International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume: 3 | Issue: 3 | Mar-Apr 2019 Available Online: www.ijtsrd.com e-ISSN: 2456 - 6470

Reduction in Size of Vars by using Different Materials in Generator

Prof. Animesh Kumar[1], Om Singh Patel[2], Nishi Yadav[2], Pooja Shakya[2], Muzzafar Ayub Khan[2]

[1]Assistant Professor, [2]Student

[1,2]Department of Mechanical Engineering, ABES Engineering College, Ghaziabad, Uttar Pradesh, India

How to cite this paper: Prof. Animesh Kumar | Om Singh Patel | Nishi Yadav | Pooja Shakya | Muzzafar Ayub Khan "Reduction in Size of Vars by using Different Materials in Generator" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 | Issue-3, April 2019, pp.1589-1591, URL: https://www.ijtsrd.com/papers/ijtsrd23473.pdf

IJTSRD23473

ABSTRACT

In present scenario to achieve refrigeration effect, we have to supply high grade energy which take from shaft which decreases the millage of automobile and increase in cost of fuel. It is not economical to produce refrigeration effect by VCRS .In VARS system we use wasteful energy from exhaust gases of automobile to produce refrigeration effect hence saving cost of fuel.

Optimization of length of tubes of heat exchanger (generator) is done for different material like stainless steel, aluminium, copper to achieve 1TR Refrigeration effect. Inlet temperature of generator is 25^{0}C and COP of refrigerator is 0.7.

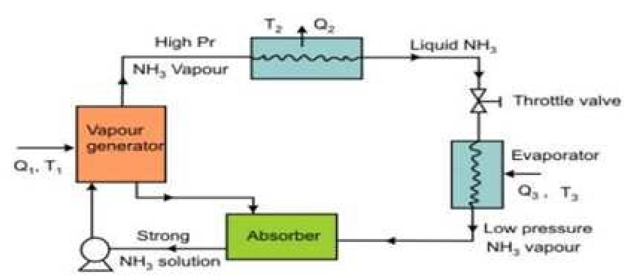
KEYWORDS: *COP (coefficient of performance), VARS (vapour absorption refrigeration system), VCRS (vapour compression refrification system),TR (Tonne of refrigration)*

INTRODUCTION

Comparison between VCRS and VARS

VCRS	VARS
1. In VCRS we use compressor that uses hybrid energy in the form of work.	1. In VARS we use generator, Absorber and pump that uses low grade energy, in form energy
2. The refrigerating effect or refrigerating capacity decreases with lower evaporator pressure	2. Very little effect is seen In the refrigerating capacity with lowering evaporator pressure.
3. VCRS doesn't work at partial load	3.Varying load doesn't affect performance of VCRS
4. Refrigrant and Hydrocarbons CFCs hydrochlorofluorocarbon's	4. Ammonia or water can be used as Refrigerant with proper absorber.

Simple vapour absorption system

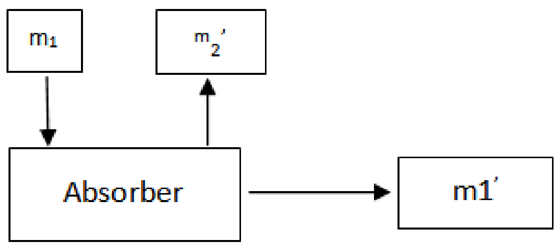


The continuos increase in the cost and demand for energy has lead to more research and development to utilize avalible energy resources efficiently by minimizing waste energy with reference to [1] Replacing the electrical energy with solar energy will reduce the consumption of high grade electrical energy.also the replacement of compression system with absorption system eliminates the energy consumption by compressors[2] In the context diesel engine exhaust heat utilization has the potential to reduce the consumption of fossil fuels and reduce the release of greenhouse gases, significant waste heat recovery technologies have been developed to recover exhaust heat and turn it into useful energysuch as electricity[5] To reduce the Ozone depletion many refrigerant has been banned and due to increase in global warming it is necessary to have an alternate source which will be reliable and meet the future requirements in cars[7]

