

循序间歇式活性污泥法处理 造漆工业废水^{*}

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摘要 循序间歇式废水生物处理工艺(SBR工艺)集进水、厌氧、好氧、沉淀于一池, 改变其运行程序不仅可去除有机物, 还能达到脱氮除磷效果。

试验结果表明, 工艺的运行周期为22h(其中进水1h, 进水和厌氧搅拌6h, 好氧14h, 沉淀及排水各1h), 进水COD浓度在1000~4000mg/L时, COD去除率为84%以上, 最高达96%。另外, 本文还分析了有机物的去除特点。

关键词 循序间歇式反应器, 活性污泥, 造漆废水。

中小型造漆厂生产废水不宜采用连续式生物处理工艺。循序间歇式废水生物处理工艺(SBR工艺)是一项新型高效废水生物处理技术^[1]。它集进水、厌氧、好氧、沉淀于一池, 适合于中小规模有机废水处理。近年, 笔者对此工艺进行较系统研究^[1], 通过改变其运行程序不仅可去除有机污染物, 还能达到脱氮除磷效果。本文将重点介绍应用此工艺处理某造漆厂的生产废水, 为我国此类废水处理提供一条新途径。

1 试验材料与方法^{*}

1.1 试验装置

试验用SBR反应器由碳钢焊接, 外涂防锈漆, 有效容积3m³。底部设置Φ200的微孔曝气头(江苏省宜兴水处理设备厂生产)两个。空气气源由空气压缩机供给。试验时, 通过一套PC机自动控制系统, 根据试验的需要选定每周期的总水力停留时间及进水、厌氧、好氧、沉淀和排水时间, 使试验装置按厌氧-好氧顺序自动控制。试验装置内污泥混合液的厌氧搅拌, 由一台无级调速电机驱动, 通过减速器减速, 由皮带传动各级搅拌叶轮, 电机转速120—1250r/min, 减速器速比为1:30, 浆叶速度可以在4.17—41.7r/min范围内无级调节, 便于选择最佳速度。整个试验系统如图1所示。

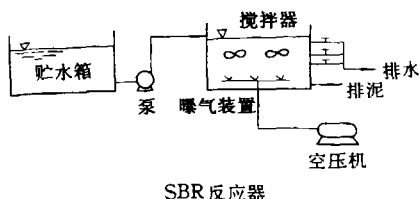


图1 试验装置示意图

1.2 试验用水

试验用水取自我国华东某市造漆厂生产废水, 主要由熬油车间排放的废水, 醇酸树脂车间生产废水和氨基树脂生产废水三股组成。其中, 氨基树脂为间歇式生产。试验时, 直接采用各车间所排放的生产废水, 按照其排放比例进行配制。由于原水中N、P含量极低, 配水时另投加一定数量的KH₂PO₄和尿素作为磷源和氮源, 以满足微生物的生存需求。然后, 经适当稀释混合进入SBR反应器。

2 试验结果与讨论

2.1 运行时序的调整阶段

此阶段是在采用该试验装置进行熬油废水

^{*} 国家环保局科技发展计划课题

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处理完全正常达稳定运行后¹⁾,自 1992 年 1 月 4 日,将进水换为工厂的生产混合废水进行试验。其中熬油废水处理期间装置的运行时序如图 2 所示。

