Experimental Investigation on the Performance Influencing Factors of a Transcritical CO_2 System

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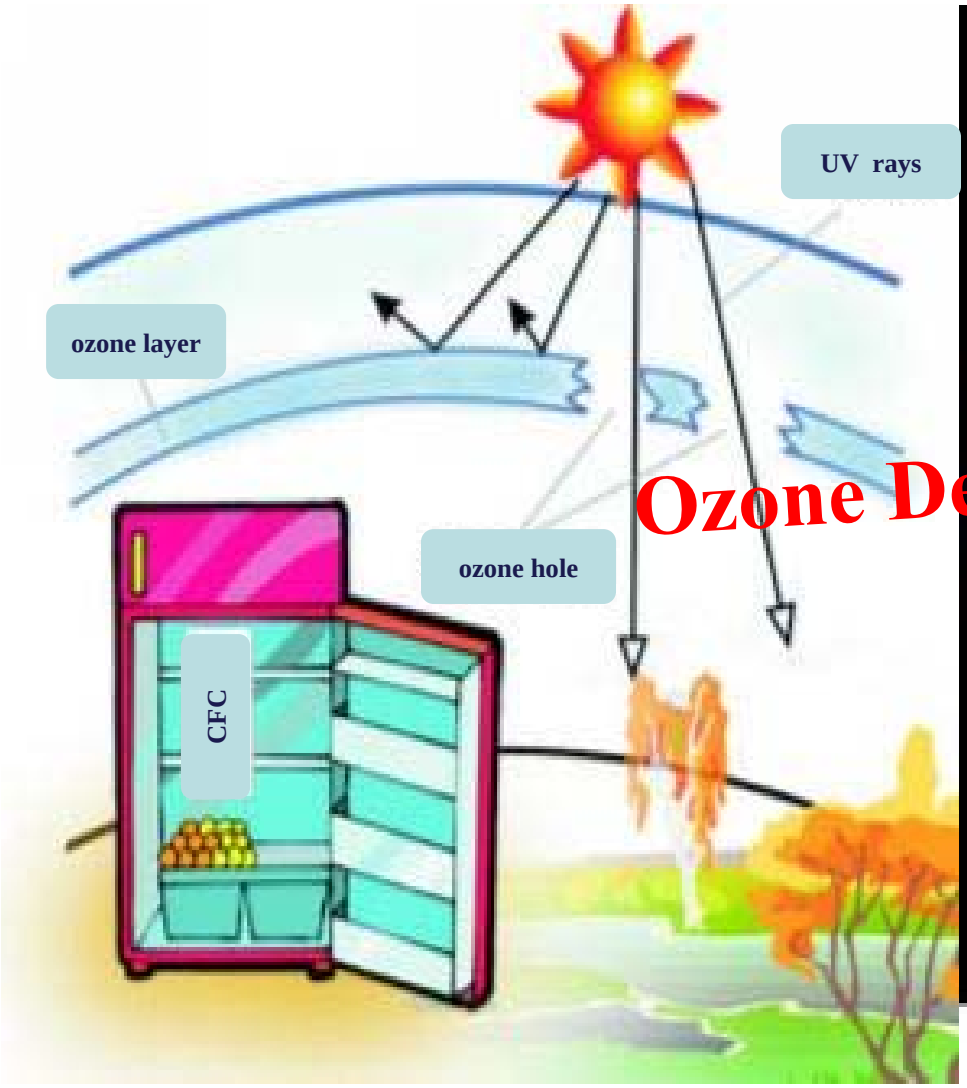
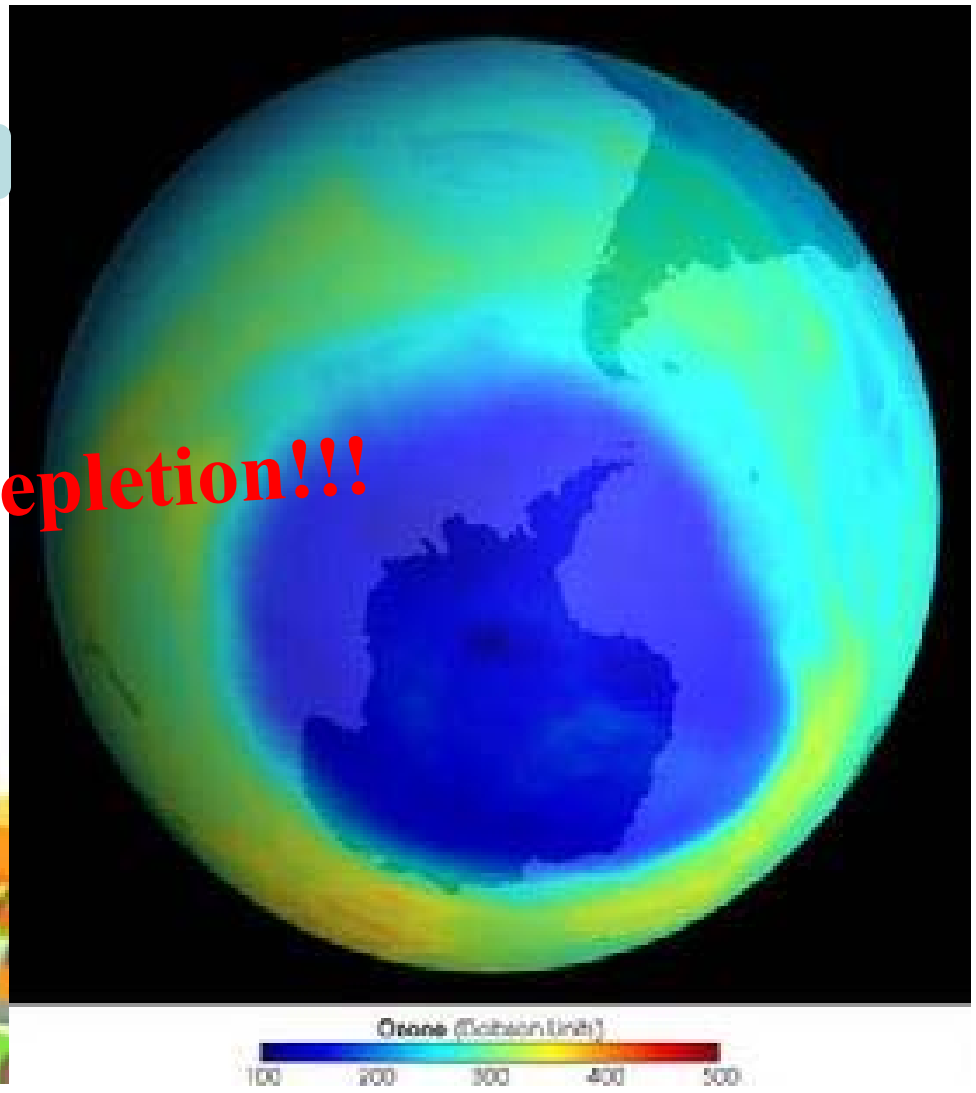
•MAIN CONTENTS

•1 INTRODUCTION



Ozone Depletion!!!

