The Start-up Mode Test of SBR Process for Pickle Wastewater Treatment

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Abstract

Salted wastewater with high salt properties, the salinity range at about 6%, its treatment processing is difficult .This experiment studies the start time and treatment effect of SBR process in different ways (stage cultivation ,full cultivation).The experimental study shows that: with the use of 2-stage salinity increasing method,the start time of SBR process for wastewater treatment being five months,the removal rate of COD,ammonia nitrogen and phosphorus respectively is 85%,87% and 88%.Using the method of low load operation for raw water,the start time being six months,the removal rate of COD,ammonia nitrogen and phosphorus respectively is 73%,72%and73%;So during the start time in SBR process for wastewater treatment ,2-stage increasing method is recommended.

Keywords:Salinity, Time, COD, Ammonia Nitrogen and Phosphorus

1. Introduction

Pickle wastewater with the characteristics of high salt,high nitrogen and phosphorus concentration of organic matter,the BOD_5/COD is 0.4,and salinity of wastewater is as high as 6%(in Nacl).Due to the high salt inhibition of general microbiology[1-4],the treatment for pickle wastewater is more difficult.At present,a variety of process for high salt wastewater biological treatment is used, but the conclusion is not very consistent.Studies have shown that the effect of high salt wastewater biological treatment depends on the growth of microorganism in the device[6].

This experiment studied the effect of SBR process for wastewater treatment in different start-up mode(stage cultivation[7],full cultivation,to determine the best start-up one for SBR process for wastewater treatment.Sequencing Batch Reactor Process(short for SBR process)with the advantages of high efficiency,flexible operation mode,good denitrification and phosphorus removal effect and less prone to sludge bulking is widely used,and provide an important theoretical basis for the operation of sewage treatment plant,also can provide certain reference value for the seawater use [8].

2. Materials and Methods

2.1 Test Device

This experiment adopts two sets of SBR reactor for start experiment of wastewater treatment,through the contrast test to determine the best way to start.Two sets of device are made of transparent organic glass,the effective volume of 10L.Device equipped with aeration device, control the stability of dissolved oxygen in the reactor, and ensure the sludge and wastewater of the equipment in the completely mixed state, water from the high water tank directly, and set up the automatic control device to ensure the plant stable operation.The test apparatus is shown in figure 1.

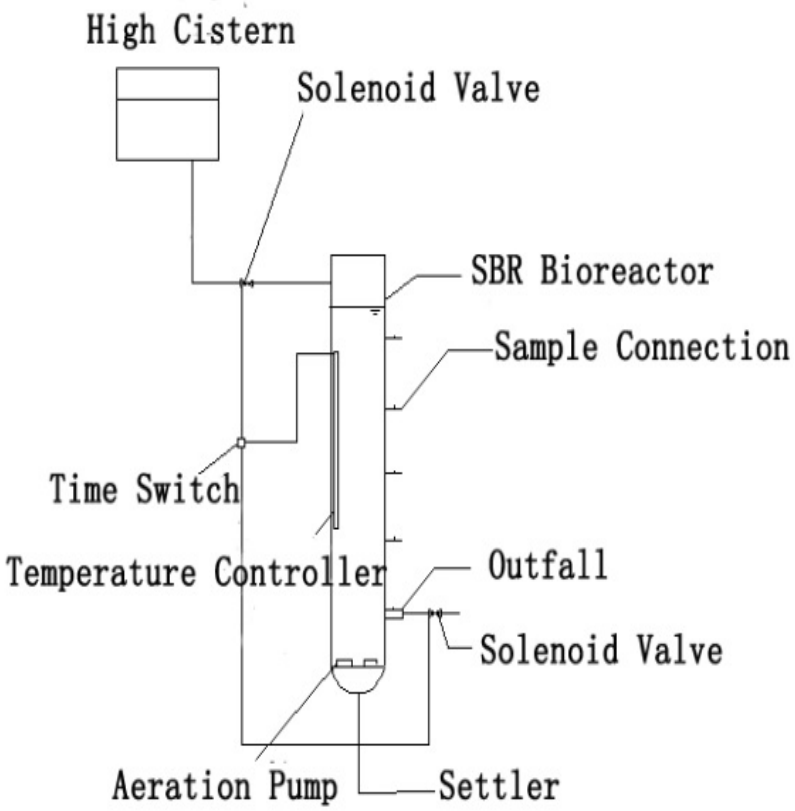

Fig.1.Schematic diagram of experimental set-up

2.2 Main equipment and instruments

PH meter, the type 752 UV-visible spectrophotometer, HC - 3518 high speed centrifuge, titrator, multi-purpose furnace, constant temperature water-bath water, dissolved oxygen meter.

