الدورة 12
مؤتمر تحلية المياه في الدول العربية
19-18 شعبان 1440 | 24-23 ابريل 2019
فندق انتركونتيننتال سيتي ستارز، القاهرة، جمهورية مصر العربية
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A Novel Desalination System using High-frequency Ultrasound Waves Humidifier

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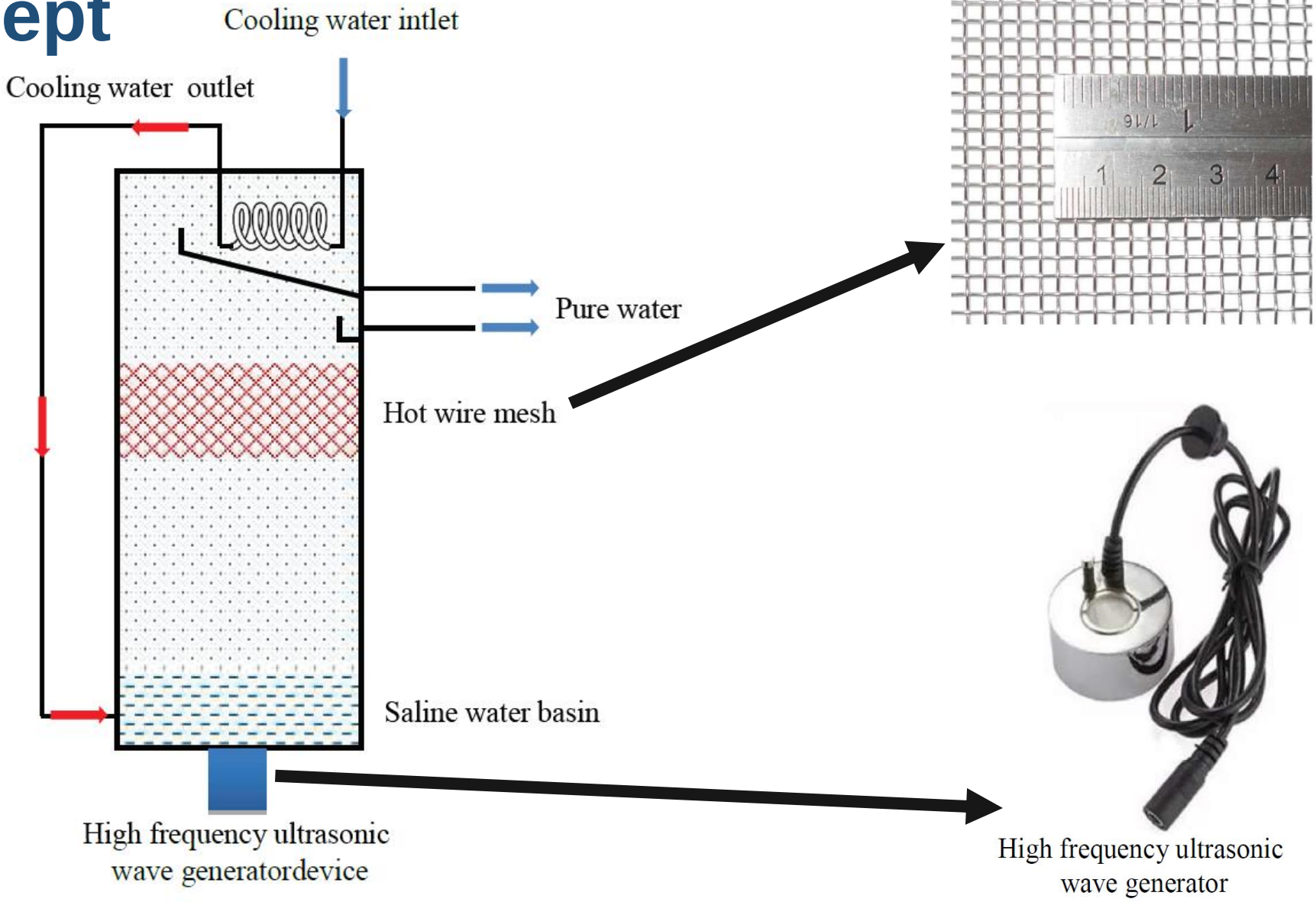
Motivation

- Simple Solution
- Easy to build
- Easy to operate
- Good water productivity
- Low power consumption

Concept


Cooling water intlet
Cooling water outlet
Pure water
Hot wire mesh
Saline water basin
High frequency ultrasonic wave generatordevice
High frequency ultrasonic wave generator

Concept

Table (1): Characteristics of the wire mesh screen.