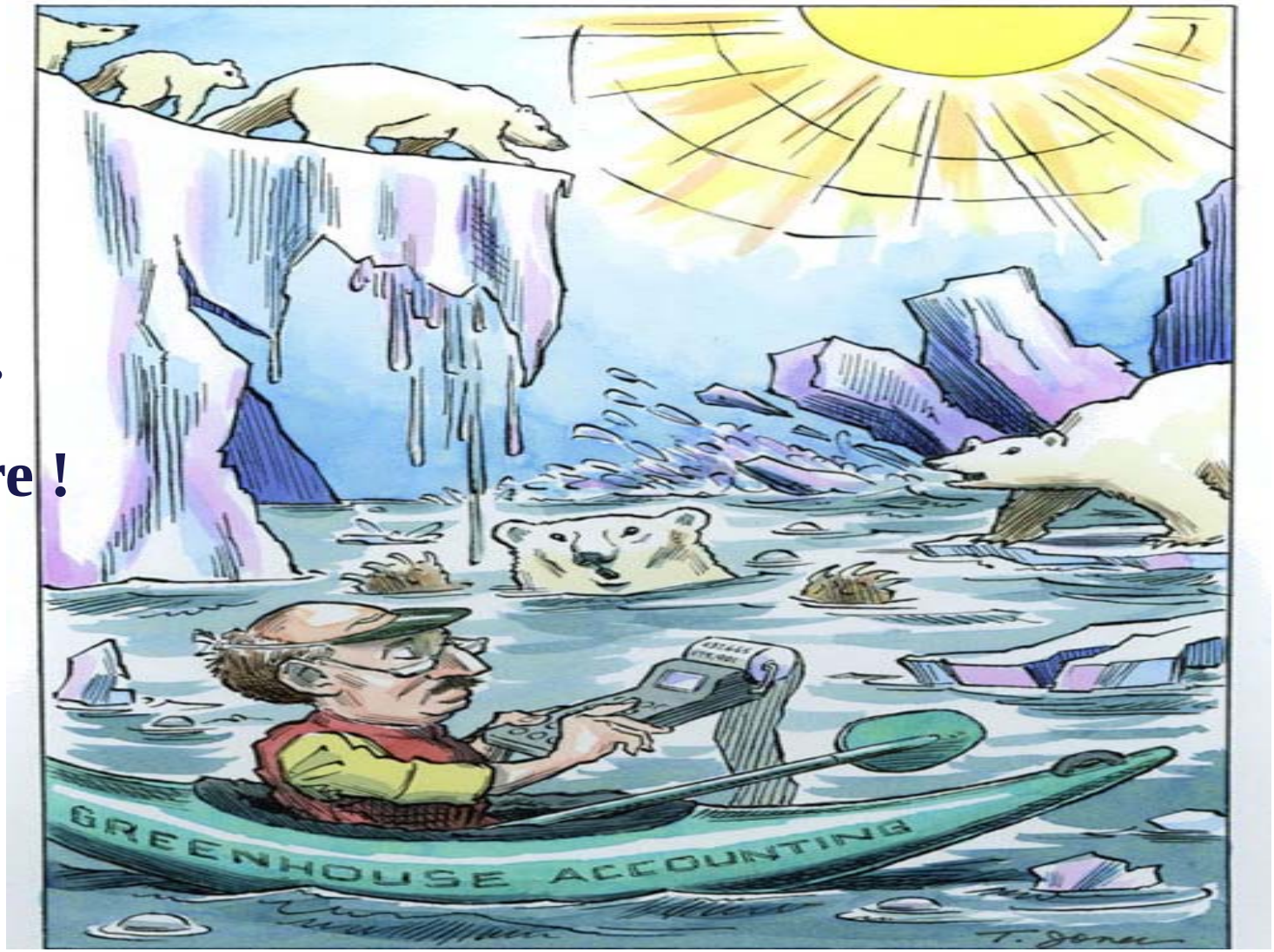


•1 INTRODUCTION

Water ? . . .

Flood ? . . .

Every where !



•1 INTRODUCTION

•synthetic refrigerants

•natural refrigerants

Alternative Refrigerants

•CO_2

•Unique advantages

•Great disadvantages：

high pressure， low COP

•2 RESEARCH PURPOSE

•How to improve the performance of the system?

cycle modifications :

internal heat exchanger, expansion turbine, multi-staging, two-phase ejector, vortex tube , parallel compression economization

operating conditions :