Engine specification of Toyota Innova Crysta
Fuel type: Diesel
Engine Displacement: 2393cc
Torque:343Nm@1400rpm
Power: 148BHP@3400rpm

System Description

Concentration	kg of NH3/Kg of solution	Enthaply
Strong solution leaving absorber	.421	30
Weak solution leaving generator(x2′)	.375	340
Vapour leaving generator	.945	1870
Liquid leaving condenser	.945	470
Vapour leaving evaporator(x1′)	.945	1388



m1 = mass of strong solution leaving absorber
m2′ =mass of weak solution leaving generator
m1′ =mass of vapour leaving evaporator
X1 =mole fraction of strong solution
X2′ =mole fraction of weak solution
X1′ =mole fraction of vapour leaving evaporator
Cp = Specific heat capacity of aqua ammonia
Tce =exhaust temperature of aqua ammonia
Tci =inlet temperature of aqua ammonia
Tavg =average temperature of aqua ammonia
ma =mass flow rate of air
mf =mass flow rate of fluid
mex = mass flow rate of exhaust
Cpex = specific heat capacity at exhaust
Di =inner dia of tube
Do =outer dia of tube
μ g =dynamic viscosity of exhaust gases
Kg =Thermal conductivity of exhaust gases
Ug =velocity of exhaust gases

U = velocity of exhaust gases $=Ug \times \frac{S_t}{S_t - d_0}$

Re $= \frac{U \times do}{\mu_g}$

Nu $= \frac{ho \times do}{k_g}$ =Nusselt Number

h_o =convective heat transfer coefficient

For Aqua-Ammonia
μ =Dynamic viscosity of aqua ammonia
k =Thermal conductivity of aqua ammonia

Pr $= \frac{\mu \times C_p}{k_g}$ =Prandtl number

Re $= m' \times \frac{D_{eq}}{\mu}$

Nu $= .06(\frac{\rho_l}{\rho_v})^{.28} \times (Re)^{.87} \times (Pr)^{.4}$

hi =convective heat transfer coefficient for inner tube

$$\frac{1}{U_o} = \frac{1}{h_i} \times \frac{do}{di} + \frac{do}{2k_s} \ln(\frac{d0}{di}) + \frac{1}{ho}$$

Thermodynamic Analysis

$$m_1 = m_2' + m_1'$$
$$m_1' * (Latentheat) = 1TR$$
$$m_1' = .00424 \ kg / s$$
$$m_1 x_1 = m_2' x_2' + m_1' x_1'$$
$$m_2' = .0483 \ kg / s$$
$$m_1 = .052539 \ kg / s$$
$$C_p = 3.8927 + 95.779 / (133 - T)$$
$$T = {}^\circ C$$
$$C_p = J / g^\circ C$$
$$Tce = 42^\circ C$$
$$Tci = 25^\circ C$$
$$Tavg = 33.5^\circ C$$
$$Cp = 4.8553 \ kJ / Kg^\circ C$$
$$\Delta T = 17^\circ C$$
$$\dot{m}_a = \rho * V * \eta * (N / 2)$$
$$= .02505977 \ Kg / s$$
$$AirFuelratio = 14 \ to \ 20$$
$$\frac{\dot{m}_a}{m_f} = 15$$
$$\dot{m}_f = 1.737318 \times 10^{-3} \ kg / \sec$$
$$m_{ex} = 0.0277971 \ kg / \sec$$
$$m_a \times Cp \times \Delta T = m_{ex} \times C_{pex} \times \Delta T_{ex}$$
$$T_{hi} - T_{he} = \Delta T_{ex} = 141.82$$
$$T_{he} = 1442.78^\circ C$$

