Study on recovery and purification technology of sulfur hexafluoride gas under zero emission constraint

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Abstract: In order to improve the efficiency of sulfur hexafluoride gas recovery and purification, an optimization method of technical parameters for sulfur hexafluoride gas recovery and purification based on quantitative characteristic parameter analysis is proposed. Combined with the reaction temperature, concentration of sulfur hexafluoride gas, concentration of SF6 gas, NOx, CO and other sulfur hexafluoride gas, the technical index constrained programming model of sulfur hexafluoride gas recovery and purification was established by using the equivalent constraint and zero emission constraint analysis method. Combined with the experimental test analysis method, the entropy weight characteristic analysis model of sulfur hexafluoride gas recovery and purification was established, and the quantitative parameter analysis of sulfur hexafluoride gas recovery and purification was carried out by combining the comprehensive index parameter analysis. The entropy weight analysis technology is used to analyze the influence of different recovery and purification parameters on the concentration of sulfur hexafluoride gas, and a quantitative analysis model of sulfur hexafluoride gas emission concentration is established. According to quantitative characteristic parameter analysis and data fusion technology, the technical parameters of sulfur hexafluoride gas recovery and purification are optimized. The experimental results show that by optimizing the technical parameters of sulfur hexafluoride gas recovery and purification, the content of toxic substances in sulfur hexafluoride gas is reduced, the effective separation capacity of sulfur hexafluoride is improved, and the energy cost is reduced.

Key words: Zero emission constraint; Sulfur hexafluoride; Gas recovery; Purification; Entropy weight characteristic

1. Introduction

Sulfur hexafluoride [1-3], an inorganic compound with the chemical formula of SF6, is a colorless, odorless, nontoxic and incombustible stable gas at normal temperature and pressure. It is an artificial inert gas synthesized by two French chemists Moissan and Lebeau in 1900. Although the pure SF6 gas is nontoxic, it is necessary to prevent the concentration of SF6 gas from rising to the level of hypoxia in the workplace [4-5]. The density of SF6 gas is about five times that of air [6-7]. If SF6 gas leaks, it will be deposited in low-lying places, such as cable trenches. If the concentration is too high, there will be a choking hazard. This situation should be taken into account when designing indoor ventilation devices. Sulfur hexafluoride gas contains a lot of toxic and harmful substances, and SF6 is the primary metal harmful substance. According to statistics, SF6 in sulfur hexafluoride gas has caused a lot of products to the environment, accounting for 32.9% of the toxic and harmful substances in sulfur hexafluoride gas [8]. It is necessary to study the optimized sulfur hexafluoride gas recovery and purification technology to improve the effective governance and control ability of sulfur hexafluoride gas pollution. By optimizing the parameters of sulfur hexafluoride gas recovery and purification, the process optimization control model of sulfur hexafluoride gas recovery and purification is established to achieve the low emission effect of sulfur hexafluoride gas SF6. Studying the optimization method of technical parameters of sulfur hexafluoride gas recovery and purification is of great significance in reducing the pollution of sulfur hexafluoride gas and improving the level of environmental protection [9].

Recovery and purification are an important process of sulfur hexafluoride gas treatment. Currently, the parameter optimization methods of sulfur hexafluoride gas recovery and purification mainly include sulfur hexafluoride gas concentration characteristic analysis method, principal component analysis method and quantitative analysis method of emission, etc. [10], and an optimization model of sulfur hexafluoride gas recovery and purification technology parameters is established. Combined with the detection of SF6 concentration in sulfur hexafluoride gas, the technical parameters of sulfur hexafluoride gas recovery and purification are optimized, but the traditional methods have poor pollution characteristic analysis ability. Therefore, this paper puts forward an optimization method of technical parameters of sulfur hexafluoride gas recovery and purification based on quantitative characteristic parameter analysis. Combined with the reaction temperature, concentration of SF6 gas, concentration of SF6 gas, NOx, CO and other concentrations of SF6 gas, the influence of different recovery and purification parameters on the concentration of SF6 gas was analyzed by using entropy weight analysis technology, and a quantitative analysis model of SF6 gas emission concentration was established. According to quantitative characteristic parameter analysis and data fusion technology, the technical parameters of SF6 gas recovery and purification were optimized. Finally, the experimental test is carried out, and the reliability control measures of sulfur hexafluoride gas are analyzed in combination with the relevant detection and analysis results [11].

2. Study on recovery and purification characteristics of sulfur hexafluoride gas

2.1 Relevant equipment and instruments

In order to realize the optimization and application research of technical parameters of sulfur hexafluoride gas recovery and purification, the entropy weight characteristic analysis model of sulfur hexafluoride gas recovery and purification is built by combining experimental test analysis methods [12], and the quantitative parameter analysis of sulfur hexafluoride gas recovery and purification is carried out by combining comprehensive index parameter analysis [13]. The experimental test instruments for optimizing the parameters of sulfur hexafluoride gas recovery and purification are mainly shown in Table 1.

Table 1. Main parameters of sulfur hexafluoride gas recovery and purification instrument

Project	Sampling/analysis instrument
Thermometer	China Pharmaceutical (Group) Shanghai Company produces K-type MHJ industrial thermometer.
Sulfur hexafluoride and NOx analyzer	Muffle furnace analyzer JH900
catalyst	Rapid pyrolysis process analysis, sampler KL-320W
pressurizer	U-tube differential pressure gauge measuring instrument 34-5056
Sulfur hexafluoride sampling	Measurement of sulfur hexafluoride -250-2900 by rotameter
Sulfur hexafluoride analysis	Air-fiber membrane gas-solid separation analyzer RT-456
Air dust measurement	Membrane module TS100
Water soluble cation	Membrane module ICSSDF

2.2 Analysis of the influence of purification technical parameters

Combined with the reaction temperature, concentration of sulfur hexafluoride, concentration of SF6, concentration of NOx, CO and other sulfur hexafluoride gases, the parameters of sulfur hexafluoride gas recovery and purification are analyzed by the equivalent constraint parameter analysis method[14], and the fuel characteristics of SF6 export plant are shown in Table 2.