high pressure side and low pressure side

•2 RESEARCH PURPOSE

•**Improve the performance of the system:**

Water-water transcritical CO_2 refrigeration system

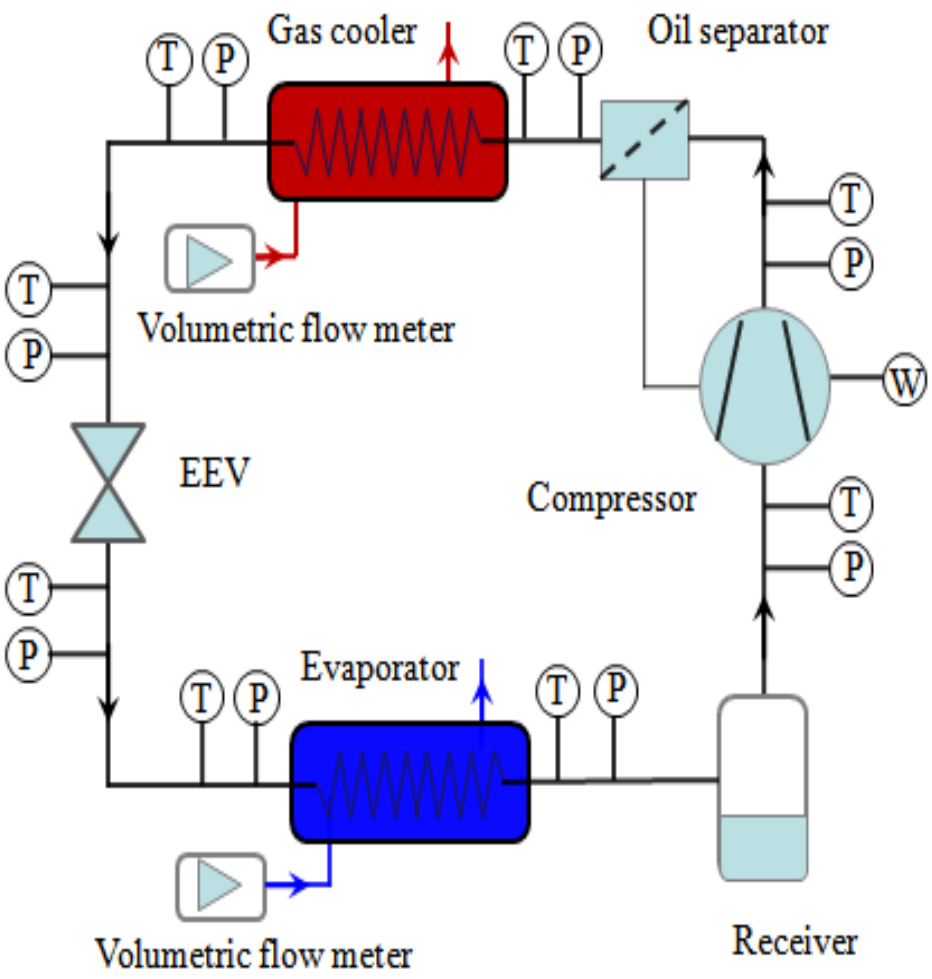
operating conditions:

low pressure side: **water temperatures and flow rates**

high pressure side: **water temperatures and flow rates**

To seek the reasonable operating conditions: temperature? flow rate?

•3 TEST RIG


Gas cooler
Oil separator
T
P
Volumetric flow meter
W
EEV
Compressor
Evaporator
Volumetric flow meter
Receiver

