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Starch and starch sugar wastewater treatment technology scheme and operation monitoring

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ABSTRACT

This paper mainly through wastewater renovation project of a program of starch and starch sugar production enterprises and its actual operating results, the analysis of various treatment structures combined operation of the treatment plant treatment effect, the purpose is to understand the characteristics of each treatment structures in starch and starch sugar wastewater treatment process, for the follow-up design or improvement of starch and starch sugar the wastewater treatment technology has certain reference significance.

KEYWORDS

Starch and starch sugar; Wastewater treatment renovation; Monitoring results.

INTRODUCTION

Starch is polyhydroxylated natural high molecular compound, widely exists in plant roots, stems and fruits, food, medicine, chemical, papermaking, textile and other industrial sectors of the main raw material. The main raw material crop starch production is the corn, potato and wheat. Produce a lot of high concentrations of acidic organic wastewater in starch processing process, its content with the production fluctuation and change from time to time, which is mainly soluble starch and a small amount of protein, no general toxicity. The validity of this combined with the actual situation of project of a starch processing enterprises sewage treatment transformation analysis of wastewater treatment technology of starch industry.

A starch factory is a large enterprise of corn starch, the crystallization of glucose, corn by-products and production in one, with the expansion of enterprise scale and production scale, the original sewage station has been unable to meet the need of production, in order to enterprise rapid development, enterprise decided to expand the sewage treatment station.

CURRENT BASIC SITUATION

Water quality

Water Quality:pH3.8～4.5, COD3000～4000mg/l, TKN≤400mg/l, $BOD_5$1500～2500mg/l ;

Water Yield: 1500m^3/d.

The treated wastewater effluent quality should meet the “Discharge standard of water pollutants for starch industry (GB 25461-2010)” : COD_{Cr}≤100mg/L ; BOD_5≤20mg/L ; SS≤ 30mg/L ; NH_3-N≤15mg/L ; pH : 6~9 ; TP : ≤1.0 mg/L.

Basic Process

The existing wastewater treatment process using anaerobic section UASB (upflow anaerobic sludge bed), good oxygen biological contact oxidation pool, the specific basic process shown in Figure 1.

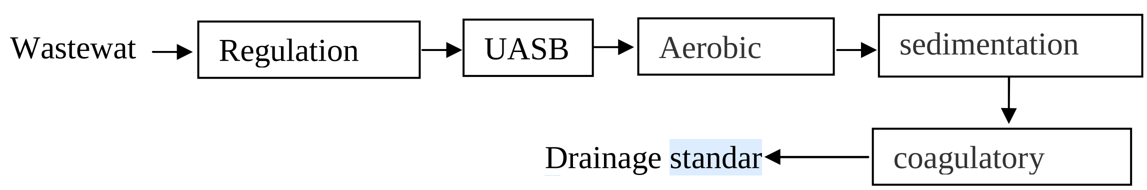

Figure 1 : The existing wastewater treatment process

RETROFIT SCHEME

The basic idea

The basic principle of transformation project of the treatment of wastewater 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; in situ transformation process as far as possible the use of a successful case of mature technology, technology, give full play to the advantages of mature technology, to ensure the stable operation of; combining with the use of existing civil engineering structures in the transformation process, the maximum possible reduction in the cost of investment. Because the system increased nearly doubled the original wastewater, anaerobic and aerobic system has been far can not meet the processing requirements, to build a new anaerobic and aerobic system, processing ability of new anaerobic system is 3000 m^3/d, the current anaerobic process basically using UASB and IC (anaerobic internal circulation reactor) technology of[1].

Anaerobic process selection

In a IC reactor, internal circulation reactor strong internal circulation stirring the sludge bed for good mixing, and therefore has no effect on the toxicity of inhibition of IC reactor process; IC and UASB reactor overflow weir need regular cleaning, and cleaning the surface of the IC reactor is only 10% of UASB, and the UASB reactor inlet distribution system need to be cleaned regularly, but the intake distributor IC do not need special cleaning; in UASB reactor, the bottom area of great on the distribution of a large number of small cloth water, very easy to cause the jam fault, this block mainly due to fiber accumulation and calcium salt deposition caused. While in the IC reactor, the water distributor is a special cloth water using large aperture in the bottom area is very small on the basic, and therefore can not be clogged; IC reactor; at the same time, allowing higher up flow rate, solid impurities can be out of the reactor and not to leave and cumulative stop in the reactor, thereby the stability of long-term operation of IC reactor is guaranteed[2]. Based on the above analysis, and through the practical application of similar enterprises investigation, considering the economic and technical indicators, the renovation project of anaerobic process, decided to adopt the investment, less land occupation, in the fermentation industry has more application of IC technology in[3].

