

# Pengembangan Evaporative Cooling Berbasis Finned Heat Pipe dengan Serat Alami sebagai Cooling Pad = Development of Evaporative Cooling Based on Finned Heat Pipe with Natural Fiber as Cooling Pad

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## Abstrak

Sebagian besar penelitian tentang evaporative cooling hanya berfokus pada proses termodinamika dan optimalisasi kinerja beberapa konfigurasi dasar, seperti direct evaporative cooling (DEC) dan tipe tubular atau plat indirect evaporative cooling (IEC). Penelitian mengenai beberapa teknologi evaporative cooling terbaru seperti heat pipe IEC, dew point IEC dan semi indirect evaporative cooling, masih sedikit dilakukan. Penelitian ini bertujuan untuk mengembangkan sistem pengkondisian udara yang menggunakan indirect evaporative cooling yang dikombinasikan dengan finned heat pipe sebagai pemindah panas dan cooling pad dari bahan serat alami. Tahapan awal dilakukan dengan melakukan studi literatur mengenai indirect evaporative cooling dan heat pipe, melakukan evaluasi terhadap penelitian yang pernah dilakukan, melakukan pengujian terhadap karakteristik finned heat pipe yang akan digunakan, melakukan penelitian terhadap bahan media pendingin berbahan serat alami yang akan digunakan, merancang bangun kombinasi indirect evaporative cooling dan finned heat pipe dengan media pendingin berbahan serat alami. Selain itu pada penelitian ini juga akan dicari beberapa hubungan atau korelasi antara parameter-parameter yang ada pada indirect evaporative cooling dengan tujuan meningkatkan efektifitasnya. Hasil dari pengujian ini menunjukkan bahwa efektifitas indirect evaporative cooling meningkat ketika digunakan serat alami berbahan nanas dibandingkan dengan serat lain (rami dan luffa), nilai maksimumnya 90% untuk efektifitas wet bulb dan 71% untuk efektifitas dew point, serta nilai EER yang mencapai 62%. Selain itu kinerja finned heat pipe sebagai pemindah panas bekerja dengan baik pada sistem ini terbukti dengan nilai kapasitas pendinginan maksimum yang mencapai 1180W.

.....The majority of evaporative cooling research only considers the thermodynamic operations and performance enhancement of a few fundamental configurations, such as direct evaporative cooling (DEC) and indirect evaporative cooling (IEC) tubular or plate kinds. There is still little research on some of the most recent evaporative cooling techniques, including indirect evaporative cooling (IEC) heat pipes, indirect evaporative cooling (IEC) dew points, and semi indirect evaporative cooling. With the use of finned heat pipes for heat transfer, cooling pads made of natural fibers, and indirect evaporative cooling, an air conditioning system is being developed. The first stage involves researching indirect evaporative cooling and heat pipes in the literature, assessing previous research, testing potential finned heat pipe characteristics, researching potential cooling media materials made of natural fibers, and designing buildings with a combination of indirect evaporative cooling and finned heat pipes and a natural fiber based cooling medium. In addition, this study will look for connections or correlations between the present indirect evaporative cooling factors in an effort to increase its efficiency. The results of this test demonstrate that using natural fibers made from pineapple increases the effectiveness of indirect evaporative cooling when compared to other fibers (ramie and luffa); the maximum value is 90% for the wet bulb effectiveness and 71% for the dew point effectiveness, and the EER value reaches 62%. Additionally, this system effectively transfers heat thanks to the finned heat pipes, as shown by the maximum cooling capacity of 1180 W.