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Pharmaceutical factory wastewater treatment scheme and its running effect

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ABSTRACT

In this paper, based on the analysis of the extraction of traditional Chinese medicine pharmaceutical factory wastewater treatment engineering scheme and the actual operation results, study on the extraction of traditional Chinese Medicine Wastewater by combined operation of specific processing structures in the treatment structures. The treatment effect, the purpose is to understand the treatment structure extraction characteristics of pharmaceutical wastewater treatment process in traditional Chinese medicine, for the follow-up design and operation of traditional Chinese medicine extraction of pharmaceutical wastewater treatment technology to provide reference.

KEYWORDS

Traditional Chinese medicine extract class; Pharmaceutical wastewater; Wastewater treatment project design; Operation monitoring data.

INTRODUCTIONG

Pharmaceutical wastewater with high concentration of organic compounds, most of high chroma, containing refractory and toxic to microbial substances, water complex composition and poor biochemical characteristics etc.. In the wastewater of antibiotic residues and high concentration of organic compounds and make the traditional biological treatment method is difficult to achieve the desired treatment effect, because of a strong inhibitory effect of residual antibiotics on microorganisms of aerobic bacteria poisoning, caused by aerobic treatment difficulties; organic matter and anaerobic treatment of high concentration and difficult to meet the effluent standard, still need further treatment.

The complexity of pharmaceutical wastewater with conventional biochemical treatment process of high consumption and inefficient, resulting in a large number of pharmaceutical wastewater is currently difficult to treat and is not easy to achieve the discharge standard of the most direct cause. Therefore, in the use of anaerobic biological treatment and anaerobic and aerobic biochemical combination of traditional process before on the pharmaceutical wastewater pretreatment for effective, drug residue and antibiotic activity of molecular damage or degradation of the transformation, which is difficult to be biodegraded substances into small molecular substances easily biodegradable, which eliminate the inhibitory effect on microbe, improve the biodegradability of wastewater biological treatment, can make the subsequent difficulty is greatly reduced.

A pharmaceutical factory for the production of plant extract drugs mainly, discharge of wastewater containing polycyclic aromatic hydrocarbons and many kinds of hard to degrade macromolecular organic compounds, wastewater discharge a greater impact on surface water. In order to control pollution, reduce the impact on the surrounding environment, the enterprise decides to build a high standard of sewage treatment system for wastewater treatment, embodies the corporate social responsibility.

BASIC SITUATION

Water quality: pH6~9, COD3850~7710mg/L, NH_3-N2.2~3.3mg/L, $BOD_5$1120~2590mg/L, SS104~145 mg/L; water yield: $1900 m^3/d$.

The treated wastewater effluent quality should meet the " Discharge standard of water pollutants for pharmaceutical industry Chinese traditional medicine category " (GB21906-2008) in direct emissions standards: COD_{Cr}≤100mg/L; BOD_5 ≤20mg/L; SS≤ 50mg/L; NH_3-N≤ 8mg/L; pH: 6~9.

DESIGN SCHEME

Design philosophy

The basic principle of engineering design of wastewater treatment is in transformation and minimize waste water treating cost and operation cost, realizes the wastewater resource utilization as much as possible, to obtain the biggest economic benefits; on the scene in the transformation process of mature technology with successful cases used as far as possible, the technical advantages into full play and mature process, to ensure the stability of operation; according to the factory production actual situation, there are three main plant wastewater: one is the high concentration wastewater pollution skullcap extract production line, mainly for chlorine root strong acid; two is the honeysuckle, Forsythia suspense extract production line of medium strength wastewater, close to neutral; the three is not after treatment can be directly discharge of cooling water, reverse osmosis water etc.. According to the characteristics of wastewater quality, considering the high concentration wastewater, biodegradability is not high, uses in the anaerobic treatment settings before the hydrolysis acidification improved biodegradability, anaerobic section selects the high efficiency ABR (anaerobic baffled reactor) process[1].

Anaerobic process

ABR is called the third generation of anaerobic reactor, which not only biological solids retention ability, and hydraulic mixing conditions are good. With the development of anaerobic technology, hydraulic design of the process from simple plug flow or fully mixed to the development of the hybrid complex hydraulic flow[2]. Including the characteristics with the third generation of anaerobic reactor: reactor has good hydraulic fluid, the reactor through the improvement of structure, in which water is mostly plug flow and completely mixed compound flow combined volume of reactor, so it has high utilization rate, can obtain high processing ability; has good biological solids retention ability, and make a reactor for microbial growth in different areas, different stages of contact with water phase, the realization of the biological phase separation in a certain extent, which can stabilize and improve treatment effect of facilities; through structure improvement, extension of water flow in the reactor the flow path, thereby promoting the wastewater and sewage contact.

