Cloud computing environment of waste heat driven air conditioning refrigeration system parameters optimization research

Jianguang Shen
Xi’an architectural design and research institute Co.ltd
shjg95@126.com

Abstract: In view of the poor performance of waste heat driven air conditioning refrigeration system parameter optimization problems such as study, through to the air conditioning heat driving power and refrigerating capacity parameters calculation, and set up according to the results of the calculation of waste heat driven air conditioning cooling parameters, after the complete parameter Settings, in order to guarantee the software and hardware of the air conditioning refrigeration system operation parameters for testing, according to the test results of waste heat driven air conditioning refrigerating system parameter adjustment and control, finally realize the cloud computing environment of waste heat driven air conditioning refrigeration system parameters optimization. Finally, it is confirmed by experiments that the parameter optimization method of waste heat driven air-conditioning and refrigeration system in the cloud computing environment has better optimization effect and can ensure the stable operation of the air-conditioning and refrigeration system.

1. Introduction
With the constant changes and development of the society, people's living standards are constantly improving. Air conditioning refrigeration design is a key means to continuously improve the use function of air conditioning[1]. The refrigeration system takes away the indoor heat by circulating and maintains the indoor temperature at a certain value. The traditional air conditioning refrigeration system has the following features: 1. Through the refrigerants in the compressor, evaporator and condenser, the throttle device parameters of equipment, the use of compression, throttling and heat treatment, and take away the quantity of heat of indoor, indoor temperatures dimension parameters are to a certain value, when circulating air through the fan coil parameters, high temperature air through the cooling coil to coil absorbs heat from the air, the air temperature is reduced, and then after cooling air into the room[2]. 2. Parameter setting of absorption refrigeration cycle: Absorption refrigeration is the use of certain characteristics to features of environment parameters for cold cycle numerical Settings, through a substance parameter Settings to absorb and release another material parameters, material change of state, to accompany the endothermic and exothermic process of cooling coil chilled water is provided by refrigerator and freezer is composed of compressor, condenser and evaporator, compressor to compress refrigerant, the compression of the refrigerant entering the condenser, which is cooled by cooling water and turns into liquid, and is discharged into the
atmosphere in the cooling tower[3]. 3. Thermoelectric circulation parameter setting: the principle of peltier effect is used to optimize the design of refrigeration parameters. Liquid refrigerant enters the evaporator from the condenser for evaporative heat absorption. Take the heat out of the room. When the ambient temperature is too low, hot water is needed to enter the fan coil. Like the above principle, air is heated and sent into the room. The cooling effect mainly depends on the thermoelectricity of the two electric couples on the materials. The liquid refrigerant enters the evaporator from the condenser for evaporation and heat absorption, which lowers the freezing water temperature. Then the frozen water enters the water-cooling fan coil to absorb the hot air in the air, and so on and so on to complete the refrigeration cycle. The liquid refrigerant enters the evaporator from the condenser for evaporation and heat absorption, which lowers the freezing water temperature[4]. Then the frozen water enters the water-cooling fan coil to absorb the hot air in the air, and so on and so on to complete the refrigeration cycle. But the above three methods have some problems such as refrigeration speed is slow, cannot guarantee the proper performance, with the rapid development of the cloud computing, based on cloud computing environment of waste heat driven air conditioning refrigerating system parameter optimization research, the system is the use of external heat source in turn in power cycle and refrigeration cycle, through ammonia power cycle, temperature and low temperature waste heat into work in the heat, to drive air conditioning refrigeration process. Experimental results show that this method can effectively improve the cooling speed of air conditioning and has high reliability.