Table 2. Characteristics of sulfur hexafluoride gas recovery and purification fuel

Fuel type	Carbon (%)	Coal compound (%)	Compounds (%)
Super coal	4.771	34.161	4.840
Crude coking coal	4.171	75.120	4.516
Head and tail coking coal	4.625	73.269	4.011

The combination analysis method of PP hollow fiber coal used in the experiment analyzed the activity of sulfur hexafluoride in the emissions from SF6 export plant, and combined with the metrological analysis method of harmful substances in the emissions from SF6 export plant, the concentrations of sulfur hexafluoride gas components in the emissions under different proportioning schemes were obtained[15-17]. The results are shown in Table 3. Among them, under the constraint scheme condition 1, the measurement results of dust in the emissions of SF6 export plant are obtained, and the air carrying dust enters the sulfur hexafluoride removal process after dust measurement.

Table 3. Detection of pollution quality concentration of emissions in SF6 export plant

Composition (mg/m)	Test sample1	Test sample2	Test sample3	Test sample4	Test sample5
smoke and dust	7.9088	4.727	12.073	2.200	0.791
Dust PM10	7.8461	4.199	12.900	2.263	0.785
PM2.5	3.6690	4.334	12.261	2.513	0.367
Sulfur compound	4.4652	4.454	12.623	2.420	0.447
nitrogen compound	2.9434	4.906	12.032	2.413	0.294
carbon compound	0.7304	4.378	12.770	2.437	0.073
sulfur hexafluoride	5.1127	4.390	12.218	2.136	0.511

Note: The unit of mass concentration of sulfur hexafluoride in the table is ng/m.

It can be seen from the above table that optimizing the emission parameter distribution in SF6 export plant, combined with technical parameter optimization, can greatly reduce the emission concentration of sulfur hexafluoride [18].

2.3 Statistical analysis of sulfur hexafluoride gas components

In order to realize the analysis of sulfur hexafluoride gas composition and pollution characteristics, a statistical analysis model was established [19-20], and Nemerov index method and quantitative gray scale quantitative analysis method were used to analyze the pollution status and potential environmental risks of sulfur hexafluoride gas pollution [21]. The recursive diagram of sulfur hexafluoride gas content distribution in the surface layer obtained by quantitative recursive statistical method, and the overall structure design of sulfur hexafluoride gas composition and pollution characteristics analysis are shown in Figure 1.

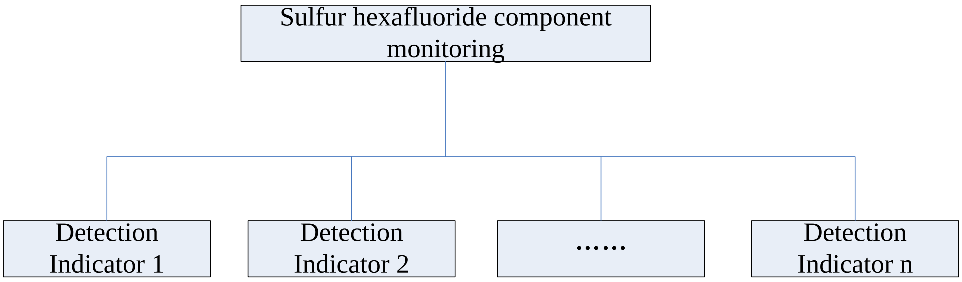


Figure 1. Analysis of pollution characteristics of sulfur hexafluoride gas component's overall structure

The correlation degree in monitoring points of different sulfur hexafluoride gas components is expressed as follows:

$$Y\left(x_i(O), x_i(k)\right) = \frac{\tau \min \Delta_i(O,k) + \tau \max \Delta_i(O,k)}{\Delta_i(O,k)} \tag{1}$$

Wherein, it represents the dynamic correlation weight of sulfur hexafluoride gas component monitoring. In the range from 0 to 1, Nemerov index analysis and gray correlation feature extraction is adopted, $Y\left(x_i(O), x_i(k)\right)$ represent the gray correlation coefficient of sulfur hexafluoride gas component, and $\tau \min \Delta_i(O,k)$, $\tau \max \Delta_i(O,k)$ represents the difference information of sulfur hexafluoride gas component, and the minimax criterion is adopted to judge the pollution severity, so as to obtain the contribution coefficient of sulfur hexafluoride gas component to pollutant emission:

$$P_n = \frac{1}{6}\sum_{i=1}^{4} Y\left(x_i(O), x_i(k)\right) \tag{2}$$

However, the pollution contribution weight of the gas component data monitored by each monitoring point has autocorrelation characteristics, and the average mutual information method is adopted to obtain the grey judgment function of pollution characteristic analysis [22], and the Nemerov index analysis is carried out on the index weight of sulfur hexafluoride monitored by each monitoring point to obtain:

$$I_i^t = \sum_{j=1}^{n} H_j I_j \tag{3}$$

The organic ligand of sulfur hexafluoride was constructed. During solid-phase extraction, the contents of Cd, Cr, Cu, Pb and Zn in sulfur hexafluoride gas fine particles were calibrated by magnetic separation with a short chromatographic column. The correlation dimension information in the recursive diagram is as follows:

$$I_i = C_i / C_{is} \tag{4}$$

In this formula, I_i^t is the component index of sulfur hexafluoride, the data collected by each monitoring point, and C_i is the normal reference index, C_{is} is the total amount of sulfur hexafluoride, s is the year GFD of sulfur hexafluoride monitoring, and the number of the monitoring point. The statistical analysis of sulfur hexafluoride gas components is carried out by Nemerov index analysis and gray-scale correlation feature extraction method, and the quantitative recursive diagram of sulfur hexafluoride gas content distribution feature analysis is constructed. On this basis, the sulfur hexafluoride pollution feature analysis is carried out [23].