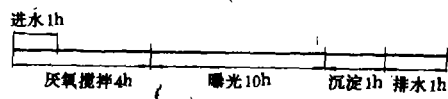


图 2 试验装置处理熬油废水的运行时序

1992 年元月 4 日至 27 日,装置按图 2 所示的时序运行,所得的 COD 去除情况如图 3 所示。

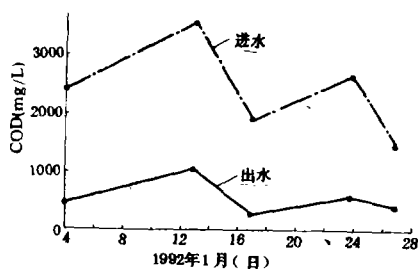


图 3 混合废水驯化初期,试验装置 COD 变化情况

进水 pH6.5—7.8,出水 pH6.4—7.8
水温为 3—6℃。

另外,此阶段污泥性能为,MLSS 约 8g/L, SV=25—30%,污泥龄 8d。

上述结果表明,按图 2 所示时序运行,试验装置出水 COD 偏高,这主要是因为试验装置进水换为混合废水后,处理水中除熬油废水外,还含有醇酸树脂和氨基树脂生产废水,其中含有大量的苯系化合物¹⁾,增加了废水的毒性,使废水的组成发生了根本性变化,导致微生物不能很快适应。为了提高处理效率,增强微生物的适应能力,需适当延长微生物与废水中有机物的接触反应时间。因此,自 1992 年 1 月 27 日,分别增加厌氧段和好氧段时间,调整后的运行时序如图 4 所示。

自 1992 年 1 月 31 日,装置停止运行。直到 2 月 11 日重新启动运行。此间的试验结果如图 5 所示。

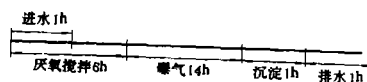


图 4 试验装置处理混合废水的运行时序

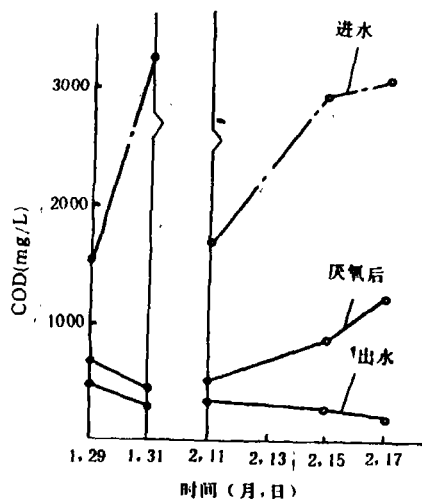


图 5 运行时序调整后试验装置的 COD 变化情况(其余参数变化同图 3)

上述结果表明,试验装置的运行时序调整后,其处理效果得到改善。重新启开后,运行不到一个星期,装置的处理效果得到恢复,处理效率在 80%以上,且逐渐提高。这表明,SBR 运行稳定性强,能耐受由意外事故性破坏而造成的冲击,具有很强的环境适应力,这对于生产连续性差的工厂的废水治理尤为重要。

2.2 稳定运行阶段

从 1992 年 2 月 17 日开始,试验装置进入混合废水处理的稳定运行阶段。

混合废水中主要污染物浓度,COD:1000—4000mg/L BOD₅:600—1250mg/L;油:55.5—250.0mg/L 二甲苯:0.26—13.8mg/L。

试验运行期间,厌氧段 DO 控制在 < 0.3mg/L,好氧段 DO 控制在 4.0—5.0mg/L。

稳定运行阶段,试验装置处理混合废水的结

1) 中国环境科学研究院,废水间歇式生物处理法(SBR)系列装置研究课题总报告,1992 年 6 月。

果如表 1 及图 6 所示。

表 1 混合废水处理稳定运行阶段 COD 变化情况¹⁾(mg/L)

序号	日期 (月,日)	进水浓度	厌氧出 水浓度	出水浓度	去除效 率(%)
1	2 17	3040.0	1214.7	198.6	93.5
2	2 20	4339.2	1060.8	136.8	96.7
3	2 22	2913.3	867.9	124.0	95.7
4	2 24	1639.3	374.3	171.5	89.5
5	2 26	1038.4	217.3	110.0	89.4
6	2 28	2258.0	335.1	114.1	94.9
7	2 29	1823.3	425.6	183.4	89.9
8	3 5	1685.6	450.9	130.4	92.3
9	3 6	1738.7	203.7	172.9	90.1
10	3 8	2806.1	534.1	150.6	94.6
11	3 9	3661.1	733.4	173.4	95.3
12	3 10	1906.0	215.4	149.4	92.2
13	3 12	3692.5	184.6	156.9	95.8