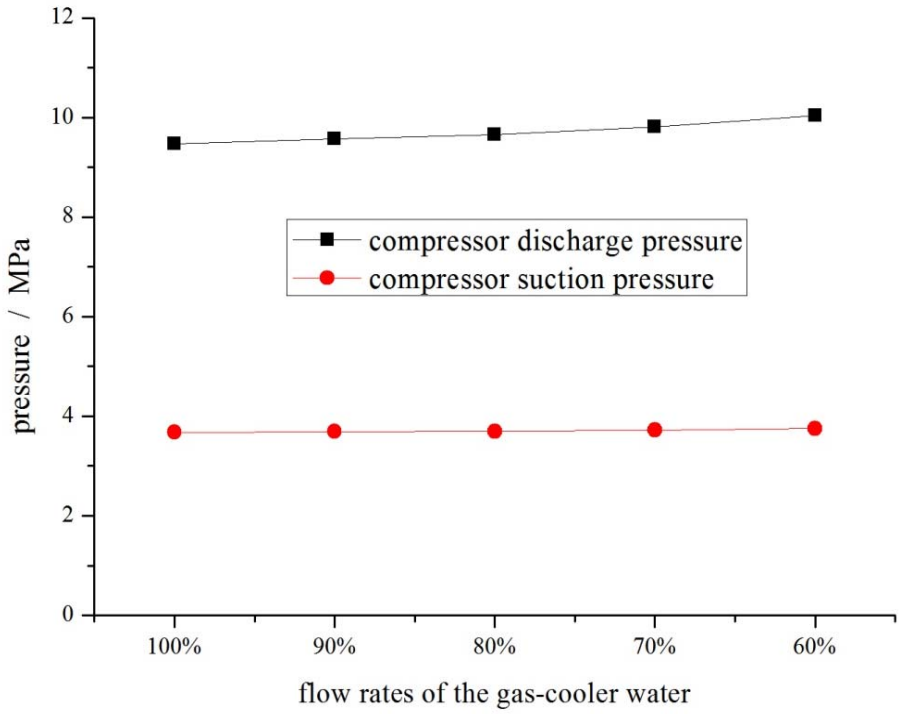
•3 TEST RIG

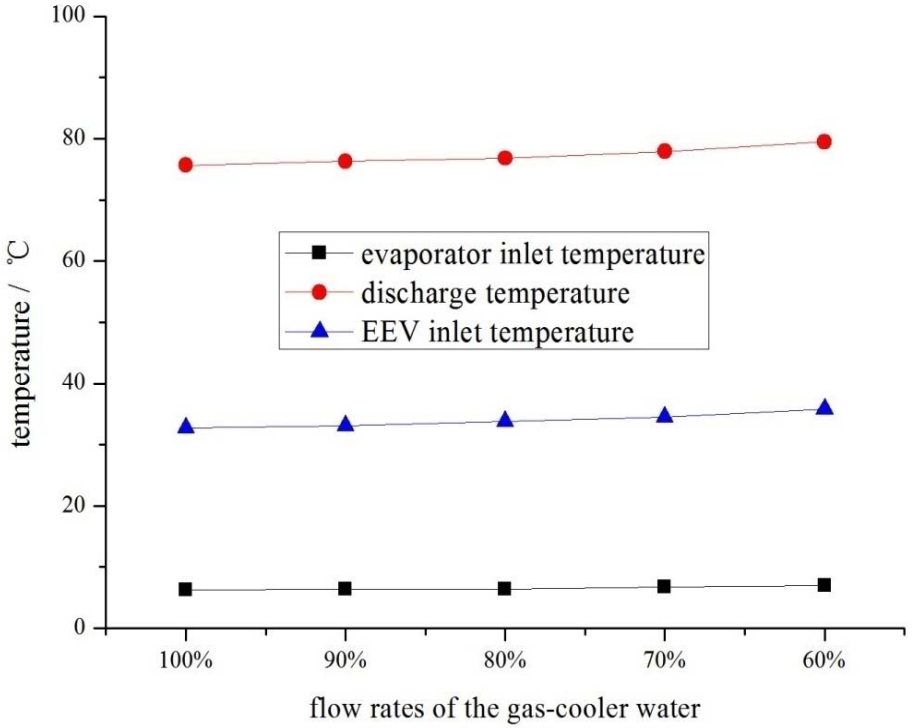
Table 1: Main Components

Name of components	Main characteristic
Compressor	Semi-hermetic reciprocating; Swept volume: 8.3 m^3/h.
Gas-cooler	Plate heat exchanger; Heat transfer area: 2.09 m^3
Evaporator	Plate heat exchanger; Heat transfer area: 1.81 m^3
Expansion valve	Electrically expansion valve.
Receiver	Inner volume: 4.9×10^{-3} m^3.
Oil separator	Inner volume: 11.7×10^{-3} m^3.