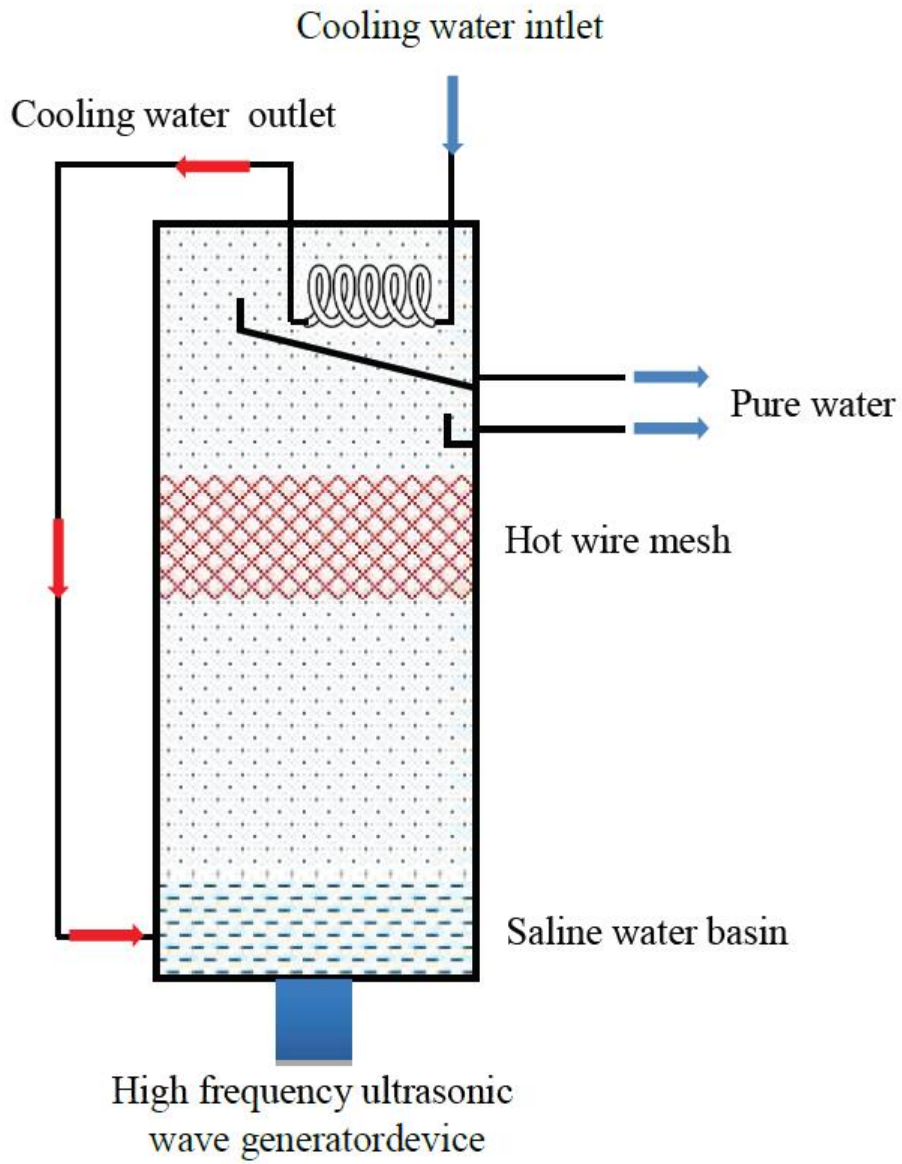
Parameter	Value
Material	AISI 310 alloy
Wire diameter, mm	0.56
Mesh size, mm	2.5
Porosity, %	61

Table (2): Technical specifications of sensors and probes.

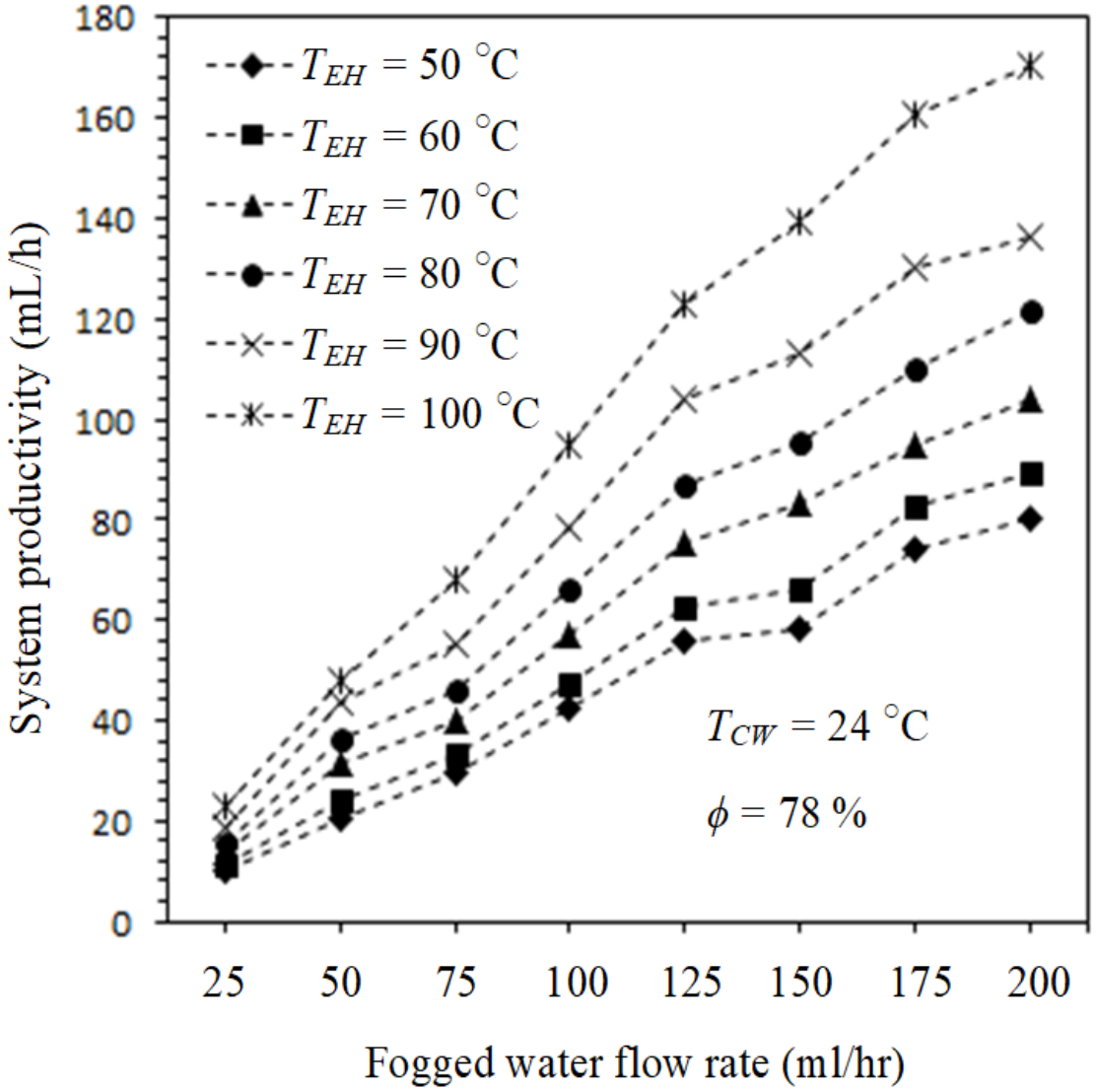
Sensor/Type	Reference	Description	Accuracy
Digital thermometer (TM-82N)	Tenmars	Temperature	±0.05%
YF-S201	Sea	Flow sensor	±2 %
Calibrated flask (0 – 2000 ml)	Local	Water yield	± 0.88 %

