

Pilot Scale Research on Combined A^2/O and Suspended Carrier Biofilm Process for Phosphorus Removal

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Abstract Combined process of A^2/O and suspended carrier biofilm process (SCBP) in pilot scale was used to enhance phosphorus removal. Effects of COD/TP ratio and dissolved oxygen (DO) on phosphorus removal were investigated. The results indicate that the average TP removal rate is 82% during the 180 d operation, which meet the requirement of GB/T18921-2002. Nitrate is no more used as an electron acceptor by denitrifying phosphorus removal bacteria (DPB) when NO_3^- -N concentration decreases to lower than 0.20 mg/L in this test. The optimal COD/TP ratio is 60 for this test. Due to the addition of modified suspended carrier by nanotechnology, effluent TP concentration reaches 0.3 ~ 0.35 mg/L when the DO concentration in aerobic tank is 2.0 mg/L.

Key words Phosphorus removal; A^2/O ; suspended carrier biofilm process (SCBP); biofilm

CLC number X703 **Document code** A **Article ID** 0529-6579 (2007) S1-0291-02

The SCBP is a new type of attached growth system that has gained a lot of interest in the last decade^[1]. The SCBP has come to an extensive use for nitrification and denitrification of municipal sewage^[2]. The feasibility of combined process of A^2/O and SCBP has been gradually verified for the innovation of original wastewater treatment plant (WWTP)^[3-4]. But most of researchers focused on nitrogen removal, little has been reported about phosphorus removal. The specific purpose of the present work is to investigate the phosphorus removal of combined process in pilot scale and further to give some advice on the operation of WWTP.

1 Experiments

The wastewater was obtained from Yingkow WWTP during operation, and the characteristics of wastewater are analyzed prior to test. The tested suspended-carrier was purchased from Dalian Yudu environmental Co. The carrier consisted of 8 mm long pieces of an black extruded tube (diameter 10 mm), the specific surface area is 500 ~ 1 100 m²/m³, and density is approximately 1.0 g/cm³. The effective volume of pilot scale equipment is 8.06 m³.

2 Results and discussion

2.1 TP removal during the operation

The influent TP concentration is within the range of 2.40 ~ 6.90 mg/L during operation, and average effluent TP concentration is 0.81 mg/L. The mean TP removal rate is 82%. Furthermore, effluent TN concentrations are all lower than 10 mg/L, effluent TP and TN concentrations both meet the requirement of GB/T18921-2002.

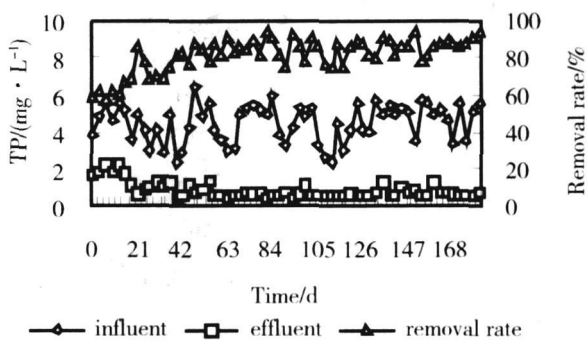


Fig 1 TP removal during the operation

2.2 TP and NO_3^- -N variations in anaerobic, anoxic and aerobic zone

Fig 2 shows that NO_3^- -N concentration lower than

4. 0 mg/L has little influence on Phosphorus release, and the NO_3^- -N concentration decreases gradually. That could be attributed to the existence of denitrifying phosphorus removal bacteria (DPBs). Nitrate is no more used as an electron acceptor by DPBs when NO_3^- -N concentration reduces to lower than 0.20 mg/L under the present conditions.