•4 RESULTS AND DISCUSSION

•4.1 The effects of flow rates of the gas-cooler water



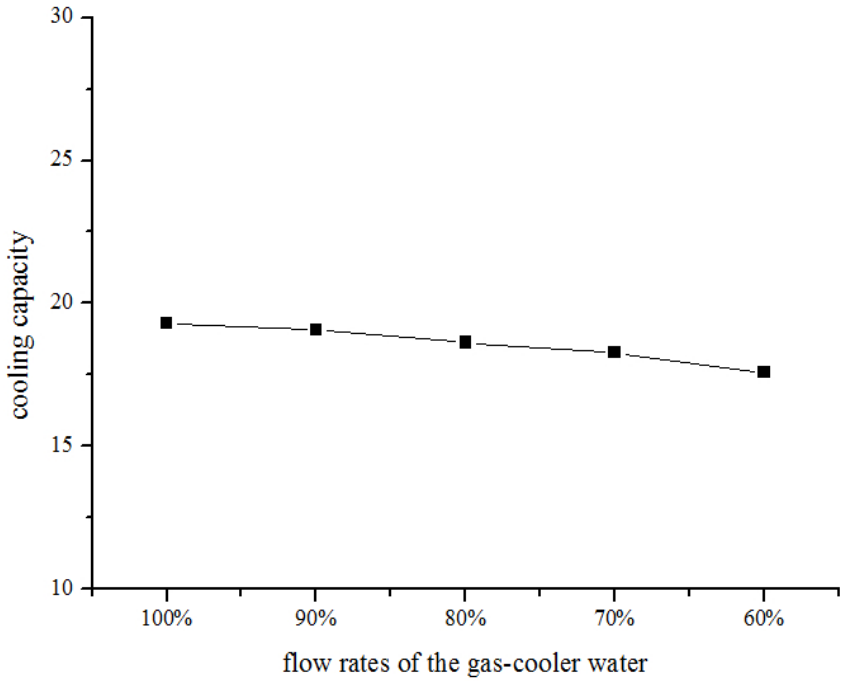


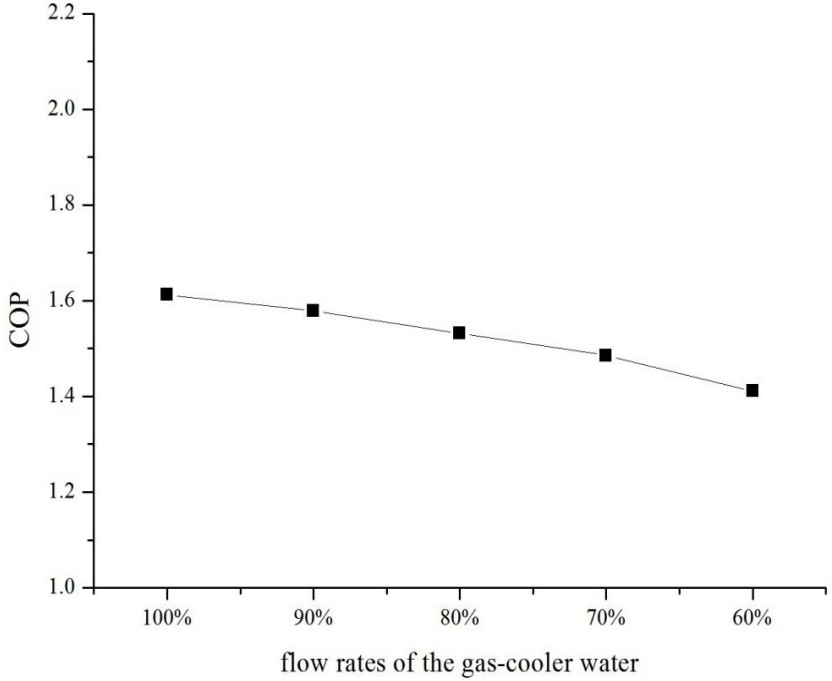
pressure :
increase slightly, not much

temperature :
increase slightly, not much

•4 RESULTS AND DISCUSSION

•4.1 The effects of flow rates of the gas-cooler water



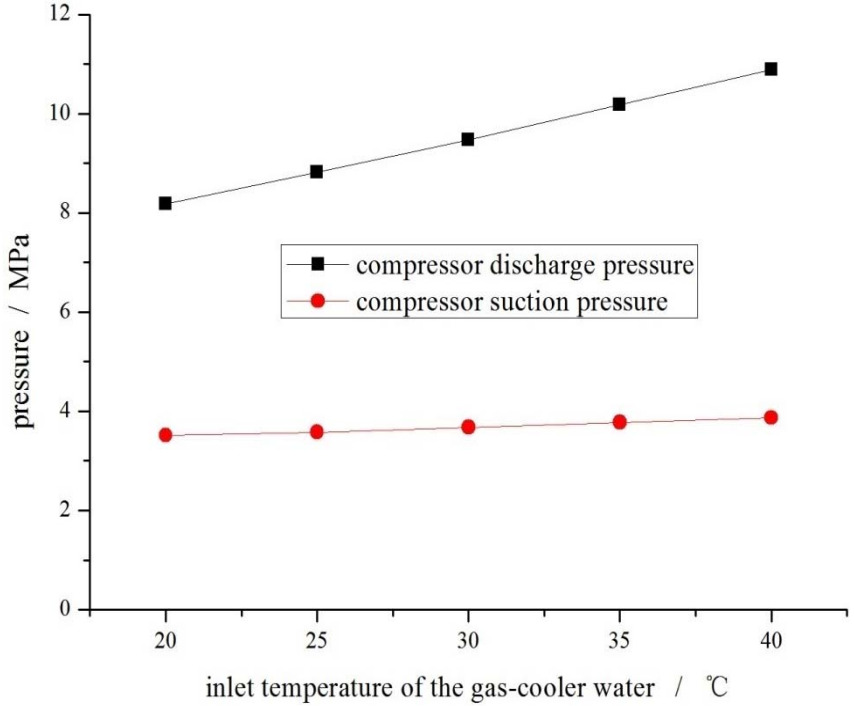


