

A design of desalting process in a chemical factory

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Abstract:—After an investigation was made on the desalination production in a certain Chemical Detergent Corporation, the “Ultrafiltration-Osmosis-Electrodeionization” system was applied into desalination. According to promulgating about the Promoting Law of Clean Production, it has become realistic pressing demands to enforce clean production in chemical industry. This short flow, convenient maintains and compact equipments are the advantages of this process, which makes the new way for the desalination production, and offers us reliable and basic research data. As a whole, this membrane integration desalination technology without acid and alkali is benefit to the environment.

Keywords:—desalination process; ultra filtration; reverse osmosis; application.

I. INTRODUCTION

Currently, most domestic desalting process based on ion-exchange. The multi-media filter usually was used into pretreatment, post-processing system gives priority to mixed beds or rehabilitation beds. The drawbacks of this desalination water technology and which caused environmental problems are caused for concern by domestic and foreign scholars. Membrane technology is the most potential separation technology in the 21st century, but it rare in reports of the membrane integrated applications in the industrial. This paper introduced salt desalination processes of a chemical factory and a set of integrated membrane desalination water treatment processes.

II. THE ORIGINAL PRODUCTION PR

A chemical factory is currently Asia's largest production base of producing detergent, which has system two sets in desalting salt in water:

1# for medium pressure boiler, the desalting device's water treatment capacity is designed of 150m³/h, in which 120m³/h is used for medium pressure boiler water and the rest 30m³/h for anion bed wash and regeneration with acid and alkali configuration ;

2# water treatment device provides the plant fatty alcohol device with process water, whose water treatment capacity is designed of 10 m³/h.

Two sets of device which desalting salt in water both adopts the traditional fixed bed counter-current regeneration ion exchange method.

1# The processes of desalting system as shown in figure 1. The main equipment includes: two mechanical filter opening and preparation, three sets of anion-cation exchanger two on one, a carbon dioxide removal device. Cation exchanger filled resin is 001 ×7 strong acid resin; anion exchanger filled resin is 201 ×7 strong base type resin.

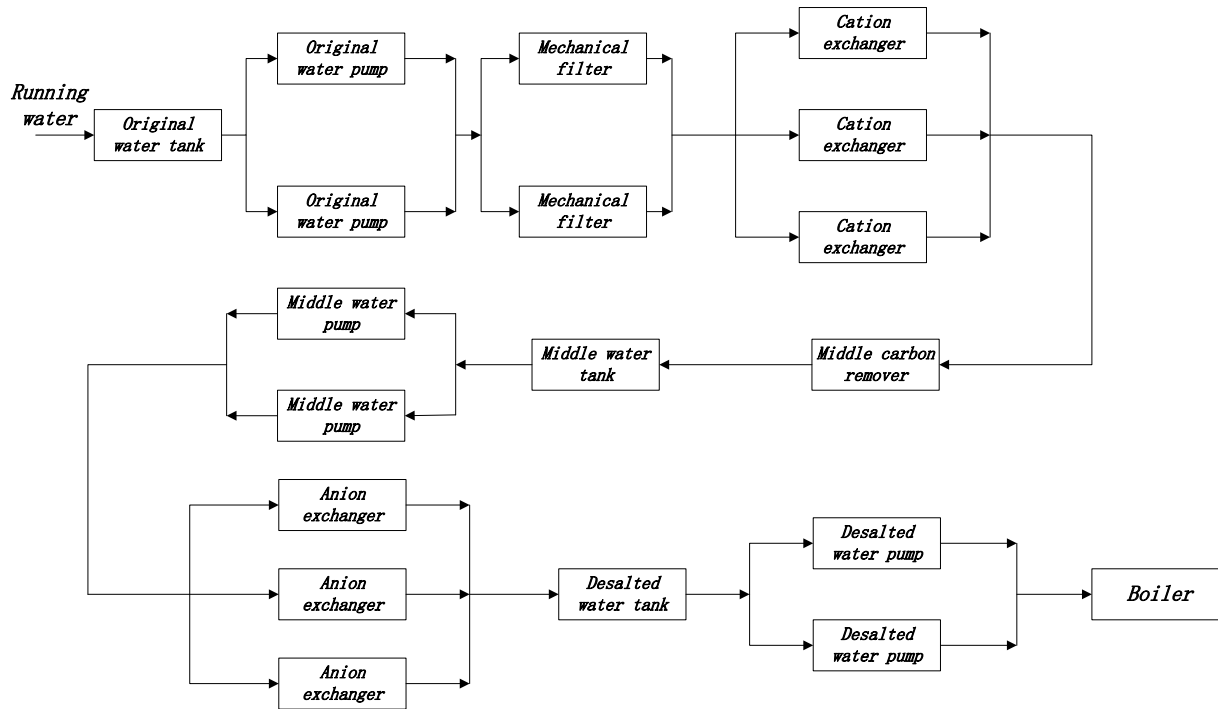


Figure 1 Desalted water system process route

2# desalting water system is of pure water processing device, processes route as shown below

