Faculty of Engineering- Fayoum University

Mechanical Engineering Department

كلية الهندسة- جامعة الفيوم

قسم الهندسة الميكانيكية

ملخص البحث باللغة الإنجليزية:

" Enhancement of heat and mass transfer performance on humidification tower using injection of different carrier gases into water bed"

The present study is presented an approach attempting for enhancement of heat and mass transfer between a continuous gas phase and liquid phase in a non-packed humidification towers by injection of different carrier gases such as air, carbon dioxide and helium through water bed. The computational technique utilized was a three-dimensional Navier-Stokes solver in the laminar flow regime with freesurface simulation in Piecewise Linear Interface Construction method to compute density variation on the two-dimensional two-phase flow field and pressure on a water bed. This work studied the influence of the operating conditions such as the water bed temperature and carrier gas type on the overall gas phase heat and mass transfer coefficient. The present study included also determining the overall pressure drop of the carrier gases through water bed, consumed power and humidification efficiency. It has been found that the mass transfer coefficient increases with increasing carrier gas molecular weight. The heat transfer coefficients are more than 5 times for carbon dioxide than air flow and less for helium than air, about 50% flow at water bed temperature 353 K. The mass transfer coefficients are more than 2.5 times for helium than air and less for carbon dioxide than air, about 50% at water bed temperature 353 K. The obtained maximum humidification efficiency of the helium was about 87%. The pressure drop was about 51.4 kPa for helium and 47.2 kPa for carbon dioxide at a water bed temperature 353 K. The consumed power was about for helium about 45.45 W and for carbon dioxide was 41.25 W at a water bed temperature 353 K. The comparison between the numerical and other experimental results shows a good matching of outlet humidity ratios for air as a carrier gas except that the numerical values were slightly smaller than experimental ones. This may be attributed to the laminar flow computation without including turbulence effects and the two-dimension computational model consideration.