Operation

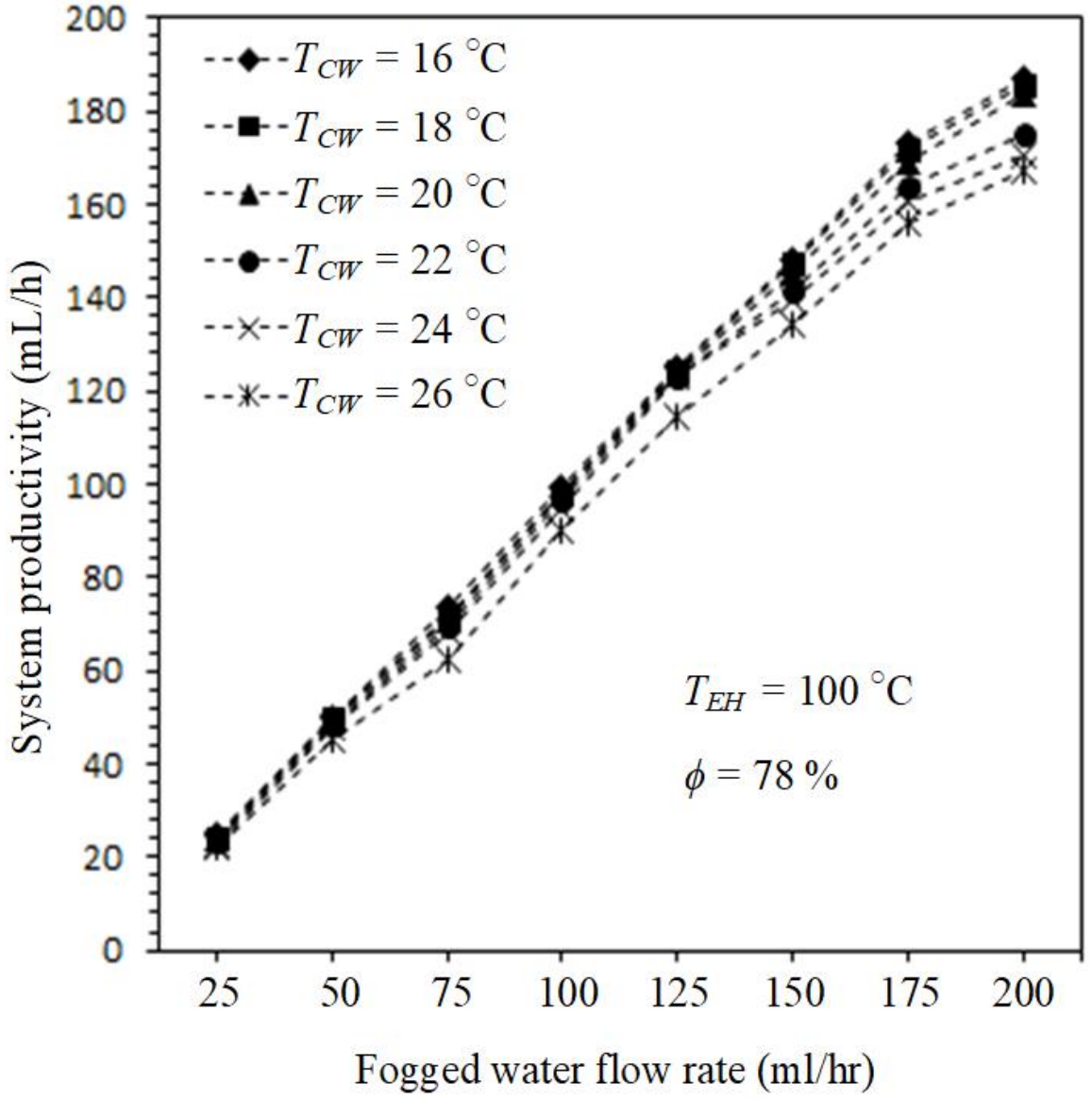
1. **charging saline water into the water trough until the water level reaches 5 cm**
2. **runs the high frequency ultrasonund wave generator and electrical heater**
3. **collecting the fresh water in the calibrated flask**