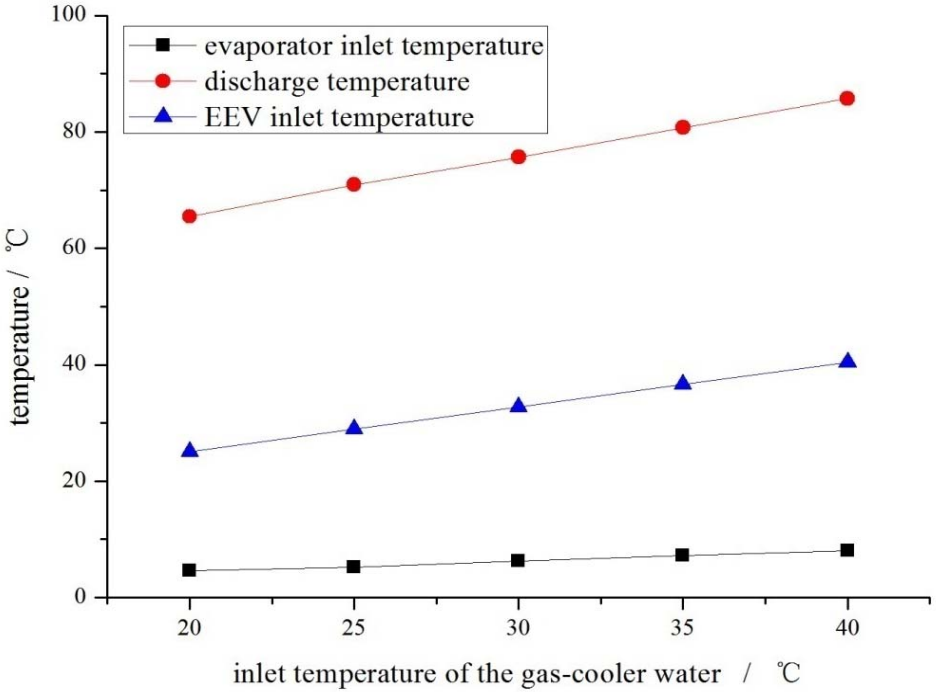
Cooling capacity:
decrease, not much

COP:
decrease ,not much

•4 RESULTS AND DISCUSSION

•4.2 The effects of inlet temperature of the gas-cooler water



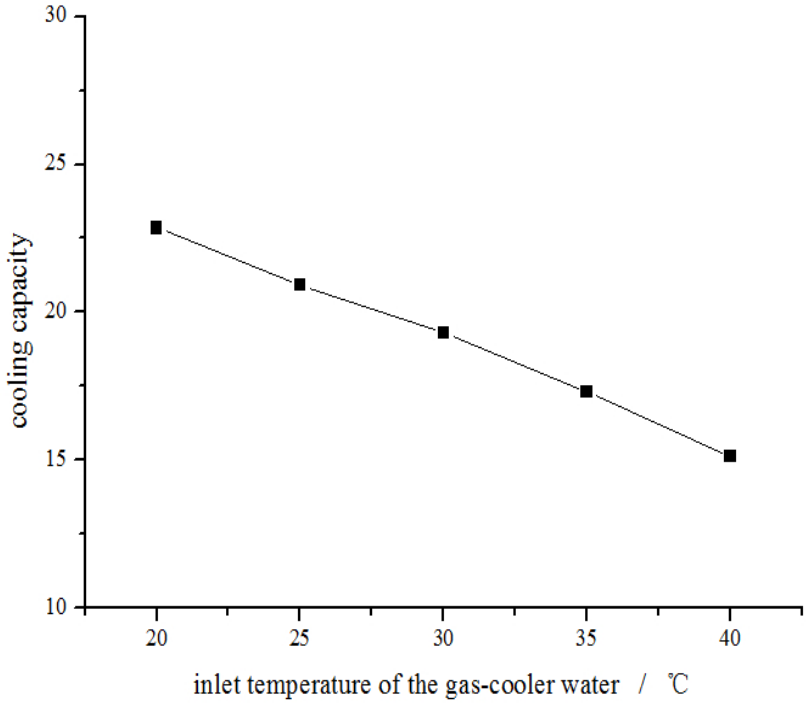


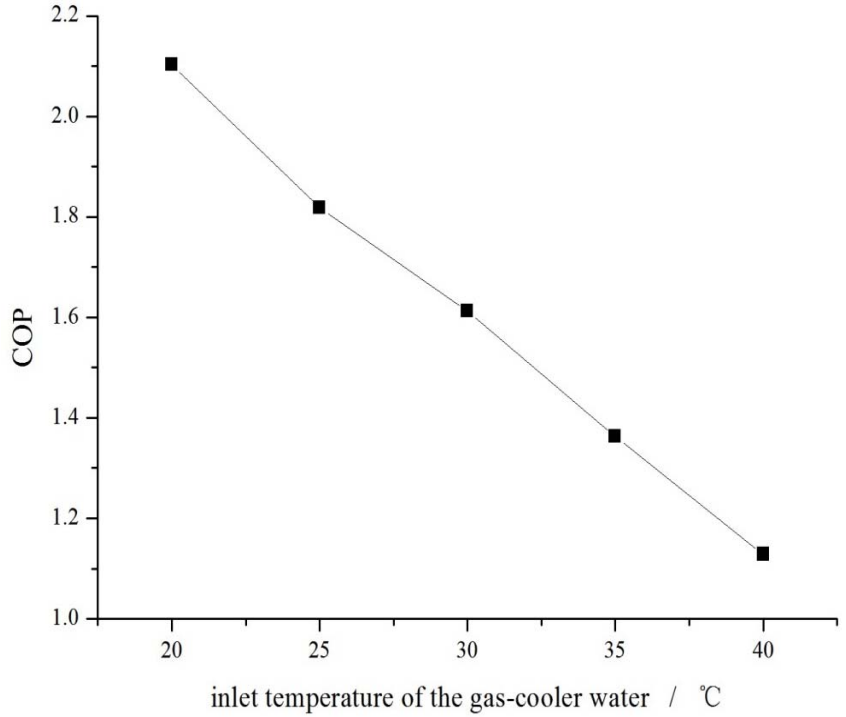
pressure :
high pressure side: increase greatly
low pressure side: increase a little

