

# 无污泥小型生活污水处理与回用系统

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**摘要** 采用两级接触厌氧滤池加两级接触好氧滤池加砂慢滤加砂快滤工艺流程及新型填料, 对居民小区生活污水的处理进行了研究。此法不排除污泥, BOD 去除率 91.7%, COD 去除率 88.9%, SS 去除率 91.1%, 总 P 去除率达 43.5%。

**关键词** 剩余污泥, 厌氧处理, 好氧处理。

生活污水的处理方法传统上有理化法和生物法。理化法要投入化学药剂, 产生较多的污泥; 生物法一般不稳定, 操作也较复杂。污泥处置费用高达 3 万元/t。虽然有条件的地方可采用土地处理、氧化塘等低费用技术, 但影响周围环境, 尤其对别墅区、渡假村及大城市郊区的边远小镇等, 污水过于集中处理会使得管网费用过大。近几年国内外都在研究小型污水处理系统。笔者设计的这套无污泥小型生活污水处理与回用系统, 消化、吸收了日本的技术, 不但操作简单、费用低廉, 而且保持了与周围环境的协调。

## 1 工艺流程

此污水处理系统共分为 3 个单元, 日处理污水 300 m<sup>3</sup>。好氧消化和保持水循环流型所需空气由一台 60 m<sup>3</sup>/h 的空压机提供。每个单元的工艺流程及厌氧好氧结构见图 1、2。

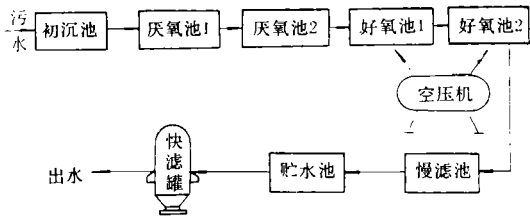


图 1 工艺流程图

本系统具有以下特点:

(1) 不排除污泥 整个系统产污泥量很少, 不必进行污泥回流和清除剩余污泥, 大大降低

了管理和维护成本<sup>[1]</sup>。

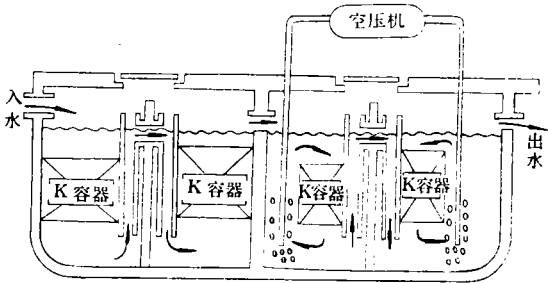


图 2 厌氧、好氧结构示意图

(2) 使用了新型填料——K 容器(又称细菌房子) 这种 K 容器的几何形状使得微生物在其表面的附着与脱落、水体在其内部的流动与阻滞得到兼顾, 大大提高了处理效果。且可用废塑料瓶加工成 K 容器, 以废治废, 变废为宝, 大大降低了成本。

(3) 除通入少量空气外, 系统不投入任何资源, 所加空气为常规用气量的 1/4<sup>[2]</sup>。

(4) 厌氧池 1 兼有粗滤作用, 好氧池有兼氧作用。

(5) 基本上不产生臭味, 对周围环境不造成有害影响, 可采用密闭式。

## 2 出水水质

从污水进入沉淀池开始, 经过 60 d 的细菌培养期后系统投入运行。运行 30 d 后进行了水质取样化验<sup>[3]</sup>, 结果如表 1。

表 1 水质处理结果

项 目	处理前 (mg/L)	处理后 (mg/L)	去除率 (%)
BOD	117	22	81.2
COD	1315	351	73.3
SS	2445	45	98.2

此后，潍坊市环境监测中心站分别在 1992-08-01 和 11-03 又进行了 2 次抽样化验，结果如表 2。

表 2 2 次抽样化验结果

项目	处理前 (mg/L)	处理后 (mg/L)	去除率 (%)
试样 1			
BOD	210.2	20.3	90.3
COD	445.5	43.3	90.3
SS	104	8.8	91.5
pH	7.30	7.88	
试样 2			
BOD	416.2	29.2	93.0
COD	802.9	100.9	87.4
SS	238	22.3	90.6
pH	7.51	8.18	
NH <sub>3</sub> -N	109.3	82.7	24.3
总 P	6.83	3.86	43.5

从 1992-10-04 至 1992-10-24 连续对出水水质作了化验，平均化验值为：BOD29.6 mg/L，COD64.8 mg/L，SS26.8 mg/L。以上指标均达到国家规定的一级排放标准。

3 经济效益分析

经过近 2 年的运行表明，处理 1 m<sup>3</sup> 生活污

水耗电不超过 0.2 kW·h，费用不超过 0.15 元。每年可处理回用水 10 万 m<sup>3</sup>，综合水资源费、电费、机械维修费及管理人员工资等按 1.2 元/m<sup>3</sup> 计算，每年节约 12 万元，2 年可收回全部投资。