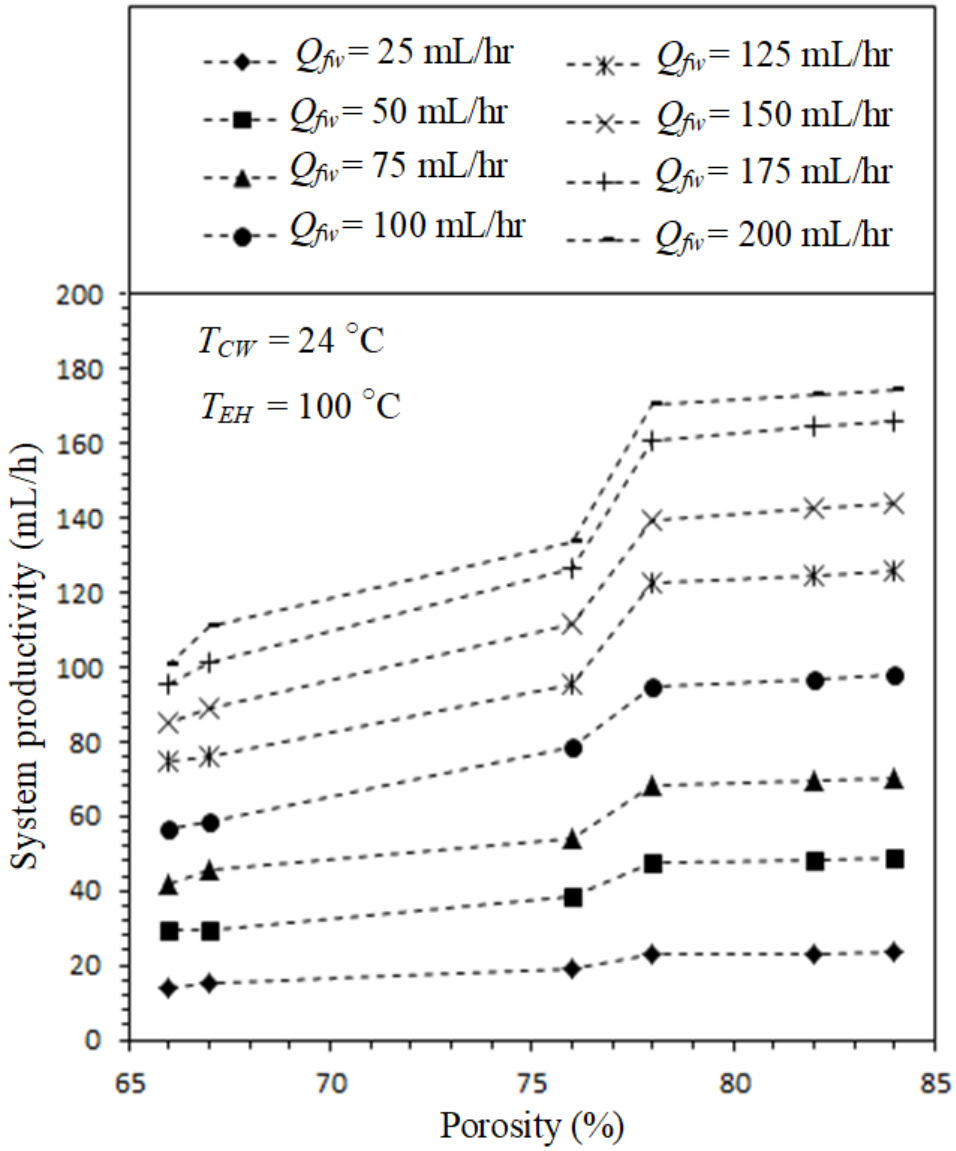
Results


T_{EH} = 50 °C
T_{EH} = 60 °C
T_{EH} = 70 °C
T_{EH} = 80 °C
T_{EH} = 90 °C
T_{EH} = 100 °C
T_{CW} = 24 °C
ϕ = 78 %
System productivity (mL/h)
Fogged water flow rate (ml/hr)
0
20
40
60
80
100
120
140
160
180
25
50
75
100
125
150
175
200