2.3 Wastewater quality

The wastewater for test is anaerobic biological filter water, water quality: 5% ~ 7% salinity, COD_{Cr} 1700±500 mg/L, BOD_5, 680±500 mg/L, pH 4.5 ~ 7, NH_4 + N98 ~ 112 mg/L, PO_4^{3-} -- P 20 ~ 40 mg/L, volatile fatty acid VFA 8mmol/L .

3. The changes of COD during the stage of cultivation and domestication process

The influent of SBR technology for water was the mixture of nutrient liquid and anaerobic biological filter efflutent according to certain proportion,by changing the proportion of inflluent ,the salinity of which was controled onceat the ratio of 1%~6%.By using $NaHCO_3$, PH of the mixed liquid was adjusted to 6.6±2,SBR reactor for intermittent reactor,two cycles a day,each time changing the water7L,inlet 15min,6h aeration, mixing 3h, 2h precipitation, drainage 15min,static 30min run mode.Determine the results of effluent after each time increasing salinity ,improving the salt content after the operation of device temperature.The result is shown in figure 2.

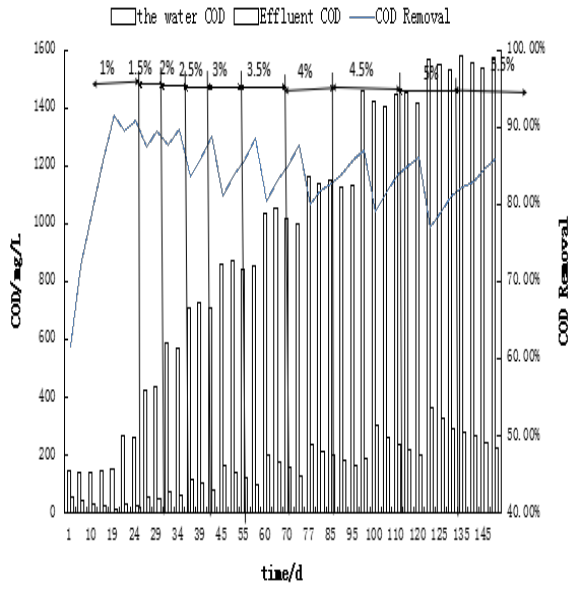

Fig.2.The effect of COD treatment in the process of 2-stage salinity ascension

It can be seen from figure 2,with the gradual increase of water salinity, the removal rate of COD have certain fluctuation,whenever the water salinity increases, the removal rate of COD can be reduced, followed by a period of recovery, adaptation to salinity of microorganisms in the device, the COD removal rate increases;when the water salinity in 1%~3%, the COD removal rate is about 87%, the recovery time in about 5 days; when the water salinity is greater than 3%, SBR process start up time increased with the increase of salinity, when the influent salinity reached 5.5%, SBR process recovery time for 25 days, after the recovery, the COD removal rate in 85%, the treatment effect is good, illustrating that through staged training start time of SBR process is in about 150 days.

3.1 The removal of ammonia nitrogen in SBR after stable operation

After the stable start-up operation in two sets of SBR devices,two sets of devices were observed and determined value of the effluent ammonia,de termining the removal effect of ammonianitrogen ,further to determine the suitable picking wastewater SBR start-up mode;stagecultivation method for 1# device, 2# device to run at full capacity;two sets of devices are running f or 30 days in the salinity 5.5%, two units of ammonia and nitrogen water is basically stable at around 60mg/L,with the determination of the value of t he effluent ammonia per day.The effluent ammonia and ammonia nitrogen r emoval rate as shown in figure 3.

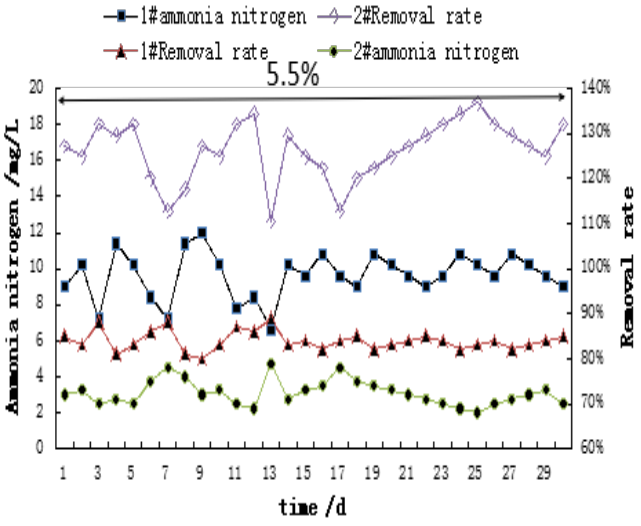

Fig.3.SBR ammonia nitrogen removal condition

It can be seen in Figure 3 that the stable operation lasts for 30 days in the amount of salt in 5.5% of the cases.During the process,the ammonia of the effluent is basically stable at 10mg/L in 1# devices,and the ammonia in 2# device is at about 18mg/L;The removal rate of ammonia and nitrogen in 1# is

basically in 87%, and 2# only 72%;Based on the ammonia nitrogen removal effect ,it can be seen the wastewater ammonia and nitrogen removal effect of stage cultivation method for the acclimated sludge is better.