4 结论

生物接触氧化是介于活性污泥法和生物滤池之间的一种生物处理技术，它兼备二者之优点<sup>[2]</sup>。其中填料是否实用(包括材质、形状和价格)、布气布水是否均匀、工艺流程是否合理是影响出水水质的关键因素。本套生活污水生物净化回用系统，较好地解决了以上几个技术关键，出水水质达到国家一级排放标准，可用于绿化、养鱼、冲洗厕所等。若进一步用 O<sub>3</sub> 消毒，还可有更广的用途。对城镇居民小区、别墅区、渡假村、高级宾馆、部队等排水比较集中但规模不大的生活污水的处理与回用，具有很大的推广价值。

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• 书 讯 •

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pp. 46—48

Lignin extracted from an alkaline wheat straw pulping black liquor was modified by sulfonation to study the feasibility of its use as a concrete water-reducing agent. This has resulted in the development of ZS-3 water-reducing admixture. In addition, a liquor containing sulfonated lignin and polysaccharides from the conversion process of wheat straw pulping black liquor was found to have a function of concrete water reduction and was turned into a superplasticizer ZS-2. Both ZS-3 and ZS-2 had a water reduction by 10%. The compressive strength of concrete was increased by 18% (7 days) or 5% (28 days) when ZS-3 was added, and by 73% (7 days) or 2% (28 days) when ZS-2 was added.

**Key words:** concrete water-reducing admixture, wheat straw lignin, sulfonation.

**Small-Sized Non-Sludge-Discharged Sewage Treatment and Reuse System.** Chen Xueyi et al. (Weifang Bestec Environmental Protection Engineering Development Co., Ltd., Weifang 261011); *Chin. J. Environ. Sci.*, **16**(4), 1995, pp. 49—50

A small-sized sewage treatment and reuse system without sludge discharge has been developed, based on a process consisting of two stages of contact anaerobic filters, two stages of contact aerobic filters, a slow sand filter and a fast sand filter. Generally, a domestic sewage can be treated through this system to give a satisfactory effluent, with a BOD removal of 91.7%, a COD removal of 88.9%, a SS removal of 91.1%, and a total P removal of up to 43.5%.

**Key words:** excess sludge, anaerobic treatment, aerobic treatment.

**Determination of Chlordimeform Residues in Rice by Enzyme Immunoassay Using Monoclonal Antibody.** Yu Wanjun et al. (West China University of Medical Sciences, Chengdu 610041); *Chin. J. Environ. Sci.*, **16**(4), 1995, pp. 51—53

Three sensitive enzyme-linked immunosorbent assays (ELISAs)—indirect competitive ELISA, direct competitive ELISA, and reverse direct competitive ELISA—with immobilized antibody were developed for the determination of chlordimeform residues in rice. Their  $IC_{50}$  are of 1.3, 1.7 and 5.3 ng/ml, respectively. Samples were homogenized with methanol in a blender or in an ultrasonic disintegrator. The extracts could be measured directly after dilution, or underwent

a simple clean up procedure, which could improve the accuracy of the ELISAs. Effects of pH in the reaction medium, the incubation temperature, the extracting agent and the sample matrix on the detection sensitivities were also studied and discussed.

**Key words:** chlordimeform, pesticide residue analysis, enzyme-linked immunosorbent assay (ELISA).

**Synchronous Scanning Derivative Spectrofluorimetry for the Determination of Selenium with 2, 3-Diaminophthalene.** Zhao Zhenhua et al. (Beijing Municipal Research Academy of Environmental Protection, Beijing 100037); *Chin. J. Environ. Sci.*, **16**(4), 1995, pp. 54—56

The synchronous fluorescence spectra of fluorescent chelate of selenium with 2, 3-diaminophthalene (DAN) and its synchronous scanning derivative spectra were studied. The specific  $\Delta\lambda$  of the synchronous spectra was found to be 140 nm. The first derivative spectrofluorimetry for the determination of selenium with DAN was described. The limits of detection were 1.5, 1.9 and 3.0 for the first derivative, second derivative and normal spectrofluorimetric technique, respectively. Coefficient of variation was 6.7 for the first derivative spectrofluorimetry, and 9.2 for the normal spectrofluorimetry.

**Key words:** selenium, synchronous spectrofluorimetry, derivative spectrofluorimetry.

**Determination of Total Organic Halogen (TOX) in Water.** Zou Huixian et al. (Dept. of Environ. Sci. and Eng., Nanjing Univ., Nanjing 210093); *Chin. J. Environ. Sci.*, **16**(4), 1995, pp. 57—60

A modified determination method for TOX was described, whereby purgeable and nonpurgeable fractions were measured respectively. Purgeable organic halogen (POX) was stripped with a mixture of  $N_2$  and  $O_2$ ; and nonpurgeable organic halogen (NPOX) was enriched with a Liquid-liquid Extraction (LLE) method. Both were introduced into a combustion system to change them into  $X^-$ , which were then determined with spectrophotometry. There was a detection limit of about 1  $\mu\text{mol/L}$ , a variation coefficient of less than 3%, with an average recovery of 81% for 10 model compounds. The TOX concentration in the tap water from Jiangsu province was from about 217 to 483  $\mu\text{g/L}$ .

**Key words:** purgeable organic halogen, non-purgeable organic halogen, total organic halogen,