3. Evaluation and comprehensive analysis of technical parameters of sulfur hexafluoride gas recovery and purification

3.1. Evaluation of technical parameters of sulfur hexafluoride gas recovery and purification

Using the zero-emission equivalent constraint parameter analysis method, a constrained programming model of technical indicators for sulfur hexafluoride gas recovery and purification is established [24], and the dynamic distribution product of quantitative optimization for sulfur hexafluoride gas recovery and purification is obtained:

$$K_i = \prod_{i=1}^{m} a_{hi} + M(h), i = 1, 2, ..., m \tag{5}$$

In the process of removing sulfur hexafluoride, polymerization and polycondensation take place at the same time. At this time, by calculating the m-th root of M_i, it can get:

$$M_i' = \sqrt[m]{M_i} \tag{6}$$

In the process of inhibiting hydrodealkylation, the technical parameter M_i' of sulfur hexafluoride removal can be standardized, and the weight system of each index of sulfur hexafluoride gas recovery and purification can be obtained:

$$p_{i,AHP} = \frac{M_i'}{\sum_{i=1}^{m} M_i'} \tag{7}$$

Using the entropy weight analysis method, the technical identification matrix A of sulfur hexafluoride gas recovery and purification is calculated, and the maximum characteristic value of technical parameter identification of sulfur hexafluoride removal is obtained:

$$\lambda_{\max} \approx \frac{1}{m} \sum_{i=1}^{m} \frac{(A \times p)_i}{p_{i,AHP}} \tag{8}$$

In the formula: $(A \times p)_i$ is the ith component of the product vector of the judgment matrix A and the weight matrix P of the gas phase product of sulfur hexafluoride gas recovery and purification.

Combined with normalized index parameter analysis, the consistency index KL of technical parameters of sulfur hexafluoride gas recovery and purification is calculated:

$$KL = \frac{\lambda_{\max} - m}{m - 1} + \prod H(i) + m(t) \tag{9}$$

The fuzzy decision-making fusion parameter model is established, and the random consistency index analysis is adopted to construct the changing parameters of the rapid pyrolysis reaction of sulfur hexafluoride in the emissions of SF6 export plant:

$$CR = \frac{CI}{RI} arc\tan(\omega L_m / R_m) \tag{10}$$

Where: RI is the judgment matrix A for the co-heating of syngas and sulfur hexafluoride, and the parameters are optimized according to the separation characteristics of different kinds of sulfur hexafluoride particles in the high temperature process [25].

3.2. Entropy weight analysis

The entropy weight analysis technology is adopted to analyze the influence of different recovery and purification parameters on the concentration of sulfur hexafluoride gas. When a single particle of coal fuel is broken into multiple particles, the calculation formula for the lower temperature or heating rate of sulfur hexafluoride separation in the emissions of SF6 export plant is obtained as follows:

$$T = \frac{t_{ij} - \min_i\left(t_{ij}\right)}{\max_i\left(t_{ij}\right) - \min_i\left(t_{ij}\right)} \tag{11}$$

Where: t_{ij} is the standardized value of pollutant x_{ij} index of sulfur hexafluoride gas emission; $\min_i\left(x_{ij}\right)$ is the minimum value of entropy weight constraint of the i-th index; $\max_i\left(x_{ij}\right)$ is the maximum value of entropy weight constraint.

Combined with the heating mode and reactor type, based on comprehensive index evaluation, the normalized treatment formula of technical parameters for recovery and purification of sulfur hexafluoride gas is obtained as follows:

$$v_{ij} = \frac{\max_i\left(x_{ij}\right) - x_{ij}}{\max_i\left(x_{ij}\right) - \min_i\left(x_{ij}\right)} \tag{12}$$

Under the fuzzy constraint index, the calculation formula of entropy weight fusion for parameter optimization of recovery and purification technology is obtained as follows:

$$R_w = \left|\frac{r_2 - r_1}{r_2 + r_1}\right|^2 \tag{13}$$

The entropy value of the i index is Calculated, to obtain $T_w = \frac{4r_1r_2}{(r_1+r_2)^2}$, $T_w + R_w = 1$, and obtain the entropy value e_i of the I index for the recovery and purification of sulfur hexafluoride gas. The formula is:

$$e_i = \left(\frac{-1}{\ln n} \right) \times \sum_{j=1}^{n} \left(z_{ij} \times \ln z_{ij} \right) \tag{14}$$

Where: When z_{ij} is 0, it indicates the convergence error of the technical parameters of sulfur hexafluoride gas recovery and purification $z_{ij} \times \ln z_{ij} = 0$.

Based on the analysis of typical pyrolysis process parameters, the entropy weight w_i calculation formula of the I index of sulfur hexafluoride gas recovery and purification is obtained as follows:

$$w_i = \frac{1 - e_i}{m - \sum_{i=1}^{m} e_i} \tag{15}$$

The comprehensive weight analysis method is taken, according to the different heating methods [11], the optimized calculation formula of technical parameters for the recovery and purification of sulfur hexafluoride gas is obtained as follows:

$$\min F(\sigma_i) = \sum_{j=1}^{n} \sum_{i=1}^{m} \left\{ \left[\left(\sigma_i - p_{i,AHP} \right) v_{ij} \right]^2 + \left[\left(\sigma_i - w_{i,EWM} \right) v_{ij} \right]^2 \right\} \tag{1}$$

Where: σ_i is the comprehensive weight constrained by the technical parameters of sulfur hexafluoride gas recovery and purification, $\sum_{i=1}^{m} \sigma_i = 1, \ \sigma_i \geq 0$; The entropy weight comprehensive index analysis method is adopted to obtain the characteristic distribution weight of technical parameters optimization of sulfur hexafluoride gas recovery and purification. To sum up, the technical parameters of sulfur hexafluoride gas recovery and purification are optimized. To sum up, the distribution of technical indexes of sulfur hexafluoride gas recovery and purification is shown in Table 4.