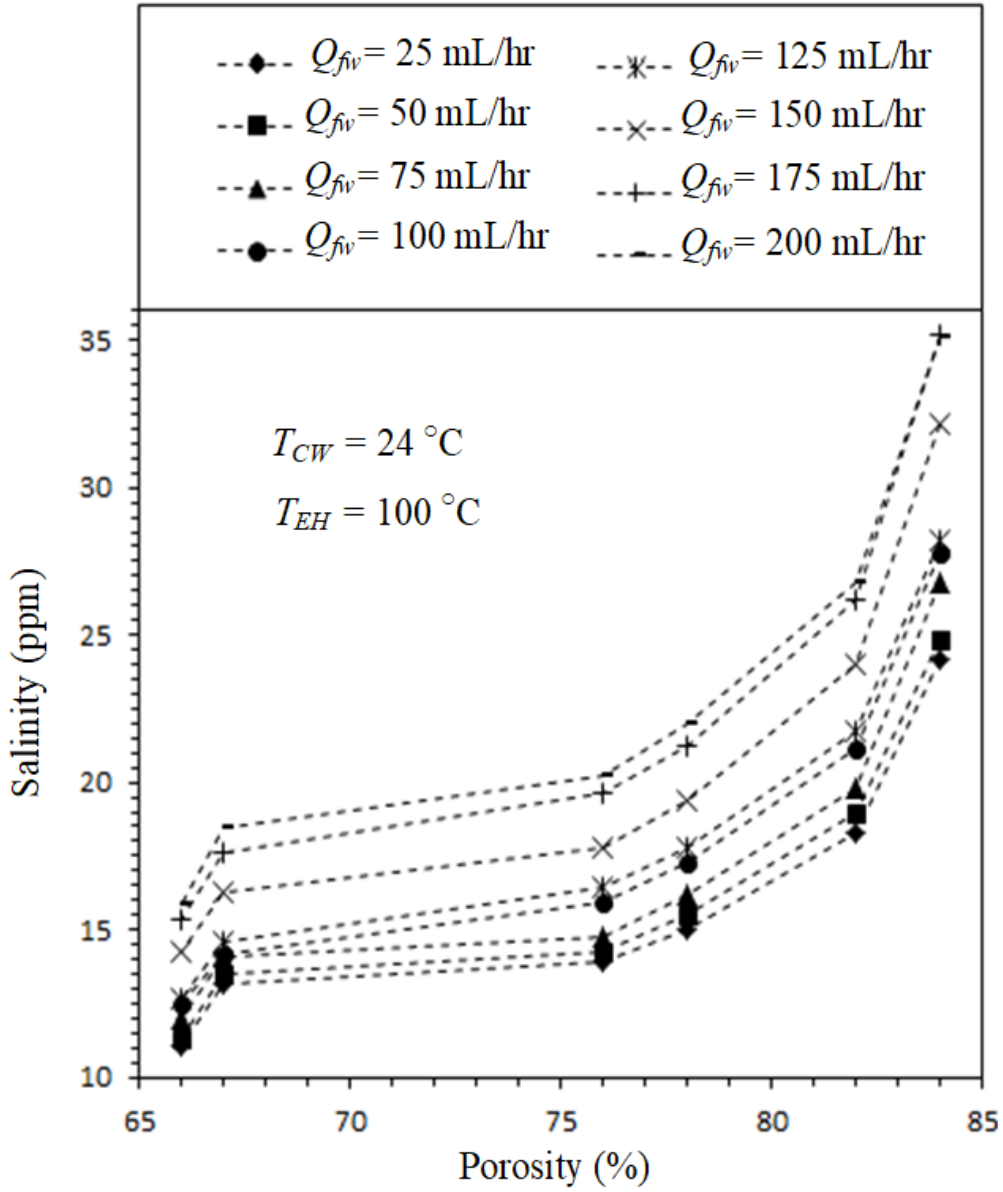
Results


T_{CW} = 16 °C
T_{CW} = 18 °C
T_{CW} = 20 °C
T_{CW} = 22 °C
T_{CW} = 24 °C
T_{CW} = 26 °C
T_{EH} = 100 °C
ϕ = 78 %
System productivity (mL/h)
Fogged water flow rate (ml/hr)
0
20
40
60
80
100
120
140
160
180
200
25
50
75
100
125
150
175
200