2. Cloud computing environment of waste heat driven air conditioning refrigerating system

2.1 Setting of refrigeration parameters of waste heat driven air conditioning

After the cooling of the air, there is water precipitation, the relative humidity of the air reduced, become dry, so the need to increase the humidity, which requires the installation of humidifier for water or steam[5]. Humidification of the air, with such wet air to supplement the lack of indoor water vapor, so it is necessary to set reasonable air-conditioning refrigeration parameters, air-conditioning refrigeration parameters set up as many as hundreds of, according to the need, need to make the corresponding modification according to the different ambient temperature[6]. Parameters in the setting process, the definition of the power process, the selection of related processes, and the calculation of running time should be retained. The specific meanings of its parameters are shown in the following table.

| Table 1 parameter definitions |
|-------------------------------|
| parameter | meaning |
| P053       | Rated current         |
| P060       | Rated voltage         |
| P366       | Rated power           |
| P970       | Parameter Settings    |

According to the parameter definition in the above table, the parameter access process of air-conditioning refrigeration is shown in the figure below.
As can be seen from the figure above, parameters are allowed to be changed through PMU and SCom1, and "fixed setting" parameter is selected. The selected parameters are as follows:

0: standard setting with PMU through MOP setting;
1: standard setting with OP1S, set by fixed value;
2: speed control cabinet with OP1S, through MOP setting;
3: ANALOGUE OUTPUTS select the actual signals to be displayed by analog OUTPUTS. Output signal processing.

After the parameters are selected, the terminal bank performs activation/deactivation, and the design value is given through a fixed design value. The execution process of the parameters is shown in the figure below.

The procedure is described as follows: first close the valve connecting adsorber A with evaporator and condenser and the return valve[7]. High temperature hot water enters the adsorption bed A through the four-way switching valve, which is used to heat the activated carbon and methanol in the adsorption bed, and then discharge the adsorption bed A; The methanol in adsorption bed A is desorbed after heated by hot water. When the pressure of adsorption bed A reaches the condensing pressure, the valve connected with the condenser is opened. The methanol desorbed from adsorption bed A enters the condenser for condensation, and then enters the evaporator for heat absorption and vaporization refrigeration through the throttle valve. Blower, meanwhile, the outdoor cold air through four-way valve into the adsorption bed B after booster, cooling air is expelled after adsorption bed B,
B adsorption bed is cooled cooling, reduced pressure, its adsorption ability was improved, when the pressure in the adsorption bed B after reaching the evaporation pressure, open the valve, which is connected with the evaporator, the adsorption of methanol vapor in the evaporator. When the desorption process of adsorption bed A and the adsorption process of adsorption bed B are completed, close the valves connected with evaporator and condenser of the two adsorption beds and open the return quality valve for the return quality\(^8\). After the return of mass, close the return of mass valve, and then switch the direction of the four-way control valve to make the two adsorption beds switch working state, that is, adsorption bed A followed by the adsorption process, adsorption bed B for desorption process.

2.2Detection of operating parameters of hvac refrigeration system driven by waste heat
After the completion of waste heat driven air conditioning parameters setting, in order to guarantee the stable operation of the air conditioning refrigeration system, the operation parameters for testing, in the process of testing need to first choose good performance of adsorption refrigerating agent, can increase the refrigerating capacity of the unit mass adsorbent, improve the refrigeration coefficient, and the adsorption refrigeration product performance. If not properly selected, the lattice of the adsorbent will be destroyed, or the adsorbent will be decomposed, so that the adsorbent adsorption property will be reduced or lost, resulting in the cycle can not be carried out normally\(^9\). Therefore, in the process of selecting the adsorption working medium pair, the adsorption working medium pair with good refrigeration effect and no pollution shall be selected first according to the working condition requirements of the adsorption refrigeration system and the physical and chemical properties of the adsorption working medium pair shall be fully considered\(^10\). When selecting adsorbents, the following factors should be considered:

1) the latent heat of vaporization per unit volume is large;
2) within a certain temperature range, the physical and chemical properties are stable;
3) the steam pressure within the working temperature range is moderate, preferably close to atmospheric pressure;
4) low toxicity, non-corrosive equipment, non-flammable and explosive;
5) low price, no pollution to the environment, easy access.

It is difficult to obtain adsorbents that fully satisfy the above conditions.

