

ORGANIC RANKINE CYCLE

ABSTRACT :

Now currently situation for obtain energy use a coal, wood. Coal are common use in thermal power plant .it is estimated that half of their fuel energy consumption is dissipated a low grade heat. so cost is high and waste of heat .so we can found solution for that situation. For this situation use Rankine cycle. rankine cycle is use for waste heat recovery from biomass combustion , industrial waste heat , solar pond .in this rankine cycle for a work using a working fluid (refrigerant).many type of refrigerant use in cycle such as CFC,HFC,HFC 245fa,xylene,n-pentane.this working fluids is directly impact on environment. CFC,HFC is harmful for environment(green house gases).so we used organic fluid for working in cycle such as R245fa. So that this cycle is called organic rankine cycle (ORC).ORC and rankine cycle work as same .the working fluid is pumped to a heater .it is converted into the vapour and passed through the turbine and then through a condenser pump work is raises the pressure of this fluid and again passed in heater. the result says that ORC units recover heat from the industrial waste heat and saving cost of fuel .it is not effect on environment and safe process.

INTRODUCTION OF WORKING FLUID:

The operating principle for organic and steam based rankine cycle are similar. main difference is choice of working fluid .from many studies selecting a proper organic working fluid for an ORC system is one of important impact on environment and cost .In market many type of working fluid such as,

- (1) If we have improve system of exhaust gas that can used HFC-245fa.
- (2)When n-pentane use as a working fluid that this system produce 1.5 KW of electricity with thermal efficiency of 4.3% .
- (3)Some working fluids temp ranges is between-12⁰C to 48⁰C. That time use R1113,R123, R245fa,isobutene but they have present best thermal efficiency and minimum irreversibility.
- (4)R245fa and R245ca were the most environmentally working fluid for engine waste heat recovery.
- (5)When turbine temperature is high with a saturated vapour input then used R245fa and R123.
- (6)Generating electrical power using a low temperature heat source that time used R245fa is best fluid.

We use R245fa as a working fluid because we have work with low temperature heat and get a electrical power, then choose the fluid after following below step.

FLOWSHEET DESCRIPTION:

Stage (1): Beginning of the process fluid Temperature is 306.46114 k and pressure is 200000 Pa. This pressure is not use for work in turbine so that increase the pressure and get 800000 pa pressure after passed in the pump. Pump raises the pressure of fluid. After increase the pressure passed in heater.

Stage (2): Working fluid (liquid) entered in the heater at 8000 pa pressure and 306.46114 k T. Heater's operating principle is converted vapour from liquid state fluid. Heater is increase the temperature of fluid and converted into vapour. The temperature of vapour is 381.17081 K and pressure is 8000 pa.

Stage (3):High pressure vapour (saturated vapour) is entered in expander(turbine). Inlet temp of working fluid is 381.17081 K (226.4374 F) and pressure is 800000 pa.turbine working principle is high pressure vapour is entered and it strikes on the rotating blades. Blades are mounted with the shaft. Shaft is connecting to the generator and get 21.5457 kW power generate.

Stage (4): Low pressure vapour is entered in the condenser at 2000 pa pressure condenser work is absorb the heat and get low temp. it is converted liquid from vapour. This working fluid is leaves the condenser at low pressure and temp.thi liquid is passed in the pump and process will start again.

RESULTS:

Operation	T in(k)	Tout(k)	P in(Pa)	P out(Pa)	Energy(KW)
Pump	306.46114	306.46114	200000	800000	0.60808635
Heater	306.46114	381.17081	800000	800000	250
Turbine	381.17081	351.13129	800000	200000	21.542728
condenser	351.13129	306.46114	200000	200000	229.06236

Conclusion:

This cycle is present on the use of ORC for waste heat recovery from low Temperature heat source. this are also suitable for waste heat recovery in solar pond .this system gives 75% efficiency.

Reference:

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- (2) Techno-economic survey of ORC systems, (Sylvain Quoilin^{a,*},Martijin van den Broek ^{b,c},Sebastien Declaye ^a, Vincent Lemort^a,Pierre Dewallef ^a.)
- (3) The Organic Rankine Cycle –Power Production From Low Temperature Heat,(Hartmut)
- (4) Waste Heat Recovery Woith Organic Rankine Cycle Technology
- (5) Experimentally study on a small-scale R245fa organic Rankine cycle system for low-grade thermal energy recovery, (L. Li^a , Y.T . Ge^{a*} , S . A Tassou^a)
- (6) “organic rankine cycle” by mahmoud ahmed sharafeldine
- (7) Ranking of Working Fluids for Organic Rankine Cycle Application,(Lars J. Brasz,William M. BilbowS)