Table 4. Characteristic quantity of recovery and purification reliability constraint of sulfur hexafluoride gas

Categories	Characteristics of recovery and purification curve of sulfur hexafluoride gas	Constrained characteristic quantity
Recovery and purification temperature of sulfur hexafluoride gas	Low temperature holding section	Constraint characteristic quantity 1~ constraint characteristic quantity 3
	High temperature degradation section	Constraint characteristic quantity 4~ constraint characteristic quantity 5
	Combustion temperature holding section	Constraint quantity 6
Sulfur compound concentration	Low temperature combustion section	Constraint characteristic quantity 1~ constraint characteristic quantity 3
	High temperature degradation section	Constraint quantity 4
	Combustion temperature holding section	Constraint characteristic quantity 5~ constraint characteristic quantity 6
Nitrogen compound concentration	High temperature degradation section	Constraint quantity 1
	High concentration section	Constraint characteristic quantity 2~ constraint characteristic quantity 4
	Combustion temperature holding section	Constraint characteristic quantity 5~ constraint characteristic quantity 6
Carbon compound concentration	High temperature degradation section	Constraint quantity 1
	High concentration section	Constraint characteristic quantity 2~ constraint characteristic quantity 4
	Combustion temperature holding section	Constraint characteristic quantity 5~ constraint characteristic quantity 6
Carbon compound concentration	Low temperature combustion section	Constraint quantity 1
	High temperature degradation section	Constraint characteristic quantity 2~ constraint characteristic quantity 4
	Combustion temperature holding section	Constraint characteristic quantity 5~ constraint characteristic quantity 6

4. Experimental part

In the experiment, according to quantitative characteristic parameter analysis and data fusion technology, an optimization analysis and control model of technical parameters of sulfur hexafluoride gas recovery and purification was established. The COED fluidized bed process in the United States was used as a heat source to carry out sulfur hexafluoride removal experiment. In the experiment, firstly, an air compressor was sampled to compress sulfur hexafluoride gas, and the sulfur hexafluoride gas was stabilized in the purifier. The initial measurement of sulfur hexafluoride content in the gas carrying sulfur hexafluoride, flow detection in the U-shaped tube differential pressure meter, etc. are carried out to realize the separation of sulfur hexafluoride through the separation device, and finally the concentration of sulfur hexafluoride is detected again by the sulfur hexafluoride meter, and the device process of sulfur hexafluoride gas recovery and purification experiment is shown in Figure 2.

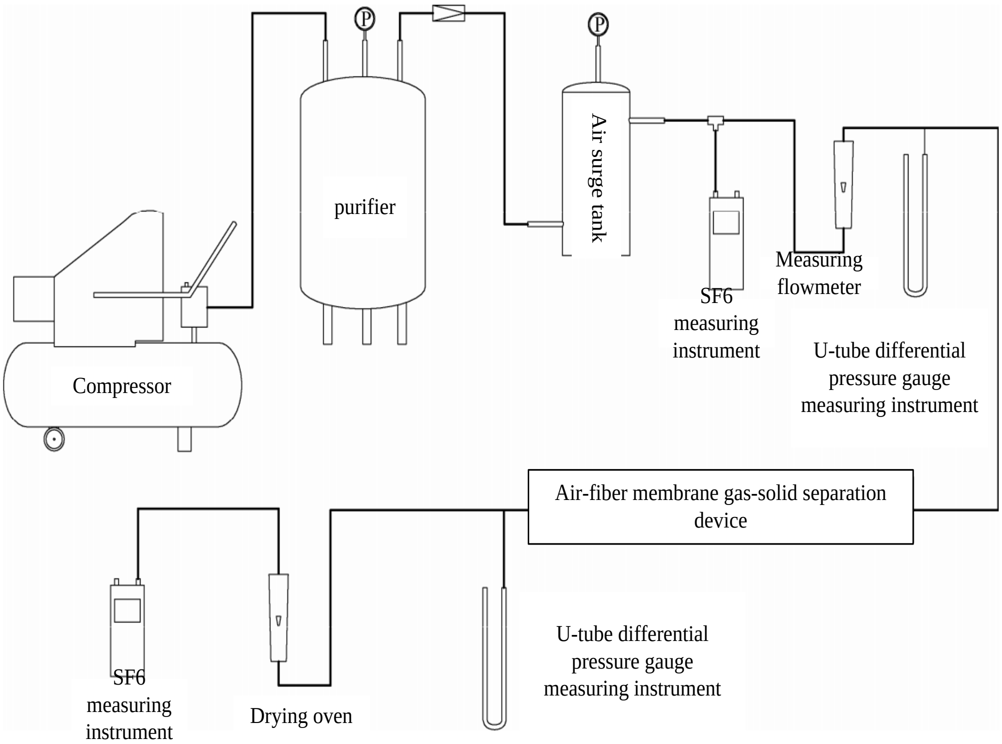


Figure 2. Device flow of sulfur hexafluoride gas recovery and purification experiment

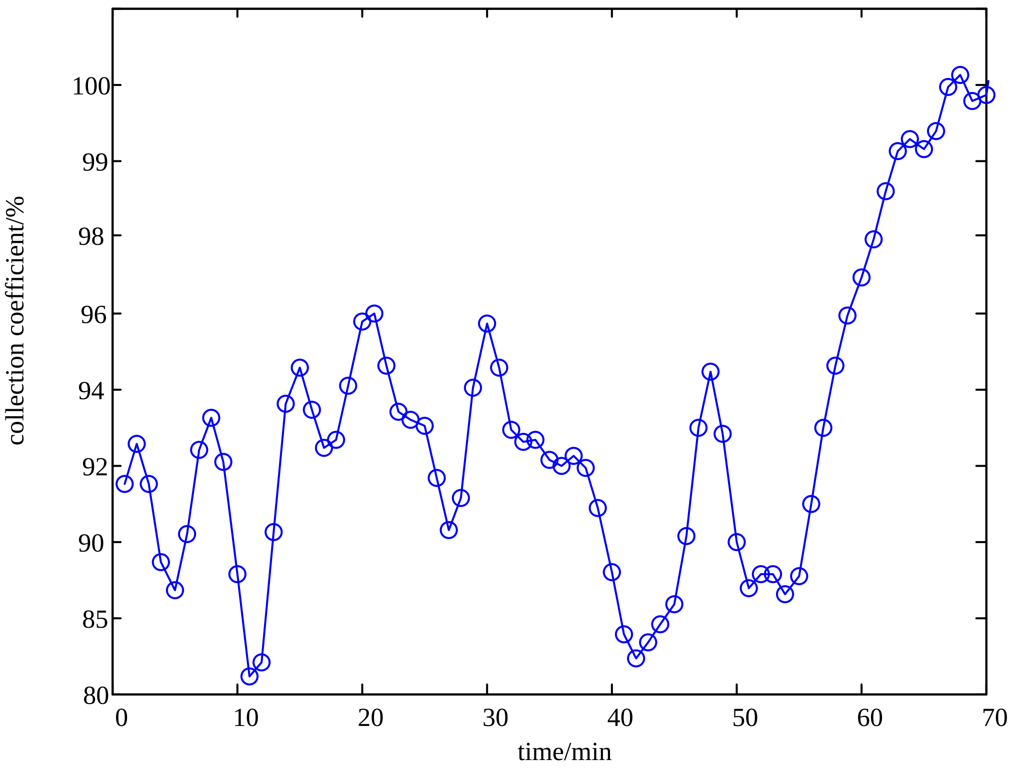
During the experiment, in addition to the analysis of different particle size distribution on the influence of the sulfur hexafluoride gas recovery purification, SF6 output factories that discharge sulfur hexafluoride gas concentration of sulfur hexafluoride, high-temperature pyrolysis performance, also analysis verify the sulfur hexafluoride leakage rate and recovery purification velocity of sulfur hexafluoride, verify the feasibility of the recovery and purification technology and practical application value.