Results and discussion
di =28mm
LMDT =174
Tavg =488.69k
μg =2.6577×10⁻⁵Ns/m²

Kg =0.36314W/mk
Pr =.80805
Ug =5.36248m/s
Re =14646.8
Nu =123.17
ho =149.092634W/m^{2}k
μ =900μPa.sec=9×10^{-4}Pa.sec
K =.504W/mk
Pr =8.0922
Re =2654.553
Nu =892.08
hi =17204.4W/m^{2}k
UO =147.611W/m^{2}k
QG =UO×A×LMTD
A =.168m^2
A =ΠDL
L =1.783m

ON THE BASIS OF THERMAL CONDUCTIVITY

S. no.	Materials	Temp(^{0}C)	Thermal Conductivity(w/mk)
1	Aluminium	124.595	239.92
2	Stainless Steel	124.595	15.53
3	Beryllium	124.595	162.1
4	Chromium	124.595	87.44

S. no.	Material	Melting Point(^{0}C)	Length of Tube(m)
1	Stainless Steel	1340	1.8
2	Aluminium	660.3	1.783
3	Berilium	1287	1.7833
4	Chromium	1907	1.785

CONCLUSION

In present times stainless steel tubes are used for Aqua Ammonia refrigerant (NH3-H2O) for heat transfer in case of steel length of tube is more compared other materials like as Aluminium, Beryllium and chromium which have the same heat transfer capacity.

For low temperature we use Aluminium, and for the high temperature we use chromium to replace the stainless steel which has high melting point up to 1907oC-

REFERENCES

[1] Satish Raghuvanshi, Govind Maheshwari (2011), "Analysis of ammonia-water", international journal of science and engineering research vol 2, issue8.

[2] Rahul yadav (1) and Mohini Sharma (2)(2016), " Analytical study of ammonia -water VARS based on solar energy ",empirical journal of interdisciplinary research(IJIR),vol2,issue-11.

[3] K Sathiya Moorthy[1], S Rajendra Kumar's[2] P Sundarsingh shivam[3], k saravanan[4] and N pratp[4] (2017), design and fabrication of vapour absorption generator to increase the effectiveness of industrial pollution control 33(2).

[4] Sohail bux, AC Tiwari 2(2014), eco-friendly Automotive Air conditioning utilization exhaust gas waste heat of internal combustion engine, international journal of mechanical engineering and technology, vol5, issue3.

[5] S.L Nadaf, P B Gangavati2, a review on waste heat recovery and utilization from diesel engine, international journal of advanced engineering technology E-ISSN 0976-3945.

[6] Abhilash Pathania Dalgobind Manto(2012), recovery of engine waste heat for reutilization in air conditioning system in automobile,global journal of research in engineering mechanical and mechanics engineering vol2,issue-1,version1.0.

[7] Sandeep Chakraborty[1], Dr.Pravin Kumar borkar2, extracting waste heat engine from the engine exhaust and reutilization in car air conditioning, international research journal of advanced engineering and science, ISSN: 24550-9024.

[8] H. Arof,wajono and K .M.Nor,(2003),linear generator: design and simulation,national power and energy conference.

[9] Yogesh R.Shendage[1], Sushant V.Pampatwar[2], a review paper on chumbaki-dravik generator, IOSR journal of mechanical and civil engineering, e-ISSN: 2278-1684,P-ISSN:2320-334X.

[10] M.A Boda, S.S deshetti[2], M.A Gavode 3(2017)" design and development of parallel-counter flow heat exchanger", international journal of innovative research in advanced engineering (IJIRAE) vol4, issue02.

[11] Ak shay Kumar Magadum,Ankit pawar,Rushikesh patil,Rohit phadtarl(2016),review of experimental analysis of parallel and counter flow heat exchanger, international journal of engineering research and technology ,vol5,issue02.

[12] Sachidanand J.Nimankar[*1] and Prof.Sachin Kumar Dahake [2](2016),review of heat exchanger ,global journal of engineering science and research s

[13] Rotchana Prapainap,KO Suen, effect of refrigerant properties on refrigerant performance comparison: A review international journal of engineering research and application (ijera) vol, issue, July aug