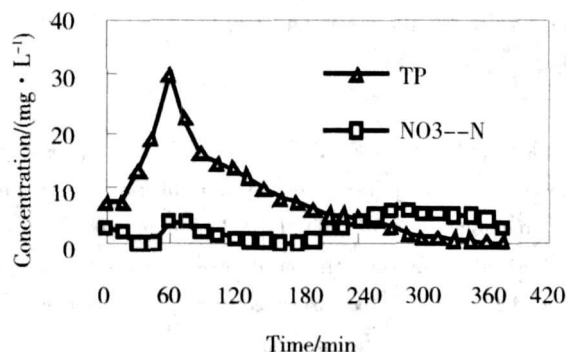


Fig 2 TP and NO_3^- -N variations in anaerobic, anoxic and aerobic zone

2.3 Effects of COD/TP and DO on TP removal

Fig 3 shows that lack of carbon source results in lower Phosphorus release rate. The optimal C/P ratio is 60 in this system, and the C/P ratio is no more a bottleneck of Phosphorus release.

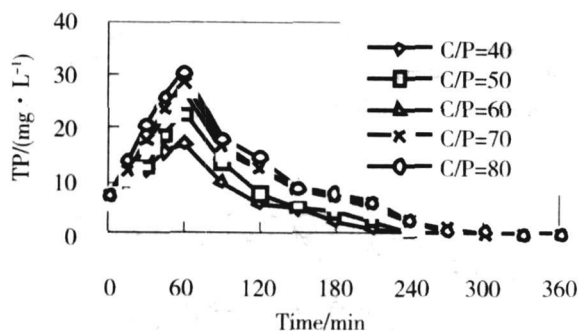


Fig 3 Effect of C/P on TP removal

Fig 4 shows that the aeration/influent ratio of 4/1 is chosen considering energy conservation. The fluid state with high Phosphorus uptake efficiency is formed because of the addition of suspended carrier.

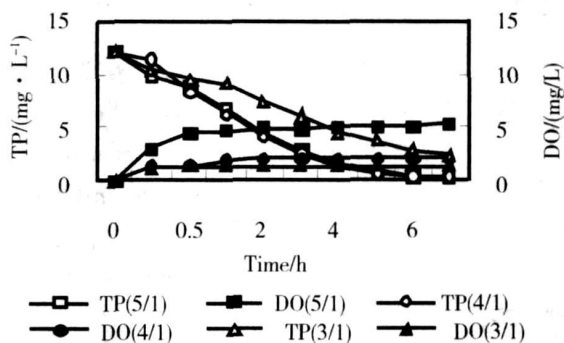


Fig 4 Effect of DO on TP removal

3 Conclusions

The average TP removal rate is 82% during the 180 d operation. The optimal COD/TP ratio is 60 for this test. Due to the addition of modified suspended carrier by nanotechnology, effluent TP concentration reaches 0.3 ~ 0.35 mg/L when the DO concentration in aerobic tank is 2.0 mg/L.

References

- [1] ODEGAARD H, RUSTEN B, WERUM T. A new moving bed biofilm reactor applications and results [J]. *WatSci Technol*, 1994, 29: 157-165.
- [2] WELANDER U, HENRYSON T, WELANDER T. Nitrification of landfill leachate using suspended carrier biofilm technology [J]. *WatRes*, 1997, 31 (9): 2351-2355.
- [3] DONG B, ZHOU Z Y, GAO T Y. Nitrification character of moving bed A²/O process [J]. *Water and Wastewater*, 2004, 30 (9): 50-52.
- [4] DONG B, ZHOU Z Y, GAO T Y. Nitrification character of moving bed A²/O process [J]. *Water & Wastewater*, 2004, 30 (9): 50-52.

A²/O与 SCBP复合工艺除磷中试研究

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摘要: 研究了 A²/O与悬浮填料生物膜 (SCBP) 中试复合工艺的除磷效率, 并考察了影响因子 COD/TP与 DO对除磷的影响。结果表明: 总磷平均去除率为 82%, 达到 GB/T18921-2002景观用水水质要求。当硝酸盐含量急剧下降至 0.20 mg/L 以下时, 反硝化除磷菌不再以硝酸盐作为电子受体进行聚磷活动, 厌氧磷释放的最佳碳磷比为 60。添加纳米改性的悬浮填料后, 好氧池的溶解氧为 2.0 mg/L时, 出水 TP为 0.3~0.35 mg/L。

关键词: 除磷; A²/O; 悬浮填料生物膜工艺; 生物膜

中图分类号: X703