The dynamic measurement method is used, the pollution components in sulfur hexafluoride gas are analyzed, and according to the optimization of technical parameters, the influence of different particle size distributions on the recovery and purification of sulfur hexafluoride gas is analyzed. The analytical results of optimized parameters for recovery and purification of sulfur hexafluoride gas are shown in Table 5.

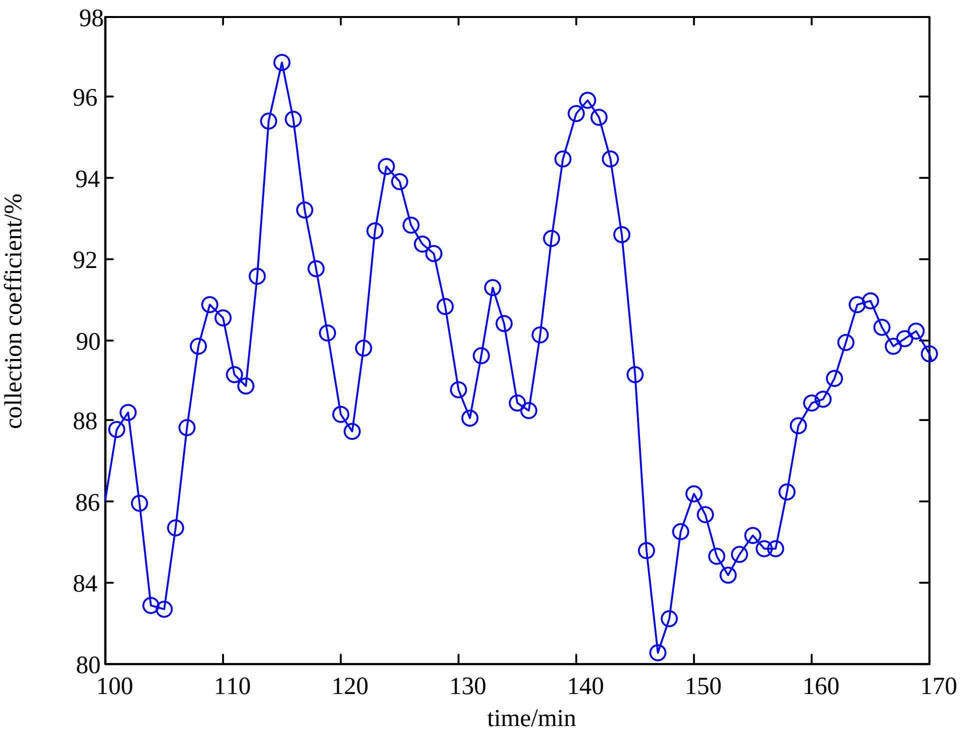
Table 5. Analytical results of optimized parameters for sulfur hexafluoride gas recovery and purification

Test sample	Concentration	Pyrolysis coefficient	Gas yield
Sample1	41.48	0.14	0.963
Sample2	40.38	0.13	0.937
Sample3	41.29	0.12	0.945
Sample4	40.21	0.11	0.960
Sample5	42.47	0.19	0.954
Sample6	40.08	0.23	0.977
Sample7	40.10	0.12	0.988
Sample8	41.04	0.11	0.930
Sample9	41.76	0.08	0.951
Sample10	42.86	0.01	0.946
Sample11	43.03	0.26	0.935
Sample12	41.51	0.02	0.326

The analysis results of the influence of different particle size distributions on the recovery and purification of sulfur hexafluoride gas are shown in Figure 2.



(a) Effective separation coefficient of sulfur hexafluoride



(b) Energy and combustion efficiency

Figure 3. Influence of different particle size distribution on the recovery and purification of sulfur hexafluoride gas

According to the analysis of Figure 3, under the optimized technical parameter distribution of sulfur hexafluoride gas recovery and purification, the effective separation capacity of sulfur hexafluoride is improved, the energy cost is reduced, and the recovery and purification efficiency of SF6 is improved.

On the basis of the above experiments, the distribution concentration of sulfur hexafluoride was tested, as shown in Figure 4.