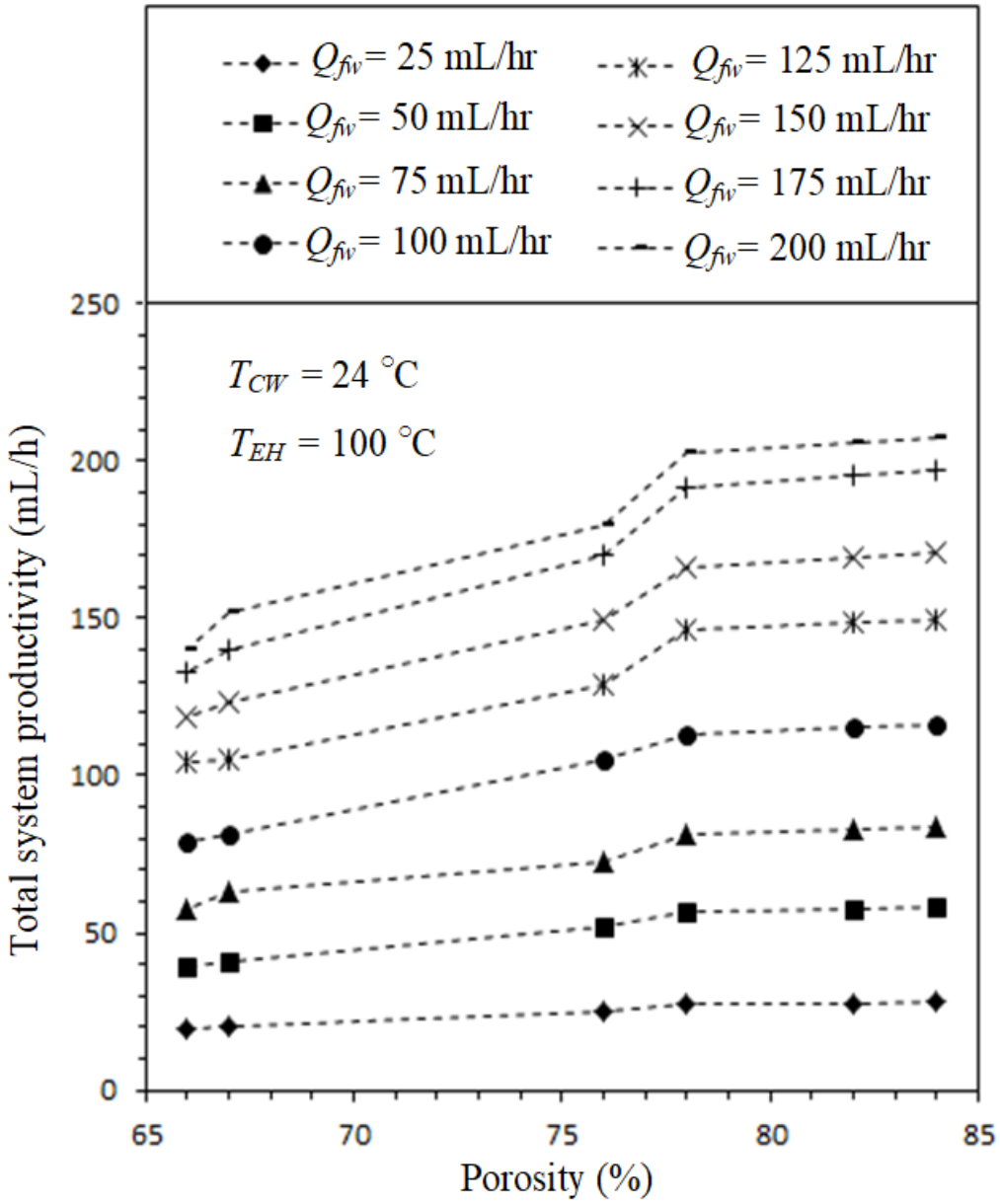
Results


Q_{fw} = 25 mL/hr
Q_{fw} = 50 mL/hr
Q_{fw} = 75 mL/hr
Q_{fw} = 100 mL/hr
Q_{fw} = 125 mL/hr
Q_{fw} = 150 mL/hr
Q_{fw} = 175 mL/hr
Q_{fw} = 200 mL/hr
T_{CW} = 24 °C
T_{EH} = 100 °C
System productivity (mL/h)
Porosity (%)
0
20
40
60
80
100
120
140
160
180
200
65
70
75
80
85