3.2 The removal rate of phosphorus after stable operation

After the stable operation of two sets of SBR devices,observe the concentration of phosphorus of the effluent in two sets of devices and determine the removal effect of phosphorus in two units;1# device for stage cultivation method,2# device for full load operation method;two sets of devices are run for 30 days at a salinity of 5.5%,and the concentration of phosphorus of inlet in two devices is at about 27mg/L stably. The effluent content of phosphorus being measured every day , the phosphorus of effluent and the removal rate of it are shown in figure 4.

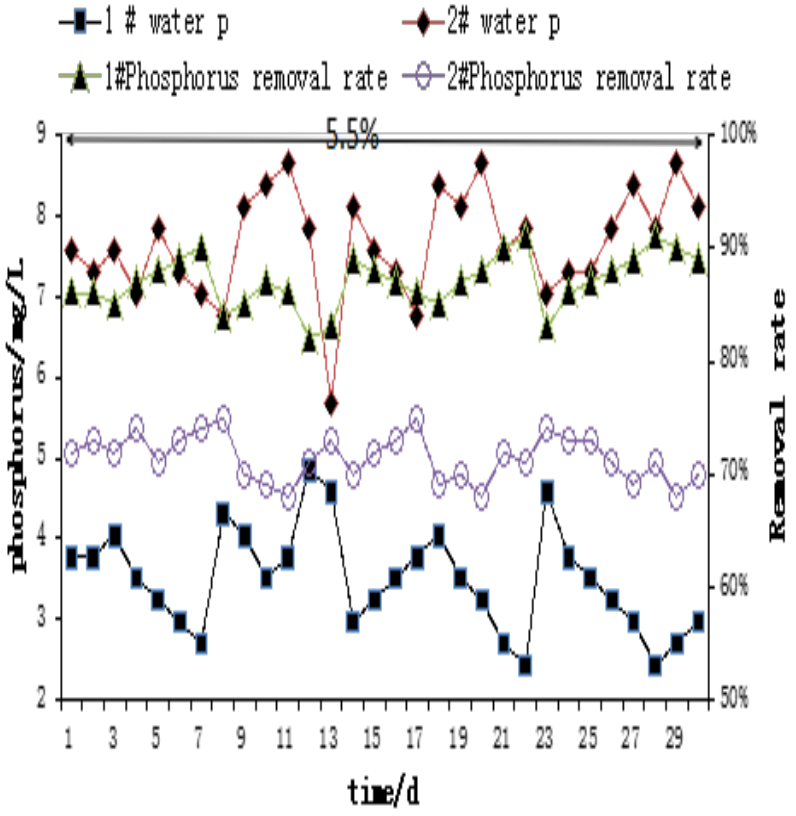

Fig.4.The SBR process for phosphorus removal

It can be seen from figure 4 that during the 30 days when we run the waste water containing the salt concentration of 5.5%, the phosphorus of effluent in 1#

device was basically stable at around 3mg/L,and the removal rate of it was at 88%,and for 2# the concentration and removal rate are at 8mg/L and 73% respectively.The removal rate of phosphorus of pickling wastewater by the stage cultivation method for acclimated sludge was significantly higher than that of raw water of low load method for acclimated sludge .

4. Conclusion

(1)The use of stage cultivation method and full load operation method to acclimate pickling wastewater sludge is feasible, the acclimation time of stage cultivation method is short,about 5 months;the removal effect of COD in picking wastewater using acclimated sludge is better,reaching more than 85%.Stage cultivation method is more suitable for domestication treatment of high salinity wastewater sludge.

(2)The acclimated sludge of stage cultivation method had good effect on ammonia and nitrogen,the effluent ammonia basically stable below 10mg/L, ammonia nitrogen removal rate reaching 87%; and full load running the acclimated sludge on the ammonia nitrogen removal rate is only about 72%.

(3)The acclimated sludge of stage cultivation method had good effect on phosphorus,the effluent phosphorus basically stable below 3mg/L, the removal rate reaching about 88%,while the removal rate of phosphorus using full operation of the acclimated sludge is only about 73%.

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