temperature :
high pressure side: increase greatly
low pressure side: increase a little

•4 RESULTS AND DISCUSSION

•4.2 The effects of inlet temperature of the gas-cooler water



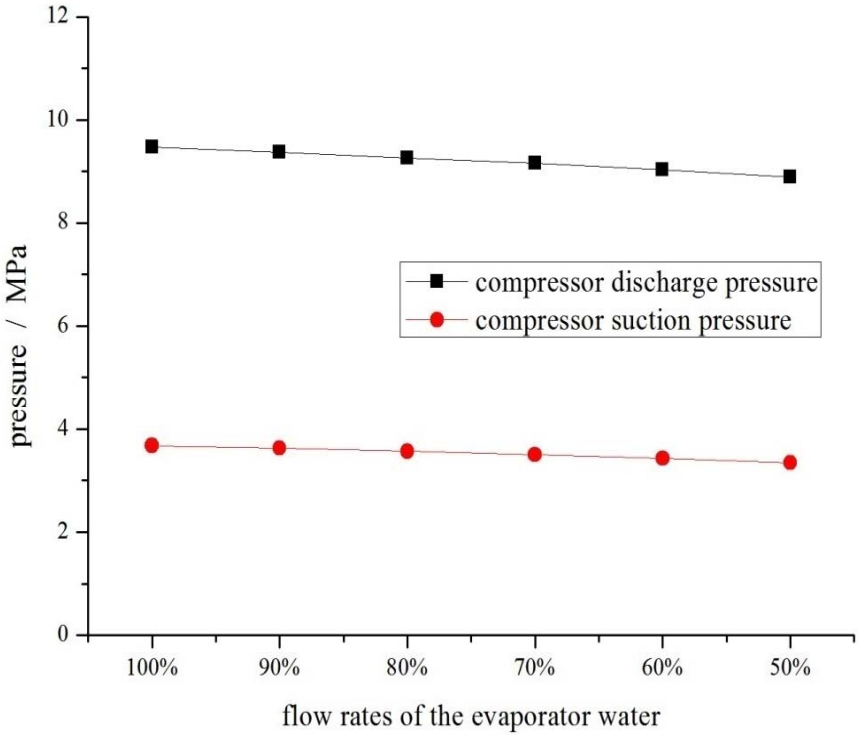


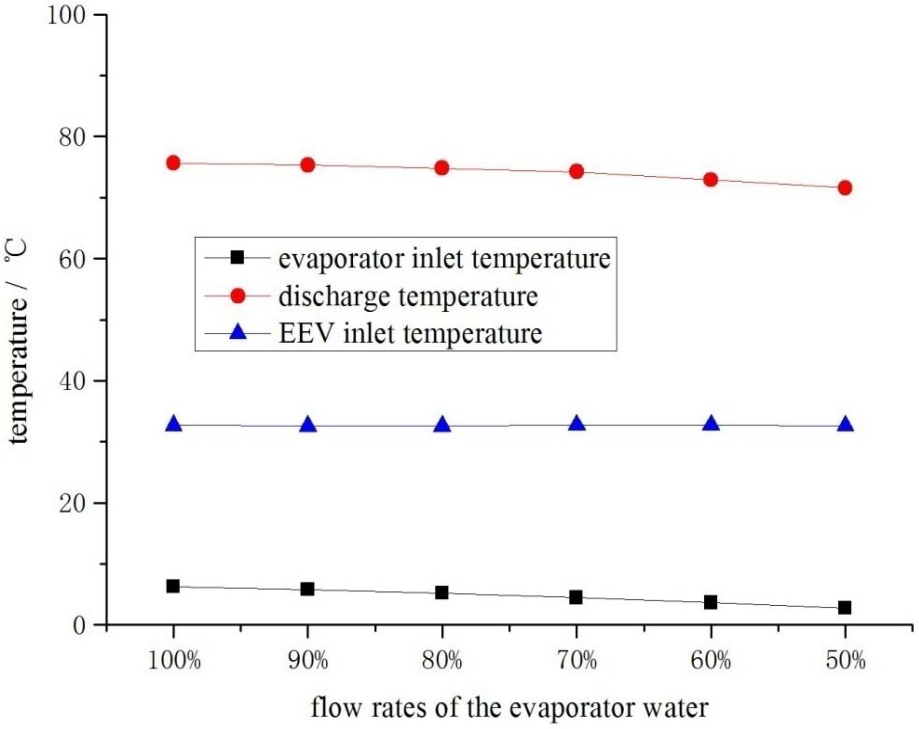
Cooling capacity:
decrease dramatically

COP:
decrease dramatically

•4 RESULTS AND DISCUSSION

•4.3 The effects of flow rates of the evaporator water



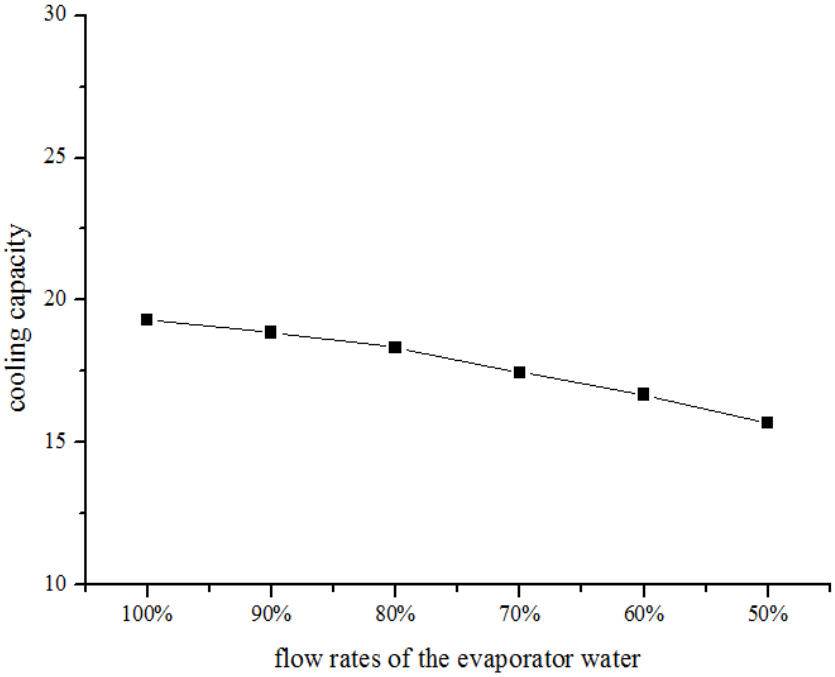


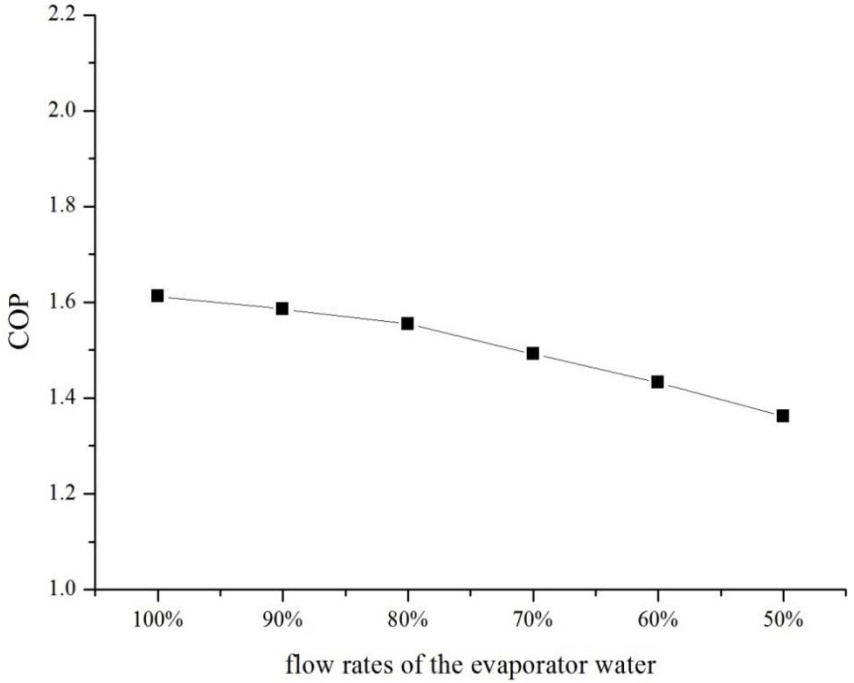
pressure :
high pressure side: decrease slightly
low pressure side: decrease slightly