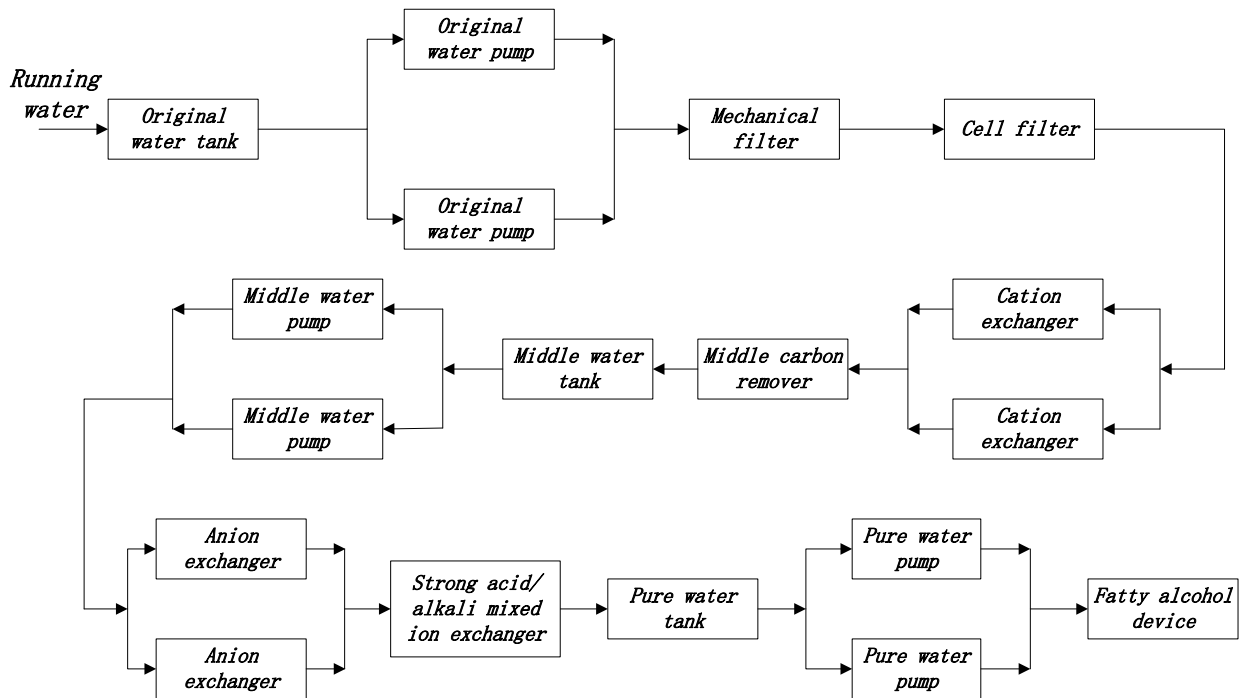


Figure 2 Desalted water system process route

III. THE EVALUATION OF THE SYSTEM THAT EXCEPT THE BRINE

Our country's traditional water treatment technology is the exchange bed ion fixed by countercurrent regeneration, Process features: downstream operation, countercurrent regeneration, the low regeneration efficiency. In the actual operation, The acid's consumption is 0.725kg/t (water) and the alkali's consumption is 0.346kg/t(water) in the process system. The acid's actual consumption is about 380t and the alkali's actual consumption is about 270 t every year in the factory; Every year the factory need to change the Yin and Yang resin about 10 t, discharge of sewage The content of CODCr in the sewage that discharged form the factory is 180 ~ 200 mg/L, must be approved by sewage farm.

IV. SCHEME DEMONSTRATION

A. The overall reform train of thought

The selection of unit considering the water quality and the problem in operation of original production: First, integrating the desalting device and water treatment device, using integrated membrane process, centralized treatment, In order to achieve unified coordination, hierarchical control purpose. This method can eliminate the acid and alkali consumption in the system, control of water without salt and water cost, it can reduce the occupied area of the equipment, saves the expense. Design of 5 kinds of different options, including the traditional pretreatment +RO+ mixed bed, traditional pretreatment +RO+RO, traditional pretreatment +RO+EDI and UF+RO+RO, UF+RO+EDI integrated of membrane. Comprehensive contrast the five kinds of schemes, although the investment of EDI is more than the mixed scheme, but its operation cost is low, after a few years will recover the investment. But the ultrafiltration pretreatment in this scheme ensures that the EDI unit quality, as the final plan.

B. Unit effectiveness analysis and design process

Because of the source water for surface water, in a large range, dissolved or solid pollutants in rainfall runoff and so on, entering into the ground surface or underground runoff effects on water quality, in order to ensure the strict EDI water requirement selection unit: laminated filter, ultra filter, security filter, reverse osmosis systems and security filter, EDI.

Following one by one on the validity of the analysis:

① laminated filter: in the developed countries has already been widely applied to the harsh conditions, and requires little maintenance work.

② Ultra filtration device to ensure the water pollution index (SDI) values of less than 2, to extend the service life of the reverse osmosis membrane.