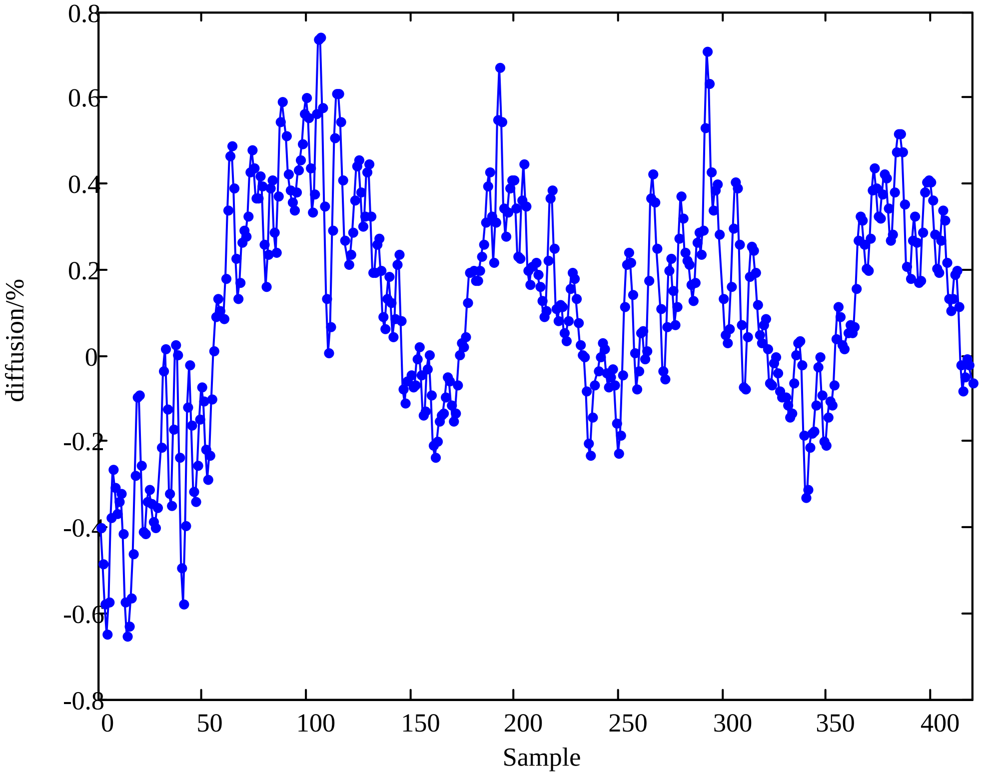


Figure 4. Distribution concentration of sulfur hexafluoride in sulfur hexafluoride gas discharged from 4SF6 export plant

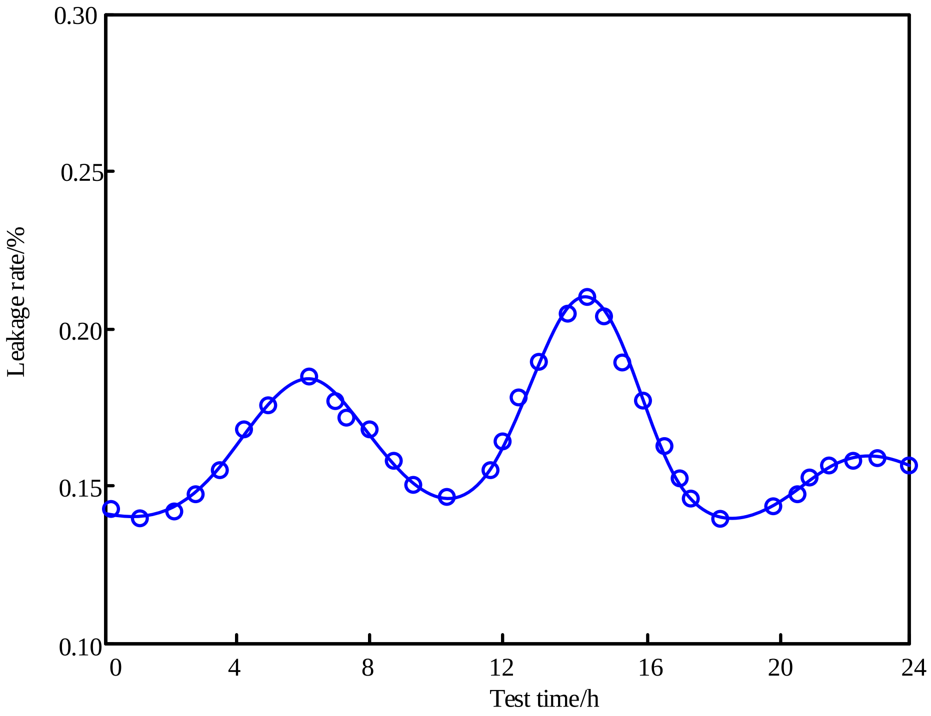
Further, the high-temperature pyrolysis performance of SF6 gas in the recovery process is test, and the test results are shown in Table 6.

Table 6. Pyrolysis performance of sulfur hexafluoride at high temperature

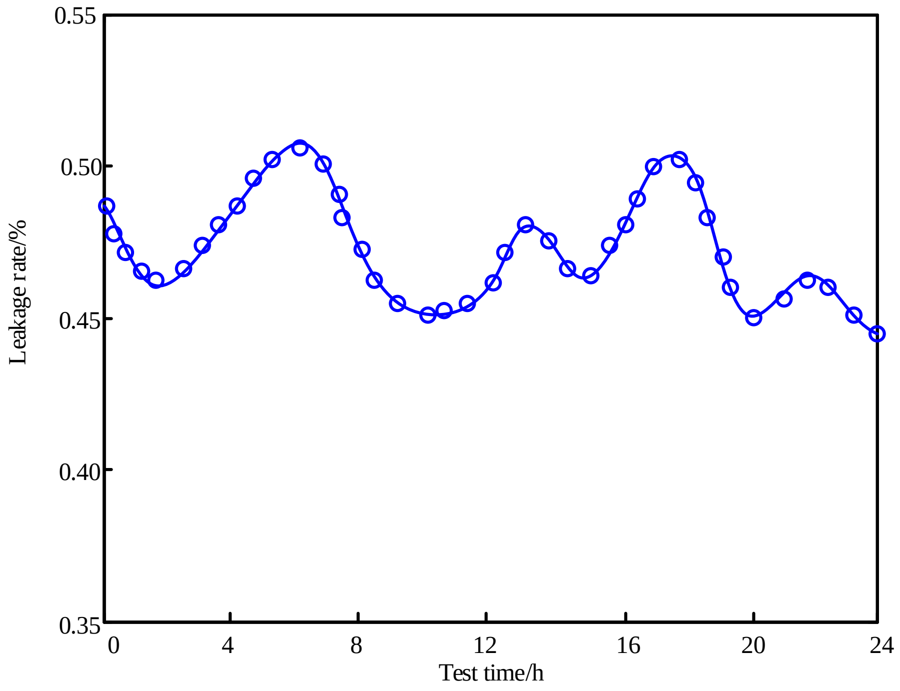
Test sample	Constant temperature section	Pyrolysis water yield	Low temperature end flow
Sample 1	0.995	1.694	0.985
Sample 2	1.022	2.843	0.937
Sample 3	1.001	2.817	0.983
Sample 4	1.009	2.240	0.984
Sample 5	1.014	1.353	0.975
Sample 6	1.052	2.435	0.950
Sample 7	1.040	1.597	0.969
Sample 8	1.049	1.979	0.960
Sample 9	0.983	0.749	0.965
Sample 10	1.055	1.654	0.978
Sample 11	1.019	0.688	0.977
Sample 12	1.021	2.615	0.400
Sample 13	1.056	0.463	0.390
Sample 14	1.015	2.970	0.363
Sample 15	1.006	2.587	0.361
Sample 16	1.036	0.992	0.387

According to the above experimental tests, the optimization analysis of the technical parameters of recovery and purification of SF6 gas discharged from SF6 export plant is realized.