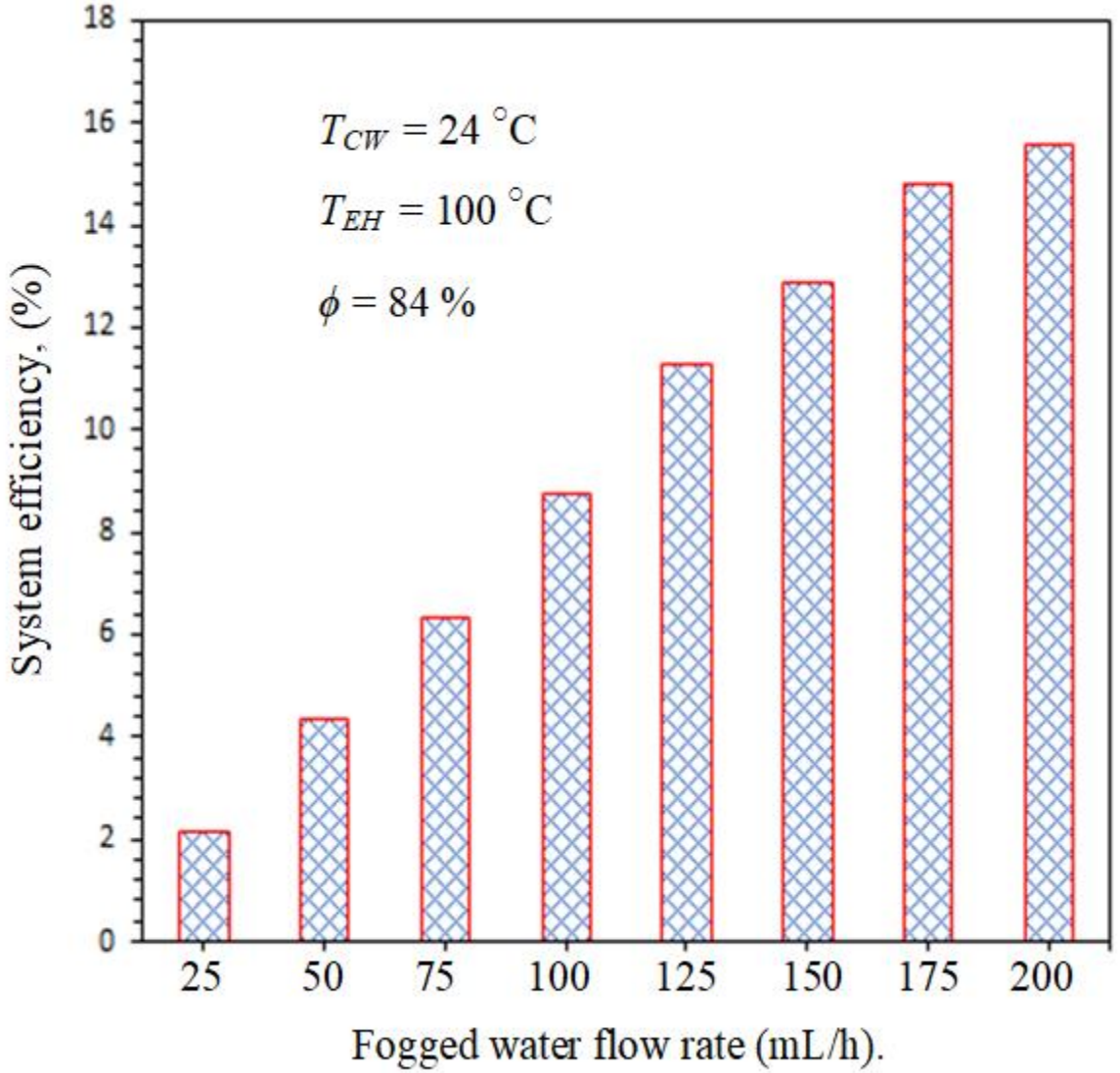
Results


Q_{fw}= 25 mL/hr
Q_{fw}= 50 mL/hr
Q_{fw}= 75 mL/hr
Q_{fw}= 100 mL/hr
Q_{fw}= 125 mL/hr
Q_{fw}= 150 mL/hr
Q_{fw}= 175 mL/hr
Q_{fw}= 200 mL/hr
T_{CW} = 24 °C
T_{EH} = 100 °C
Salinity (ppm)
Porosity (%)
10
15
20
25
30
35
65
70
75
80
85

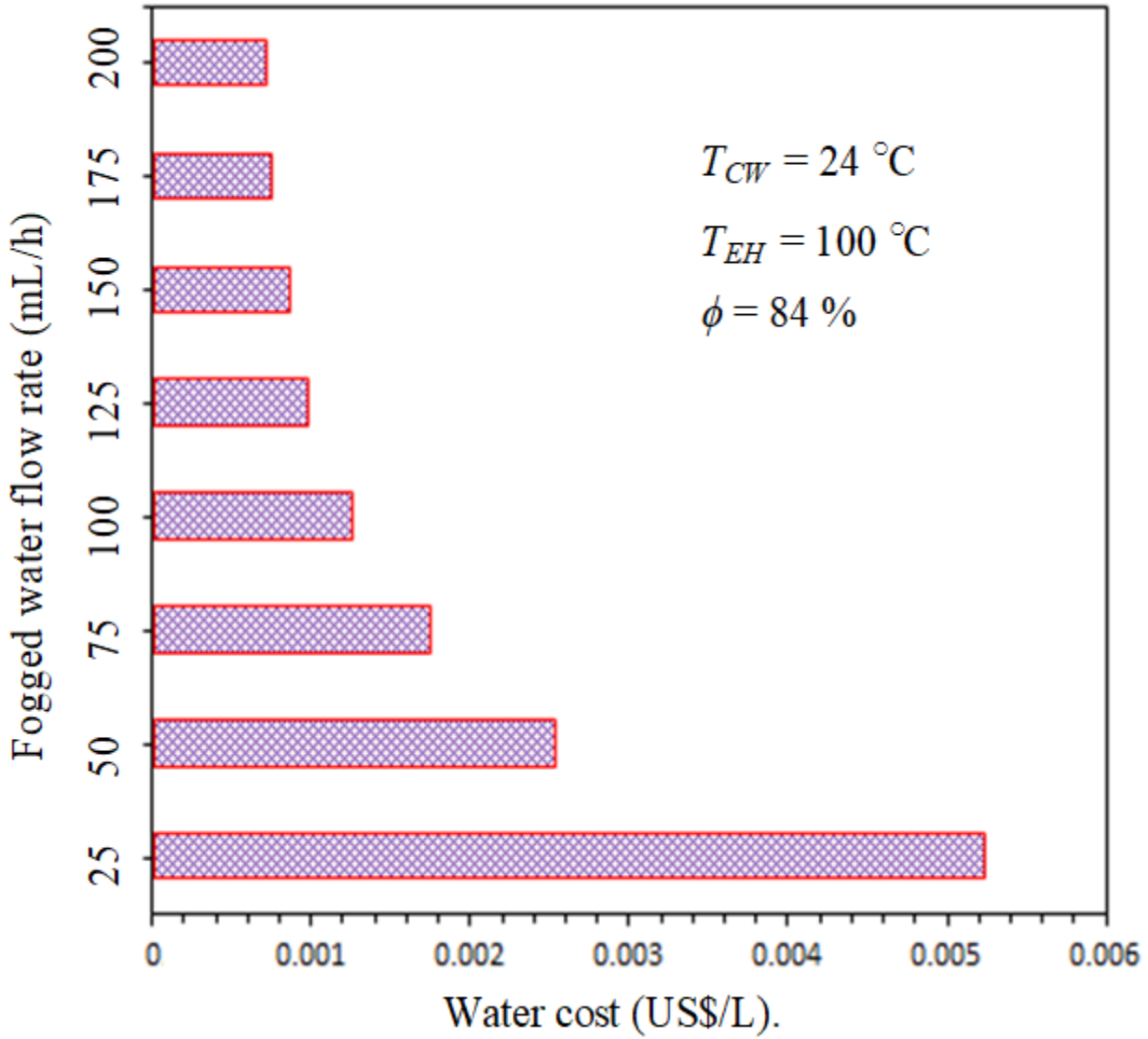
Results


Q_{fw}= 25 mL/hr
Q_{fw}= 50 mL/hr
Q_{fw}= 75 mL/hr
Q_{fw}= 100 mL/hr
Q_{fw}= 125 mL/hr
Q_{fw}= 150 mL/hr
Q_{fw}= 175 mL/hr
Q_{fw}= 200 mL/hr
T_{CW} = 24 °C
T_{EH} = 100 °C
Total system productivity (mL/h)
0
50
100
150
200
250
65
70
75
80
85
Porosity (%)