③ The reverse osmosis system: selection of Hyde ultra low aromatic poly phthalein amine compound film, single membrane desalination rate greater than 99.6%.

Combined with the analysis of the effectiveness of each unit, fully consider the entire works of various influencing factors, that integrated membrane desalination of water treatment process as illustrated in figure 3.

Add water boiler design line is: the raw water pump raw water tank + heat + laminated filter + ultra filtration + ultra filtration tank + ultra filtration filter + security filter high pressure pump + A + level reverse osmosis device + two stage high pressure pump + two stage reverse osmosis k device + sweet water tank + Dematerialized water pump.

Process (new fatty alcohol device):

Design of pure water is dematerialized water tank and pure water supply pump + Security filter + electric desalting device (EDI) + pure water tank and pure water pump.

In addition, before the laminated filter considering the addition of heat exchanger, heat exchanger with increased while the increase of steam consumption, but the water temperature of the system increases, can increase the ultrafiltration and reverse osmosis water yield, reduced ultra filtration reverse osmosis system energy consumption. But, after heating desalted water into the boiler, the energy loss is small. So the running cost calculation does not need to be included in this part of the cost.

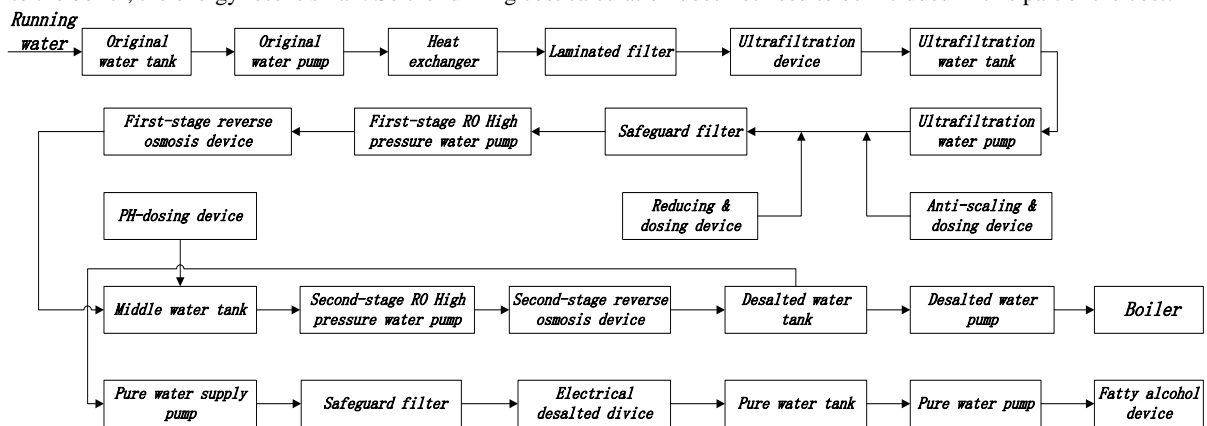


Figure 3 Desalination technology overall design process flow chart

V. CONCLUSION

This study conducted over a period of one years of research and testing, conducted a pilot test, completed for the desalting process design and debug, test shows that this technique can make the groundwater, completely removing the salt used as boiler make-up water, level two of EDI treatment for fatty alcohol plant process water. Reflect the problems are summarized as follows:

1) Do pretreatment measures of desalination system have important significance? In the normal conditions of production, it is necessary to strictly monitor each device influent water quality, provide a good prerequisite for normal desalination system running smoothly. UF as a pretreatment buffer force poor, and although UF is PVDF anti-pollution, but when encountered the raw water quality deterioration ,it timely adjust the operating mode, narrow UF backwash interval to ensure that UF will not be fouling.

2) The water quality of secondary desalination fully meets the requirements, but the run appeared in EDI effluent quality decline situation. We consider metering pumps plus sodium hydroxide in front of the security filter, or added in the middle of the tank, so that the bicarbonate is converted to carbonate.

3) In addition, Fushun City, located in the upper reaches of Liao he, more than 1,800 of the existing urban industry, mining enterprises, industrial water consumption of 815 800 t / d, industrial water supply capacity of 922,000 t / d. Urban water resources are mainly derived from the Hun river and latent layer groundwater.

WangHua District in the west of Fushun concentrated more than 20 large and medium-sized industrial and mining enterprises in the city, industrial water consumption, accounting for more than one-third of the city's industrial water consumption, Fushun chemical plant is one. Fushun City, groundwater is only a very small amount of mining, industrial water main from the Hun river surface water, and the dry season water resources can only reach 60% of the normal case. Therefore dematerialized water device may be affected due to the above reasons, the conservation program is the next step that we investigated object.

Taken together, compared with the domestic desalination process, the process is simple, but includes physical, chemical processing, the purpose of each unit process is strong, and compared to the other mainly with mixed bed technology have obvious differences, process more reasonable, more advanced technology. Is a set of successful secondary desalination process, and based on this, it is necessary to conduct the further industrialization trial, as soon as possible to put into industrial fields , for the enterprise benefit, bring benefit to society.

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