In the experiment, on the basis of analysis of sulfur hexafluoride leakage rate, the index is one of the important indicators, sulfur hexafluoride current recovery purification processing system leakage rate lower than 0.5% is equal to the general requirements, in the event of sulfur hexafluoride leakage quantity is too much, serious environmental pollution, this paper studies the sulfur hexafluoride gas recovery and purification technology of application value is not high, therefore, Analyze the leakage rate of sulfur hexafluoride before and after the application of sulfur hexafluoride gas recovery and purification technology with zero emission constraint. First, analyze whether the leakage rate of sulfur hexafluoride is reduced after the application of the technology in this paper, thus reducing air pollution; second, verify whether the technology in this paper meets existing regulations and meets actual needs. Since the leakage rate of sulfur hexafluoride varies greatly before and after the application of the technology in this paper, two graphs are drawn for easy analysis. The specific experimental results are shown in Figure 5.



(a) After application

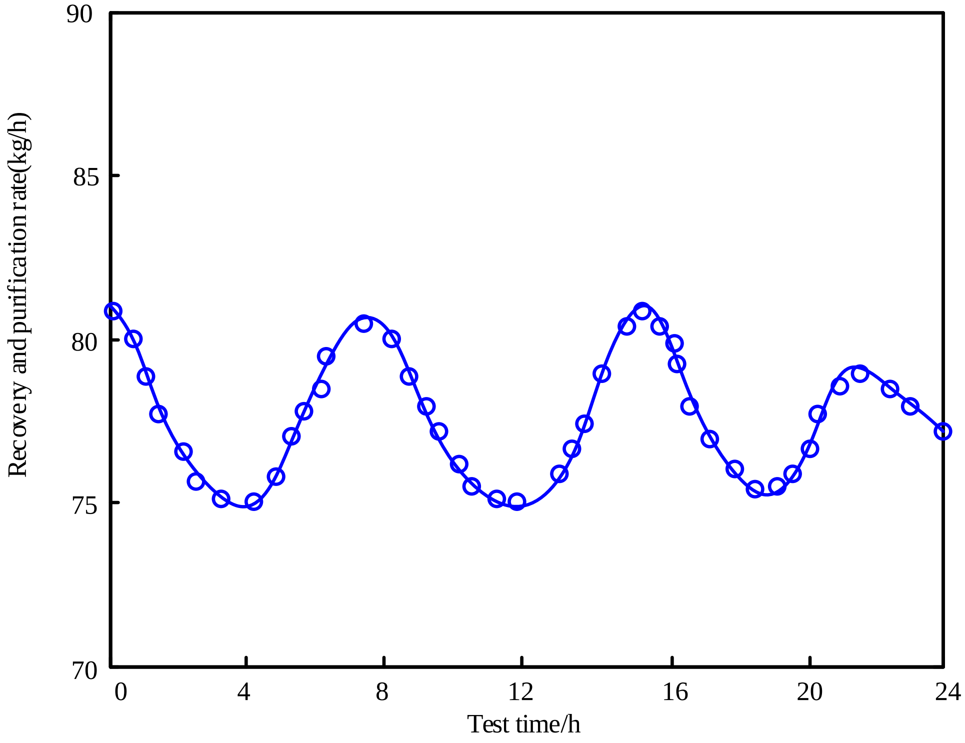


(b) Prior to application

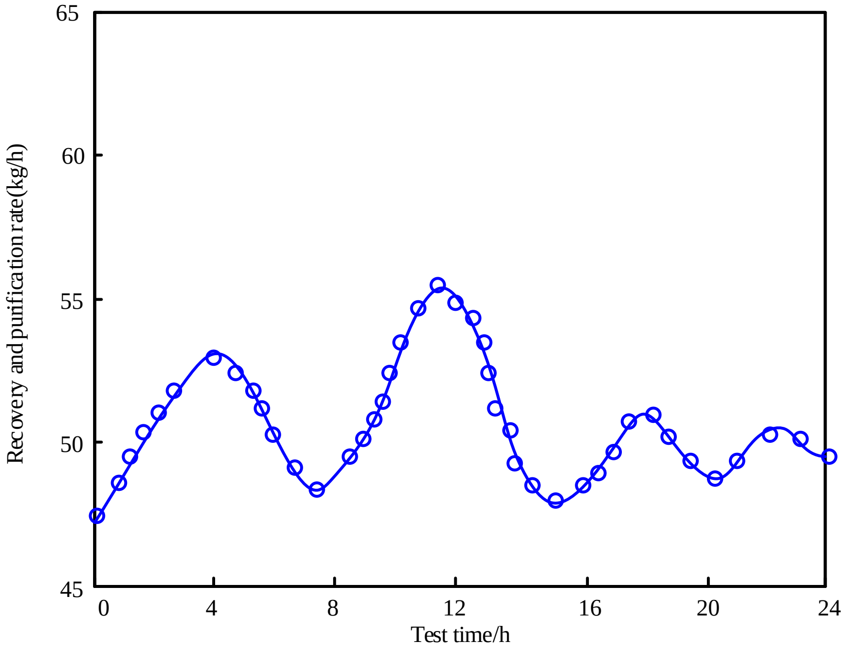
Figure 5 Comparison of leakage rates of sulfur hexafluoride