Technological process

This modification content to increase the IC reactor before the original UASB, due to nitrogen containing effluent in anaerobic aerobic process route, therefore must consider the removal of nitrogen. Therefore consider the process using A/O to achieve nitrification and denitrification of nitrogen removal, according to the actual situation of this transformation, can be UASB the transformation of the original process for nitrogen pool (A) and aerobic pool (O), aerobic system all of the original as aerobic, considering the stability of the effluent and further improve the effluent water, add MBR after the coagulation sedimentation tank (membrane bioreactor), this transformation can make better use of existing facilities, The modified process as shown in Figure 2.

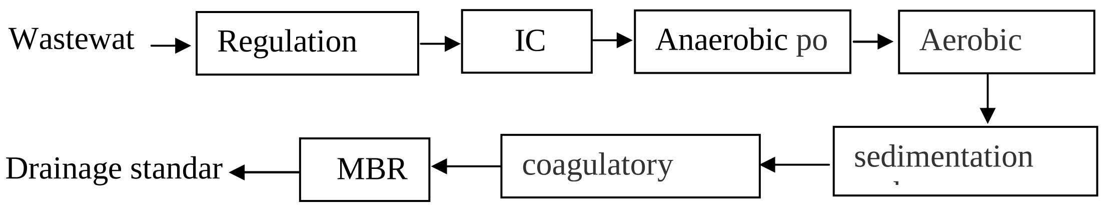

Figure 2 : After the transformation of wastewater treatment process

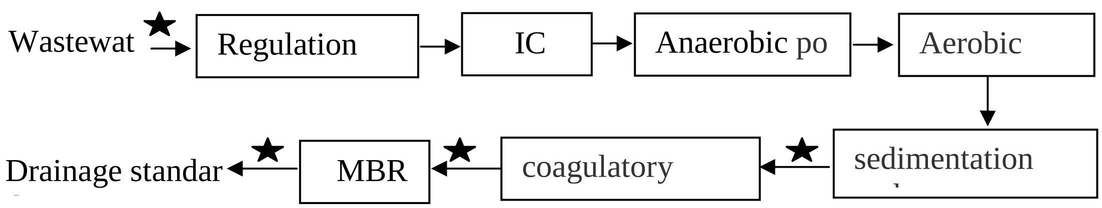

Figure 3 : Monitoring point bitmap

Monitoring period for the November 12, 2012 ~2013 year in October 11th, a total of one year's monitoring data, every months to monitor a. See table 1~4 for the specific monitoring data.

TABLE 1 : Wastewater treatment station of the monitoring results (regulation pool)

Monitoring point	Monitoring time	H	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）	2012.11.12	1.8	401	3040	1280	31.2	22.8	120
	2012.12.11	.32	432	3323	1260	32.4	22.5	121
	2013.01.09	.32	511	3530	1270	32.0	23.0	123
	2013.02.10	.15	564	3650	1290	31.3	22.6	121
	2013.03.10	.20	444	3850	1320	31.4	22.3	122
	2013.04.12	1.0	525	3140	1310	32.7	22.5	123
	2013.05.13	.24	463	3430	1300	32.2	22.9	123
	2013.06.10	.24	510	3320	1290	31.7	23.2	121
	2013.07.10	.85	521	3320	1300	32.6	22.1	122
	2013.08.14	.93	521	3100	1290	32.5	22.3	124
	2013.9.10	0.9	482	3200	1290	32.1	22.4	128
	2013.11.11	.14	587	3190	1280	31.8	22.5	124
Mean value			497	3300	1290	32.0	22.6	123

TABLE 2 : 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)（★2）	2012.11.12	7.90	353	94	30	0.624	3.64	24.5
	2012.12.11	7.88	454	95	31	0.667	3.54	24.4
	2013.01.09	7.88	445	82	26	0.710	3.80	25.1
	2013.02.10	7.04	406	89	28	0.681	3.66	25.4
	2013.03.10	7.63	431	95	31	0.653	3.57	24.9
	2013.04.12	7.91	359	90	30	0.696	3.54	25.0
	2013.05.13	7.08	402	82	27	0.739	3.66	25.1
	2013.06.10	7.80	440	87	28	0.610	3.46	25.0
	2013.07.10	7.42	404	94	32	0.596	3.55	24.9
	2013.08.14	7.25	488	87	28	0.710	3.50	25.0
	2013.9.10	7.84	427	85	27	0.781	3.70	25.4
	2013.11.11	7.02	510	80	26	0.624	3.69	25.7
Mean value		/	427	88	29	0.674	3.61	25.0
Removal rate %		/	14.1	97.3	97.8	97.9	84.0	79.7