1)有毒物二甲苯的出水浓度为 0.007—0.03mg/L;水温 3—10℃;进水 pH6.5—7.8 出水 pH6.4—7.8。

从表 1 可以看出,在稳定运行阶段,试装置处理效果理想,COD 的去除率在 84%以上,最高达 96%。

上述结果还进一步表明,在此期间尽管因生产原因导致进水浓度波动很大,出水水质始终保持了相当的稳定性。因此,SBR 反应器不仅能处理较高浓度的难降解有机废水,而且耐冲击负荷能力强。这一特性对于生产季节性变化大,排放废水规律性很差的工厂尤为重要。

另外,上述结果还表明,厌氧结束时进水 COD 的降解率在 55%以上。因此,厌氧作用对于造漆混合废水中有机污染物降解极为重要,其机理待进一步研究。

3 结论

(1) SBR 工艺处理造漆工业生产混合废水,进水 COD 浓度在 1000—4000mg/L,去除率为

84%以上,最高达 96%。而且,COD 去除主要发生在厌氧阶段。

(2)在低水温(3—6℃)条件下,SBR 反应器停止运行数天后,可以快速启动,稳定运行。表明此工艺特别适用于连续生产性差的工厂的有机废水治理。

(3) SBR 工艺有很强耐冲击负荷能力。因此,适应于水质变化幅度大的造漆行业废水处理。

致谢 试验阶段,曾得到江苏常州能源设备总厂、常州造漆厂等单位多方面支持与帮助,谨表衷心感谢。

参 考 文 献

- 1 周岳溪等.环境科学.1992,13(4):2

of sludge clogging, liquid shortcircuiting and aggregation of scum have been solved. The experiment of treating aerobic excess sludge studied in 120 liter reactor at 35°C shows that the organic pollutant removal efficiency of 51.4%—58% is reached corresponding to HRT=3.53—8.57 days. When HRT is fixed at 7.5 days, the organic loading rate, COD loading rate and average organic removal efficiency are 2.97 KgSS/(m³·d), 3.89 kgCOD/(m³·d) and 55.3%, respectively. The methane content of biogas is more than 66%.

Key words: two-phase digestion, anaerobic reactor, aerobic excess sludge treatment.

Production Test on Facultative Anaerobic-AB Process in Treating Slaughterhouse Wastewater and Its Microbiological Characteristics. Zheng Dandan et al. (Chengdu Institute of Biology Academia Sinica, Chengdu 610041); *Chin. J. Environ. Sci.*, 14(4), 1993, pp. 66—70

To treat the slaughterhouse wastewater of Neijiang Comprehensive Processing Plant, facultative anaerobic-AB process was used. During the trial operation, the loading rate of facultative anaerobic regulating tank was 0.50 kgCOD_{Cr}/m³, and its removal rate of COD_{Cr} (η COD_{Cr}) was 31.15% the sludge loading rate (B_{rs}) in A-stage was 4.78 kgBOD₅/(kgMLSS·d) and η COD_{Cr}=53.37%; in B-stage, B_{rs}=0.73 kgBOD₅/(kgMLSS·d) and η COD_{Cr}=54.70%. There was no problem for this process in compliance with the national standards, the effluent had COD_{Cr} 103.1 mg/L (η =88.77%), BOD₅ 32.0 mg/L (η =94.47%), SS 36.1 mg/L (η =89.64%), Color 26 times (η =80.60%), and pH 7.72. When this process was put into formal operation, its effluent quality remain stable with η =0.48. Results indicated that this process was stable with high efficiency and low investment needed. It is an advanced process worth spreading. There was an anaerobic digestion microorganism community in the biomembrane formed on the support material in facultative anaerobic regulating tank; besides this, there were different biosystematics existing in A and B stages' aerobic tanks, A-stage is predominant in bacteria and B-stage in protozoa. The analysis of the microbiological characteristics of this process offer theoretical basis for using it to treat other kinds wastewater.

Key words: facultative anaerobic-AB process, slaughterhouse wastewater, production test, microbiological characteristics.