temperature :
high pressure side: decrease
low pressure side: decrease

•4 RESULTS AND DISCUSSION

•4.3 The effects of flow rates of the evaporator water



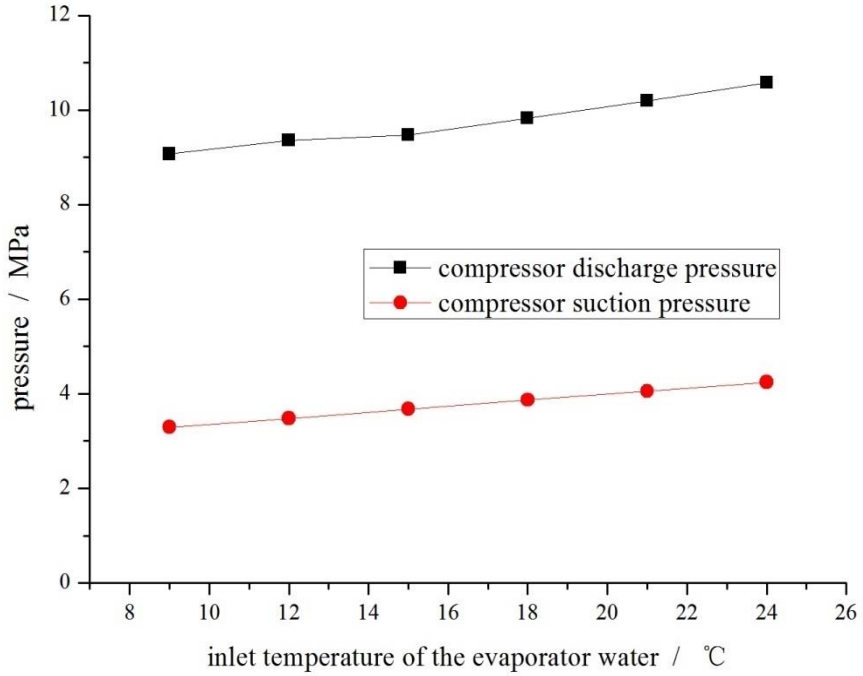


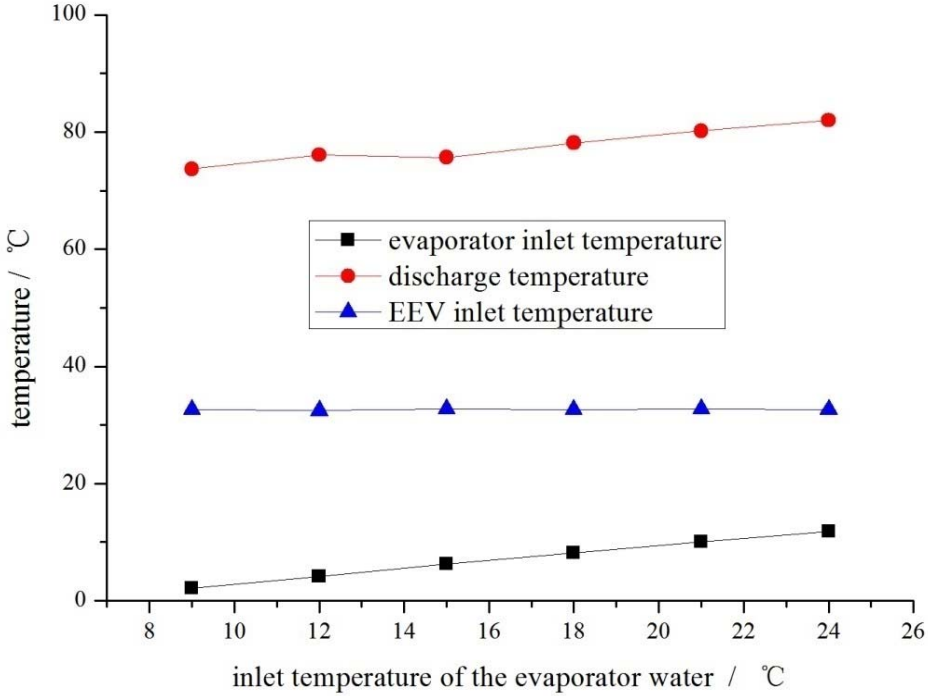
Cooling capacity:
decrease, not much

COP:
decrease ,not much

•4 RESULTS AND DISCUSSION

•4.4 The effects of inlet temperature of the evaporator water



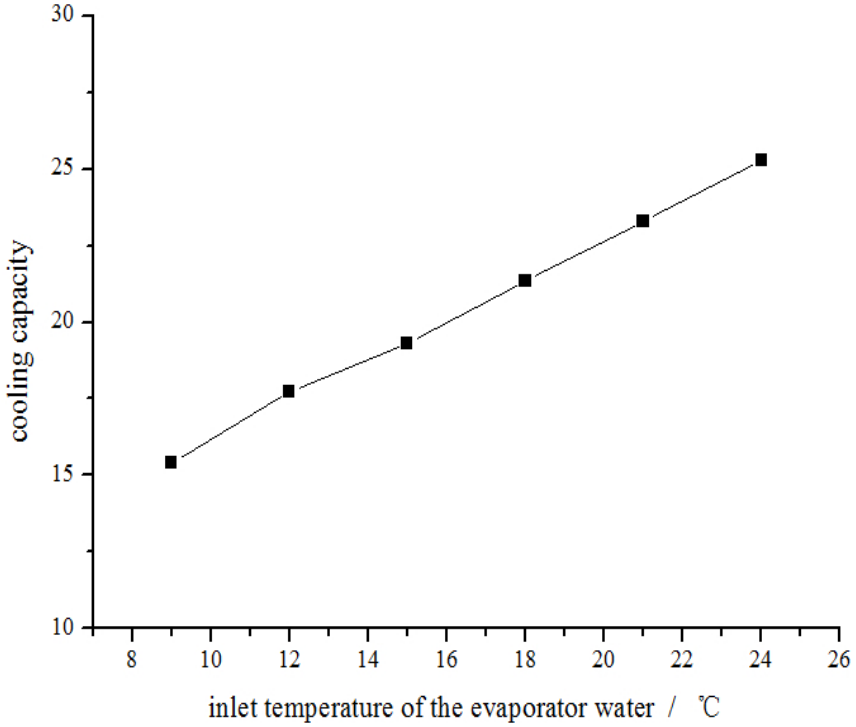


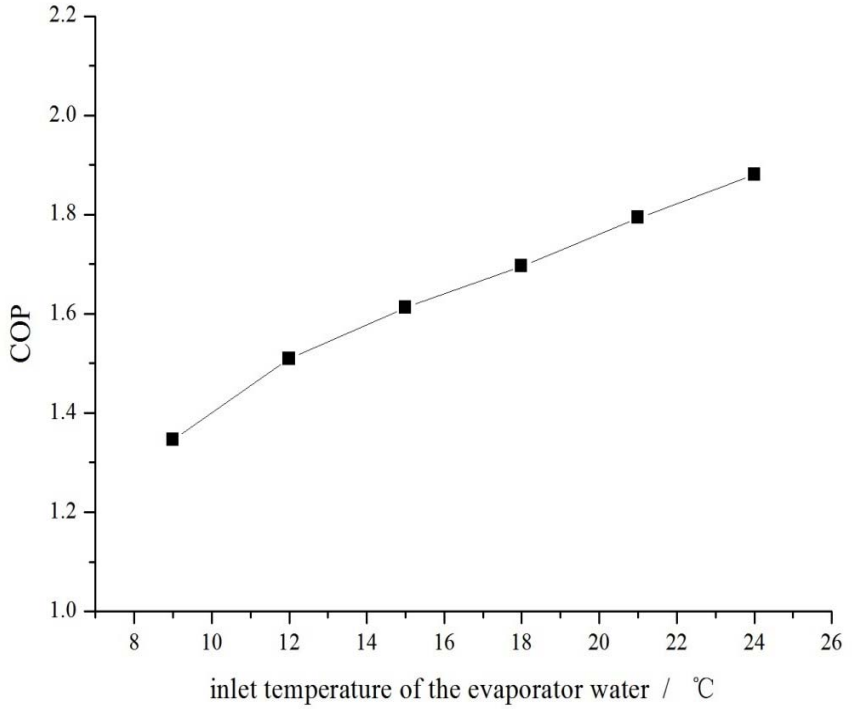
pressure :
high pressure side: increase greatly
low pressure side: increase

temperature :
high pressure side: increase
low pressure side: increase greatly

•4 RESULTS AND DISCUSSION

•4.4 The effects of inlet temperature of the evaporator water





Cooling capacity:
increase dramatically

COP:
increase dramatically

•5 CONCLUSIONS

•(1)EEV inlet temperature strongly dependents on heat transfer condition of gas-cooler.

• (2) Compressor discharge pressure and temperature relates to both heat transfer condition of gas-cooler and evaporator.

•(3) Effects inlet temperature and flow rates of heat exchangers on the system characteristics are the same as the conventional refrigerants.

THANKS !