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

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 (coagulatory settler)（★3）	2012.11.12	7.95	170	60	19	0.353	0.661	23.1
	2012.12.11	7.93	288	53	16	0.410	0.664	22.9
	2013.01.09	7.96	230	57	17	0.339	0.652	23.1
	2013.02.10	7.28	342	53	16	0.453	0.659	23.5
	2013.03.10	7.71	247	60	19	0.381	0.649	23.3
	2013.04.12	7.50	229	57	18	0.439	0.662	23.0
	2013.05.13	7.26	280	53	16	0.290	0.677	22.9
	2013.06.10	7.70	199	51	16	0.510	0.668	23.3
	2013.07.10	7.56	198	59	19	0.396	0.671	23.6
	2013.08.14	7.30	253	57	18	0.453	0.662	22.5
	2013.9.10	7.65	207	59	19	0.424	0.651	22.8
	2013.11.11	7.33	287	55	17	0.439	0.633	22.9
Mean value		/	244	56	18	0.407	0.659	23.1
Removal rate %		/	42.9	36.4	37.9	39.6	81.7	7.6

CONCLUSION

According to the monitoring data of the year, the reconstruction project of wastewater treatment station by IC+A/O processing unit of suspended solids, chemical oxygen demand, five day BOD_5 and ammonia nitrogen, total phosphorus, total nitrogen removal rate were 14.1%, 97.3%, 97.8%, 97.9%, 84% and 79.7%; coagulation and sedimentation treatment unit of suspended solids, chemical oxygen demand, ammonia nitrogen, total phosphorus and BOD_5, total nitrogen removal rate were 42.9%, 36.4%, 37.9%, 39.6%, 81.7% and 7.6%; MBR pool the processing unit of the suspended solids, chemical oxygen demand, ammonia nitrogen, total phosphorus and BOD_5, total nitrogen removal rate was 90.2%, 1.8%, 5.6%, 32.9%, 71% and 10.4%. The wastewater treatment station of suspended solids, chemical oxygen demand, five day BOD and ammonia nitrogen, total phosphorus, total nitrogen, total removal rate respectively is 95.2%, 98.3%, 98.7%, 99.1%, 99.2% and 83.2%. The removal efficiency of the modification project, ammonia nitrogen and total phosphorus and suspended solids, chemical oxygen demand, five days biochemical oxygen demand, total nitrogen reached the design target.

2.The actual operation results show that the sand biofilter (MBR) on suspended solids and total phosphorus removal efficiency is high, can reach more than 90% and 70% respectively, while the COD and BOD_5 removal efficiency is low, the average removal rate of only 1.5% and 5.6%.

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

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 (MBR)（★4）	2012.11.12	7.80	28	53	16	0.238	0.185	20.8
	2012.12.11	7.75	22	55	17	0.247	0.206	20.9
	2013.01.09	7.85	24	60	19	0.278	0.198	21.3
	2013.02.10	7.80	30	57	18	0.318	0.209	20.4
	2013.03.10	7.75	23	55	15	0.221	0.170	20.8
	2013.04.12	7.71	25	47	16	0.264	0.201	20.9
	2013.05.13	7.51	20	55	17	0.290	0.220	20.5
	2013.06.10	7.80	28	57	16	0.301	0.194	20.8
	2013.07.10	7.50	20	53	16	0.318	0.169	20.6
	2013.08.14	7.47	20	53	17	0.267	0.182	20.1
	2013.9.10	7.60	24	55	17	0.295	0.166	20.3
	2013.11.11	7.44	27	53	16	0.244	0.185	20.1
Mean value		/	24	55	17	0.273	0.191	20.7
Removal rate %		/	90.2	1.8	5.6	32.9	71.0	10.4
Total removal rate %		/	95.2	98.3	98.7	99.1	99.2	83.2
Discharge standard of water pollutants for starch industry (GB 25461-2010)		6~9	30	100	20	15	1.0	30

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