

## **Dedication**

To my colleagues, students and researchers.

## **Acknowledgement**

First of all, giving thanks to Allah,

And a special thanks to supervisor

Dr. Yosif Hassan Mohammed Ali.

I can't forget giving thanks to everyone who helped me and gave me a new hope for successful.

I am gratefully acknowledges the financial support of the lectures and all the staff of Sudan University's, School of Mechanical Engineering for all what they offered throughout my educational path in the university.

I wish to acknowledge the efforts of the air conditioning work shop staff for their help during the experimental work.

At the last "thanks" for every one stood beside me until the last dot.

## **Abstract**

High energy demand associated to the massive use of air conditioning systems requires careful consideration of passive cooling strategies, with evaporative cooling being recognized as a useful possibility for that purpose. One important factor that influences the performance of evaporative cooling systems is the media material that supports water evaporation process (cooling pad). As a result a lot of research is being carried out to determine the performance of the cooling pads experimentally.

The major purpose of the study was to evaluate the performances of using Luffa (local natural fibers Type) to be used as wetted pads in direct evaporative cooling.

The tests were carried out at two levels of air velocity (4 m/s and 8 m/s) and two levels of pad thickness (40 mm and 80 mm). According to the results of this study, it can be stated that the average maximum saturation efficiency is highest for Luffa at 95.1%, compared to 90% for the reference commercial pad. The results show that there are a negative relationship between the cooling efficiency and the air velocity and a positive one with the pad thickness change.

## تجريد

يقتضي إرتفاع الطلب على الطاقة المرتبطة بالإستخدام المكثف لأنظمة التبريد والتكييف دراسة إستراتيجية متأنية، و بدأ أصبح نظام التبريد التبخيري حل مناسب لهذه المشكلة.

أحد العوامل الهامة التي تؤثر على أداء أنظمة التبريد التبخيري هو المادة العاملة التي تدعم عملية تبخر المياه (وسائد التبريد)، ونتيجة لذلك يجري العديد من الباحثين التجارب حول تقييم أداء هذه المواد معملياً.

الهدف الرئيسي من هذه الدراسة هو تقييم أداء إستخدام الليف (نوع من

الألياف الطبيعية المحلية) كوسائد تبريدية مبللة في التبريد التبخيري المباشر.

أجريت الإختبارات على مستويين من سرعة الهواء (4 م / ث و 8 م / ث)

ومستويين من سمك الوسادة (40 مم و 80). وفقاً لنتائج هذه الدراسة، يمكن القول

أن أقصى متوسط كفاءة تشبع في الليف 95.1٪، مقابل 90٪ للوسادة التجارية.

وأظهرت النتائج أن هناك علاقة سلبية بين كفاءة التبريد وسرعة الهواء وإيجابية مع

تغير سمك الوسائد.

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## **Abbreviations & Symbols**

### **A/ Abbreviations:**

°C	Degree Celsius
DBT	Dry Bulb Temperature
WBT	Wet Bulb Temperature
v	Air velocity
m/s	Meter per Second

**B/ List of symbols:**

<b>Symbol</b>	<b>Function</b>	<b>Unit</b>
$T$	Temperature	$^{\circ}\text{C}$
$v$	velocity	m/s
$\Delta T$	Temperature decrease	$^{\circ}\text{C}$
$\eta$	Saturation cooling efficiency	%
$t_o$	Dry bulb temperature of the outdoor air	$^{\circ}\text{C}$
$t_s$	Dry bulb temperature of the supply air	$^{\circ}\text{C}$
$t_{o,wbt}$	Wet bulb temperature of the entering air	$^{\circ}\text{C}$

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