*Area+0.0005)$ ), and the increasing of water mass induces increasing of cooling time ( $t=7.2667*mass+14$ ).

**Keywords:** vacuum pump; condenser; cooling effect; compared; vacuum cooling; mass transfer.