With reference to the above system flow, Aspen Plus was used for simulation calculation of the waste heat driven air-conditioning and refrigeration system. According to the mass conservation and energy, in order to facilitate the study of key issues, the system was simplified and assumed as follows.

1) the system cycle is under stable working conditions;
2) the pressure loss of pipeline and general heat exchanger in the system is ignored
3) the heat loss of components and pipelines is ignored
4) the exits of reboiler, absorber and condenser are all in a saturated state;
5) isentropic efficiency of CO2 compressor and NH3 compressor is calculated according to the following formula according to the pressure ratio.

\[
\eta_{SCO2} = 0.047R_0^2 - 0.09238R_0 + 0.89810 \quad (1)
\]

\[
\eta_{SNH3} = -0.00097R_0^2 - 0.010296R_0 + 0.83955 \quad (2)
\]

The evaluation standard of its refrigeration is usually COP, the performance coefficient of which is only the input of residual heat. The overall performance coefficient COP of the system is the ratio between the low temperature evaporation cooling capacity (QC) and the residual heat of flue gas (QH) recovered by heat exchange equipment.

\[
COP = \frac{Q_c}{Q_H} \quad (3)
\]

For the new system, the flue gas heat source is directly discharged into the atmosphere after the
heat energy is recovered by the system. In terms of the utilization of heat source, the heat loss in the smoke exhaust system should also be regarded as the energy loss of the system. At the same time, we should also consider the quality of energy, therefore, in order to more comprehensive and objective view of the system energy efficiency.

2.3 Optimization of cooling system parameters of waste heat driven air conditioning

The hvac refrigeration system driven by waste heat consists of 5 parts:

1. The cold source or heat source of the air conditioning system: in the air conditioning system, the natural cold source and the artificial cold source are generally adopted as the cold source sources of the air conditioning system. Natural cold source is generally from 80~100 meters or even deeper water; Artificial cold source refers to the cold source obtained by artificial means, including steam jet refrigeration, steam compression refrigeration, absorption refrigeration and so on.

2. Air purification: the air conditioning purification system adopts the following three ways: simple purification device, equipped with a primary air filter; The general purification system is provided with a primary air filter and a medium air filter; The high purification system is equipped with three filtration devices, namely primary air filter, medium air filter and high efficiency air filter. What kind of air purification in the end, according to the use of air conditioning, the use of purification requirements and the most economical way.

3. The heat and humidity treatment part of air: the device which can pass hot water or water vapor in the surface heat exchanger is called surface air heater, referred to as the aerated water heater of air for short. Three heaters are used to adjust the temperature in an air-conditioned room.

4. Fresh air supply: the fresh air system of the air conditioning system is composed of fresh air inlet, fresh air pipeline, fresh air filter and fresh air preheater. The fresh air filter is the dust filter device of the fresh air, and the fresh air preheater is the primary heater of the air conditioning system.

5. Air conveying, distribution and control part: in the air conditioning system, the air conveying part includes fan, air supply pipe and air return pipe.

The air distribution and control part includes starting valve, butterfly valve, fire valve, regulating air valve and air outlet. The number of fans to be set depends on the air resistance in the air-conditioning system. A system with both supply and return air is called a single fan system. In the air conditioning system, there is both a fan and a return fan called double fan system. The specific workflow is shown in the figure below.
As can be seen from the above figure, when the ambient temperature is too high, the new system takes away the indoor heat and maintains the indoor temperature at a certain value. Heat exchange takes place between the circulating air and the adsorption bed. Through heat exchange, the high-temperature air absorbs the heat in the air and reduces the air temperature. The compressor compresses the refrigerant, and the compressed refrigerant enters the condenser. After being cooled by cooling water, the refrigerant turns into liquid, and the heat precipitated is taken away by the cold water and discharged into the atmosphere in the cooling tower. This cycle takes away the indoor heat. Thus, the parameters of the refrigeration system driven by waste heat can be optimized in the cloud computing environment.