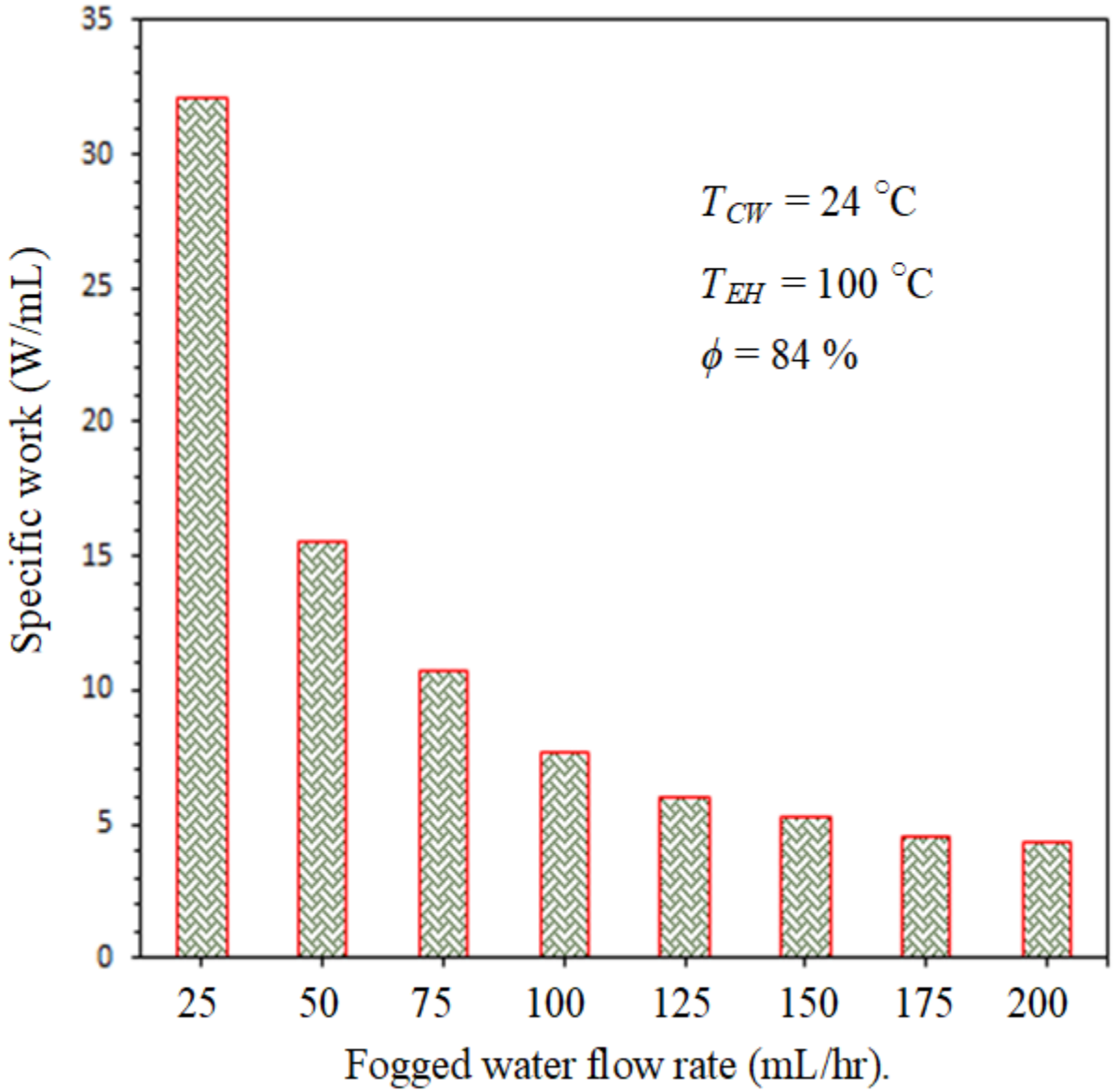
Results


T_{CW} = 24 °C
T_{EH} = 100 °C
ϕ = 84 %
System efficiency, (%)
0
2
4
6
8
10
12
14
16
18
25
50
75
100
125
150
175
200
Fogged water flow rate (mL/h).

Results


T_{CW} = 24 °C
T_{EH} = 100 °C
ϕ = 84 %
Fogged water flow rate (mL/h)
25
50
75
100
125
150
175
200
0
0.001
0.002
0.003
0.004
0.005
0.006
Water cost (US$/L).

Results


35
30
25
20
15
10
5
0
Specific work (W/mL)
$T_{CW} = 24\ ^{\circ}C$
$T_{EH} = 100\ ^{\circ}C$
$\phi = 84\ \%$
25
50
75
100
125
150
175
200
Fogged water flow rate (mL/hr).

Conclusions

1. The system water yield was 187.05 mL/hr.

2. The system efficiency was about 12.77 %.

3. The cost of collected water was changed between 0.0032 US$/L and 0.00042 US$.

4. Specific work consumption of fresh water produced varied varied from 5.29 W.h/L to 39.04 W.h/L.

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