Anaerobic baffled reactor is a new high rate anaerobic reactor developed based on UASB, which has the advantages of simple structure, convenient operation and management, no need of filler, with excellent retention ability, start fast, hydraulic condition is good, stable and reliable operating performance of biomass.[3]

Technological process

The process design for the hydrolysis acidification process is added before the anaerobic reactor ABR, biological contact oxidation by aerobic process, considering the stability of the effluent and further improve the water quality of effluent, quartz sand filter arranged in the sedimentation tank after the process shown in Figure 1.

Monitoring of operating condition

Project after the completion of the actual operation stage of the influent water quality and main treatment structures water situation monitoring and analyzing the specific monitoring points, Figure 2.

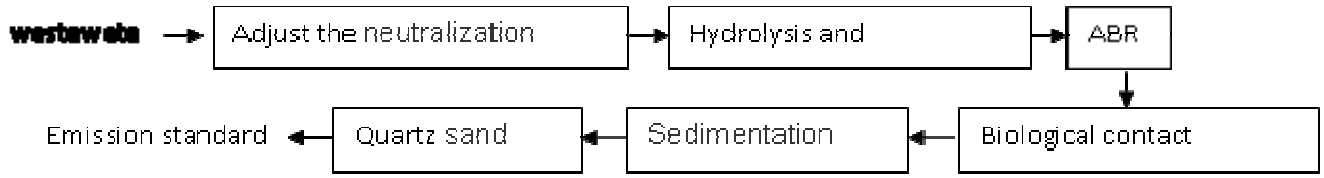

Figure 1 : Wastewater treatment process

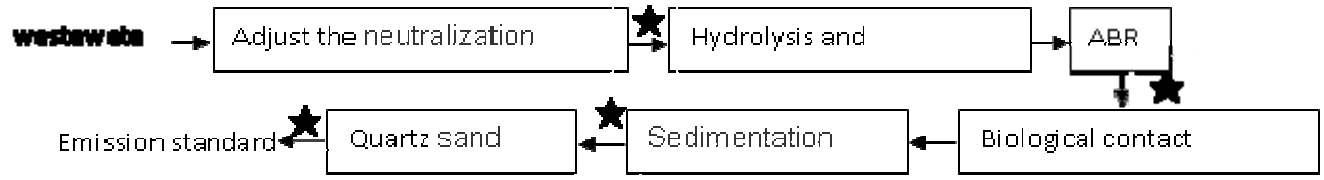

Figure 2 : Wastewater treatment process monitoring point bitmap

The monitoring of sample collection and analysis are made of the country and the industry standard method, monitoring analysis method and instrument are shown in TABLE 1.

TABLE 1 : Monitoring analysis method and instrument

Monitoring item	Monitoring method	Method source	instm	detection limit
pH	Portable pH meter method	/	pHB-4	/
COD	dichromate titration	GB/T11914-1989	Heating reflux device	10mg/L
BOD_5	Dilution and inoculation method	HJ505-2009	Biochemical incubator	0.5mg/L
NH_3-N	Nessler's reagent colorimetric method	HJ/T 535-2009	723 Spectrophotometer	0.025mg/L
SS	Gravimetric method	GB/T11901-1989	AB204-SElectronic analytical balance	4mg/L

Monitoring period of 2013.11.12~2014.10.11., the monitoring data were a year, every months to monitor. See TABLE 2~5 for the specific monitoring data.

TABLE 2 : Wastewater treatment station of the monitoring results (regulation pool)

Monitoring point	Monitoring time	pH	SS mg/L	COD mg/L	BOD_5 mg/L	NH_3-N mg/L	TP mg/L	TN mg/L
The wastewater treatment station total import regulation pool(★1)	2013.11.12	6.8	104	4041	1284	22.2	2.8	80.2
	2013.12.11	7.32	132	4320	1265	25.4	2.5	81.3
	2014.01.09	7.32	111	4533	1273	26.0	2.0	83.4
	2014.02.10	8.15	144	4655	1295	21.3	2.6	81.5
	2014.03.10	8.20	144	4856	1324	22.4	2.3	82.6
	2014.04.12	9.0	125	5145	1319	21.7	2.5	83.3
	2014.05.13	7.24	136	5437	1308	24.2	2.9	83.2
	2014.06.10	7.24	110	4328	1295	21.7	2.2	81.1
	2014.07.10	7.85	121	5322	1306	22.6	2.1	82.6
	2014.08.14	8.93	121	5100	1294	22.5	2.3	84.7
	2014.9.10	8.9	128	5206	1290	22.1	2.4	88.9
	2014.11.11	8.14	134	4195	1282	21.8	2.5	84.7
Mean value		/	125.8	4761.5	1294.6	21.0	2.4	83.1

TABLE 3 : Wastewater treatment station of the monitoring results (ABR)