3. Analysis of experimental results
In the process of energy transfer or transformation, the total amount is conserved. But according to the second law of thermodynamics, any irreversible process must have losses. So these 㶲 in the process of the input and output entropy will be unequal. 㶲 loss size analysis was carried out on the system of key parts, the new method compared with traditional methods, sets the traditional approach to the control group. Set up the new system and reference input 㶲 are the same, is 109.30 KW, then to cycle coupling of two groups, the parameter coupling as shown in the figure below.
The above coupling process represents the process of energy conversion and transfer within the system. It can be seen from the figure that the higher temperature part of the heat source is converted into power generation to drive the compressed cold sub-cycle in the absorption and compression compound refrigeration sub-cycle by introducing the ammonia hydrodynamic sub-cycle, which has a higher energy conversion grade. The lower temperature part of the heat source and the turbine exhaust heat jointly drive the absorption refrigeration subcycle, and the energy grade of this part is lower. Through the coupling of the positive cycle of the mixed working medium and the reverse cycle of the composite refrigeration with absorption and compression, the heat source is utilized step by step. After the cyclic coupling above, the results are shown in the figure below.

Can be seen from the above results, under the condition of the same input 㶲, a new method of cooling rate significantly faster than conventional methods, a new method of cascade utilization of heat source, achieve a good match, meet the requirements of the human body comfort.

4. Conclusion
Traditional air conditioning refrigeration system has such problems as slow cooling, with the development of cloud computing, cloud computing environment is put forward under the waste heat driven air conditioning refrigerating system parameter optimization research, the method to choose good performance of adsorption refrigerating agent, can increase the unit mass of adsorbent refrigerating capacity, improve the refrigeration coefficient, achieve rapid cooling, through the simulation experiments show that this method can quickly realize air conditioning refrigeration, high reliability.
Reference

[1] Ren Lihui, Zhao Xuegong, Gao Shucheng. Applied Research on Combined Quasi-low Temperature Grain Storage Technology Based on Phase Change Materials and Air Conditioning Refrigeration [J]. Grain and Feed Industry, 2017, 12 (3): 12-15.

[2] Zhang Feng. Application Analysis of BIM Technology in Air Conditioning Refrigeration Room in Building Electromechanical Installation Project [J]. china plant engineering, 2018 (10): 150-151.

[3] Zhao Jiawei, Zhang Hao, Shi Junye, et al. Experimental Study on Refrigerant Charge of Electric Vehicle Heat Pump Air Conditioning [J]. Refrigeration Technology, 2017, 37 (2): 60-63.

[4] Chen You. Analysis of Thermal Energy Conversion Air Conditioning Refrigeration Technology Based on Solar Radiation Technology [J]. Science and Education Journal: Electronic Edition, 2017 (35): 256-257.

[5] Chenyi, Han Wei, Sun Liu Li. research on absorption and compression combined cryogenic refrigeration system driven by waste heat [J]. journal of engineering thermophysics, 2017, V38(1):18-26.

[6] Chen Lingen, Wang Junhua, Sun Fengrui. Density Performance of Brayton Cogeneration Cycle Driven by Residual Energy and Waste Heat of Blast Furnace [J]. Electricity and Energy, 2017,38 (6): 763-768.

[7] Jiangyingchun, Han Wei. absorption-compression composite heat pump system using low temperature flue gas waste heat [J]. journal of engineering thermophysics, 2017, V38(06):18-24.

[8] Huang Liangwei. Application Analysis of Frequency Conversion Technology in Central Air Conditioning Refrigeration System [J]. China High-tech Enterprise, 2017 (11): 86-87.

[9] Liu Enhai, Zhou Guanghui, Pan Jiaxin, et al. Research on Design of Automotive Air Conditioning Refrigeration System with Ejector for Large Temperature Difference Environment [J]. Journal of Zhongyuan Institute of Technology, 2017, 28 (1): 65-68.

[10] Liu Zhenyu. Discussion on CFD Technology Application in HVAC Refrigeration Project [J]. Fujian Construction Technology, 2017 (4): 71-72.