According to the comparison of the leakage rate of sulfur hexafluoride before and after the application of the sulfur hexafluoride gas recovery and purification technology under the zero-emission constraint in Figure 5, it can be seen that the leakage rate of sulfur hexafluoride is between 0.45% and 0.50% before the application of the recovery and purification technology in this paper, and the lowest leakage rate of sulfur hexafluoride is 0.448% in the 24h test time. Highest sulfur hexafluoride leakage rate reached 0.521%, its highest value sulfur hexafluoride leakage rate more than 0.50%, but in a day on average, the overall sulfur hexafluoride leakage rate lower than 0.50%, therefore, before using the recovery and purification technology, sulfur hexafluoride leakage rate meet the actual requirements, but the sulfur hexafluoride leakage rate is higher, nearly 0.50%, After the application of the recovery and purification technology in this paper, it can be seen in Figure 5 that the leakage rate curve of sulfur hexafluoride is below 0.25%, and the leakage rate of the highest sulfur hexafluoride is only 0.223%, and the leakage rate of the lowest sulfur hexafluoride is 0.139%, which meets the actual requirements. Compared with that before the application of the technology in this paper, The leakage rate of sulfur hexafluoride after application is much lower than before, which is reduced by more than 0.20%. Therefore, the recycling and purification technology in this paper effectively reduces the leakage rate of sulfur hexafluoride, which indirectly reduces air pollution, reduces the pollution degree of sulfur hexafluoride, and provides power for the development of sulfur hexafluoride.

In practical applications, the sulfur hexafluoride recovery purification speed is hard Numbers, if sulfur hexafluoride recovery purification speed is slow, cannot satisfy the actual need, that is no actual application value of the technology, therefore, verification analysis under the restriction of zero discharge sulfur hexafluoride gas recovery and purification technology of sulfur hexafluoride recovery purification speed, Conventional sulfur hexafluoride recovery purification speed of 50 kg/h, inlet velocity is generally not less than 100 kg/h, to verify as the foundation, the test in this paper, purification and recycling within 24 h of sulfur hexafluoride recovery purification speed, verify whether they meet the actual demand, and in this paper, on the basis of traditional recovery purification rate, recovery and purification rate whether there is a certain degree of ascension. The experimental results are shown in Figure 6.



(a) After application



(b) Prior to application

Figure 6 Comparison of recovery and purification speed of sulfur hexafluoride

According to the recovery and purification speed of sulfur hexafluoride before and after the application of sulfur hexafluoride gas recovery and purification technology under the zero-emission constraint shown in Figure 6, it can be seen that the recovery and purification speed of sulfur hexafluoride is between 47.5kg/h and 56.8kg/h before the application of the recovery and purification technology in this paper, which is basically maintained at about 50kg/h and only meets the actual demand. After the application of the recovery and purification method in this paper, the recovery and purification speed of sulfur hexafluoride will be improved tomorrow, and the improvement is large, the highest recovery and purification speed of sulfur hexafluoride is 81.7kg/h, and the lowest recovery and purification speed of sulfur hexafluoride is also more than 70kg/h, the lowest value is 74.9kg/h, Applied in this paper, recovery and purification technology of sulfur hexafluoride recovery purification rate before and after comparison, the application of this technology in the low than high above 18.1 kg/h before application, therefore, applied in this paper, after the recovery and purification technology, sulfur hexafluoride recovery purification process effectively improve the recovery purification velocity of sulfur hexafluoride, this technology in the cases of ventilation time, The amount of effective recovery and purification of sulfur hexafluoride is more, and its work efficiency is higher. This is because the recovery and purification technology in this paper, based on the analysis method of equivalent constraint and zero emission constraint, has established the constraint planning model of technical indicators of sulfur hexafluoride gas recovery and purification, and optimized the recovery and purification technology, so as to improve the recovery and purification speed of sulfur hexafluoride.

5. Conclusions

In this paper, the optimization model of technical parameters of sulfur hexafluoride gas recovery and purification is studied, and the constrained programming model of technical indicators of sulfur hexafluoride gas recovery and purification is established by using the equivalent constrained parameter analysis method. According to the experimental results, the following conclusions are obtained:

(1) With the increase of temperature, the concentration of sulfur hexafluoride content in the discharged sulfur hexafluoride gas is less, and the separation characteristics of sulfur hexafluoride are improved after constant maintenance.

(2) According to the concentration distribution of sulfur hexafluoride, sulfur hexafluoride is separated in the PP hollow fiber membrane module, and the method of recovering sulfur hexafluoride by stages can improve the reliable separation ability of sulfur hexafluoride.

(3) The concentration of sulfur hexafluoride and the concentration of CO have great influence on the air. In the process of recovery and purification, it is necessary to comprehensively distribute the weight according to the distribution characteristics of each particle size, reduce the influence of sulfur hexafluoride pollutants, and realize the recovery and purification of sulfur hexafluoride under the constraint of zero emission.

(4) After the optimization of recovery and purification technology, and through experimental analysis, it can be seen that the leakage rate of sulfur hexafluoride in the new recovery and purification technology has been reduced from about 0.50% to about 0.17%, and the application of the recovery and purification technology in this paper, the highest leakage rate of sulfur hexafluoride is only 0.223%. The lowest leakage rate of sulfur hexafluoride reached 0.139%. The method effectively reduced the leakage rate of sulfur hexafluoride, thus reducing the emission of harmful substances.

(5) After experimental analysis, the recovery and purification speed of the sulfur hexafluoride recovery and purification technology in this paper has been improved. Before the application of the

technology in this paper, the recovery and purification speed of the sulfur hexafluoride is about 50kg/h, but after the application of the technology in this paper, the recovery and purification speed of the sulfur hexafluoride rises from 50kg/h to 77.0kg/h. And sulfur hexafluoride recovery and purification speed up to 81.7kg/h, this method in practical application, its recovery and purification speed is faster, its work efficiency and application value is higher.

(6) Recovery and purification technology in the use of equivalent constraint and zero emission constraint analysis method, the establishment of sulfur hexafluoride gas recovery and purification of technical indicators constraint planning model, optimization of technical parameters, through the above method to improve the sulfur hexafluoride recovery and purification technology, so as to achieve the purpose of reducing pollution.

To sum up, by optimizing the technical parameters of sulfur hexafluoride gas recovery and purification, the content of toxic substances in sulfur hexafluoride gas is reduced and the level of environmental treatment is improved.

6. Funding

The research is supported by: Research and application of near zero emission technology for Sulfur hexafluoride based on Internet of things (No. kj2020-043).

7. References

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Submission: 20.02.2022.
Revision: 10.04.2022.
Acceptance: 25.06.2022.