A Study on the Treatment of Paint Wastewater by a Sequencing Biological Batch Reactor. Zhou Yuexi et al. (Chinese Research Academy of Environmental Sciences, Beijing 100012); *Chin. J. Environ. Sci.*, 14(4), 1993, pp. 71—73

In this paper, the research was made on the treatment of paint wastewater by a sequencing biological batch reactor. The experimental results demonstrate that the biological batch system can effectively remove organic matter. With the experimental time sequence (flow-in 1 h., anaerobic 6 h., aerobic 14 h., setting 1 h. and flow-out 1 h.), the removal rate of COD is 84%—96% (influent COD is 1000—4000 mg/L).

Key words: sequencing biological batch reactor, paint wastewater.

The Effects of the UV Light on the Catalase (CAT) Activity of Several Species of Aquatic Plants. Li Hongwen et al. (Suzhou Institute of Urban Construction and Environmental Protection,

Suzhou 215008); *Chin. J. Environ. Sci.*, 14(4), 1993, pp. 74—77

By testing the volume of O₂ which is released after the CAT of the plants exposed to exceeded UV decomposed H₂O₂, the CAT activity of the exposed plants is determined. The results show that the CAT activities for three plant species, *Azolla imbricata*, *Lemna minor*, *Alternanthera philoxeroides*, obviously rose respectively after they had been exposed to exceeded UV in different hours. But the maximum values of the CAT activities for three plant species is vary with different species. There is a maximum value of the CAT activity for *Azolla imbricata* which is exposed to exceeded UV in 72 hours. There is a maximum value of the CAT activity for *Lemna minor* which is exposed to exceeded UV in 24 hours. There is a maximum value of the CAT activity for *Alternanthera philoxeroides* which is exposed to the exceeded UV in 8 hours. The CAT activities for three plant species decreased respectively in some hours after the influence of the UV had been withdrawn. This shows that there obviously are stimulative affects of the exceeded UV on the CAT active for three plants. Meanwhile, the tissues and metabolism of the exposed plants are injured by the exceeded UV. It finally leads up to decrease the CAT activity of the exposed plants. The ecological effects of various plant species on the exceeded UV are different.

Key words: Catalase (CAT), Ultraviolet (UV), *Lemna minor*, *Azolla imbricata*, *Alternanthera philoxeroides*.

Improvement in the Pretreatment Method of Samples for the Determination of Sulfides in Wastewater. Wu Yuzhen. (Nanning Environmental Monitoring Station, Nanning 530012); *Chin. J. Environ. Sci.*, 14(4), 1993, pp. 78—80

The pretreatment method of samples, known as N₂-blowing method, for the determination of sulfides in wastewater has been further studied and improved. The improvement includes the test apparatus, pretreatment procedure, acidity and temperature used in the pretreatment, and the volume of reaction bottle. Particularly, a multihole blowing ball was used to replace the single hole blowing pipet, and a mixture of NaOH, EDTA and TEA was used as the blowing-absorbing solution instead of ZnAc₂-NaAc. Then a step-wise pressure procedure has been suggested. The studies on the recovery and precision of the improved method and the comparative determination of six different kinds of industrial wastewater show that the improvement has seen an obvious effectiveness and the recovery increases from 40% for the original method to over 95% for the improved method. The blowing time is shortened by 25%. The apparatus is easy to operate.

Key words: N₂-blowing method, multi-hole blowing ball, sulfide.

Quality Control for the Analysis of Volatile Organic Pollutants by GC-MS. Sun sien et al. (The Research Center for Eco-Environmental Sciences, Academia Sinica, Beijing 100085); *Chin. J. Environ. Sci.*, 14(4), 1993, pp. 81—86

This paper described the Quality control for the analysis of volatile organic pollutants by GC-MS according to the US EPA CLP programme. The criteria of quality control in the process of analysis were presented. Five samples have been analysed in order to demonstrate the procedure. This method is used to quantify most volatile organic compounds having boiling points below 200°C and compounds are insoluble in water. The practical quantitation limit