Monitoring point	Monitoring time	pH	SS mg/L	COD mg/L	BOD_5 mg/L	NH_3-N mg/L	TP mg/L	TN mg/L
Wastewater treatment station of the monitoring results (ABR)(★2)	2013.11.12	7.90	93	1394	530	16.24	1.64	44.5
	2013.12.11	7.88	94	1395	531	16.67	1.54	44.4
	2014.01.09	7.88	95	1382	526	17.10	1.80	45.1
	2014.02.10	7.04	96	1389	528	16.81	1.66	45.4
	2014.03.10	7.63	91	1395	531	16.53	1.57	44.9
	2014.04.12	7.91	99	1390	530	16.96	1.54	45.0
	2014.05.13	7.08	92	1382	527	17.39	1.66	45.1
	2014.06.10	7.80	90	1387	528	16.10	1.46	45.0
	2014.07.10	7.42	94	1394	532	15.96	1.55	44.9
	2014.08.14	7.25	98	1387	528	17.10	1.50	45.0
	2014.9.10	7.84	97	1385	527	17.81	1.70	45.4
	2014.11.11	7.02	90	1380	526	16.24	1.69	45.7
Mean value		/	94.1	1388.3	528.7	16.74	1.61	45.0
Removal rate %		/	25.2	70.8	59.2	20.3	32.9	45.8

TABLE 4 : Wastewater treatment station of the monitoring results (Sedimentation tank)

Monitoring point	Monitoring time	pH	SS mg/L	COD mg/L	BOD_5 mg/L	NH_3-N mg/L	TP mg/L	TN mg/L
Wastewater treatment station of the monitoring results (Sedimentation tank)(★3)	2013.11.12	7.95	50	100	29	6.53	0.56	23.1
	2013.12.11	7.93	58	103	26	6.41	0.56	22.9
	2014.01.09	7.96	50	107	27	6.33	0.55	23.1
	2014.02.10	7.28	52	103	26	6.45	0.55	23.5
	2014.03.10	7.71	47	100	29	6.38	0.54	23.3
	2014.04.12	7.50	59	107	28	6.43	0.56	23.0
	2014.05.13	7.26	50	103	26	6.29	0.57	22.9
	2014.06.10	7.70	49	101	26	6.51	0.56	23.3
	2014.07.10	7.56	48	109	29	6.39	0.57	23.6
	2014.08.14	7.30	43	107	28	6.45	0.56	22.5
	2014.9.10	7.65	57	109	29	6.42	0.55	22.8
	2014.11.11	7.33	57	105	27	6.43	0.53	22.9
Mean value		/	51.7	104.5	27.5	6.42	0.56	23.1
Removal rate %		/	0.45	92.3	94.8	61.6	65.2	48.7

CONCLUSION

1. According to the monitoring data of the year, the wastewater treatment using hydrolysis acidification anaerobic +ABR reactor + biological contact oxidation and filtration process of suspended solids, chemical oxygen demand, five day BOD and ammonia nitrogen, total phosphorus and nitrogen removal rate were 80.7%, 98.9%, 99.1%, 77%, 92.1% and 79.8%. The treated wastewater effluent quality should meet the "pharmaceutical industrial water pollutant discharge standard" (GB21906-2008) in direct emission standard.

2. The actual operation results show that the ABR (anaerobic baffled reactor) on the extraction of traditional Chinese medicine pharmaceutical wastewater of pharmaceutical wastewater COD removal of up to 70.8%, the extraction of

traditional Chinese medicine pharmaceutical wastewater of pharmaceutical wastewater COD removal of up to 92.3% biological contact oxidation process.

TABLE 5 : Wastewater treatment station of the monitoring results (Quartz sand filter)

Monitoring point	Monitoring time	pH	SS mg/L	COD mg/L	BOD_5 mg/L	NH_3-N mg/L	TP mg/L	TN mg/L
Wastewater treatment station of the monitoring results (Quartz sand filter)(★4)	2013.11.12	7.80	28	53	12	5.23	0.18	17.8
	2013.12.11	7.75	22	55	11	5.24	0.20	16.9
	2014.01.09	7.85	24	60	13	4.27	0.19	17.3
	2014.02.10	7.80	30	57	12	6.31	0.20	16.4
	2014.03.10	7.75	23	55	12	5.22	0.17	16.8
	2014.04.12	7.71	25	47	10	5.26	0.20	15.9
	2014.05.13	7.51	20	55	11	4.29	0.22	18.5
	2014.06.10	7.80	28	57	13	4.30	0.19	14.8
	2014.07.10	7.50	20	53	11	4.31	0.16	15.6
	2014.08.14	7.47	20	53	12	5.26	0.18	17.1
	2014.9.10	7.60	24	55	13	5.29	0.16	17.3
	2014.11.11	7.44	27	53	13	5.24	0.18	17.1
Mean value		/	24.3	54.4	11.9	5.02	0.19	16.8
Removal rate %		/	53.0	47.9	56.7	21.8	66.1	27.3
Total removal rate %		/	80.7	98.9	99.1	77.0	92.1	79.8
Discharge standard of water pollutants for pharmaceutical industry Chinese traditional medicine category (GB21906-2008)		6~9	50	100	20	8	0.5	20

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