## CONTENTS

### Editorial letter
We are integrating with the world – Journal of Environmental Sciences Journey of twenty five years
Qingcai Feng, Xiaoshan Tie ................................................................. 1

### Aquatic environment
Characterization of the airborne bacteria community at different distances from the rotating brushes in a wastewater treatment plant by 16S rRNA gene clone libraries
Yunping Han, Lin Li, Junxin Liu .......................................................... 5

Growth and nutrient accumulation of *Phragmites australis* in relation to water level variation and nutrient loadings in a shallow lake
Ying Zhao, Xinghui Xia, Zhifeng Yang ................................................. 16

Cost-performance analysis of nutrient removal in a full-scale oxidation ditch process based on kinetic modeling
Zheng Li, Rong Qi, Bo Wang, Zhe Zou, Guohong Wei, Min Yang ...................... 26

Sulfur-containing amino acid methionine as the precursor of volatile organic sulfur compounds in alga-induced black bloom
Xin Lu, Chengxin Fan, Wei He, Jiancai Deng, Hongbin Yin ......................... 33

Nitrous oxide reductase gene (*nosZ*) and N$_2$O reduction along the littoral gradient of a eutrophic freshwater lake
Chaoxu Wang, Guibing Zhu, Yu Wang, Shanyun Wang, Chengqing Yin ........ 44

Influence of oxygen flow rate and compost addition on reduction of organic matter in aerated waste layer containing mainly incineration residue
Hiroshi Asakura, Kei Nakagawa, Kazuto Endo, Masato Yamada, Yusaku Ono, Yoshiro Ono ................................. 53

Removal and transformation of organic matters in domestic wastewater during lab-scale chemically enhanced primary treatment and a trickling filter treatment
Qingliang Zhao, Huiyuan Zhong, Kun Wang, Liangliang Wei, Jinli Liu, Yu Liu ................................................................. 59

Occurrence and distribution of hexabromocyclododecane in sediments from seven major river drainage basins in China
Honghua Li, Hongtao Shang, Pu Wang, Yawei Wang, Haidong Zhang, Qinghua Zhang, Guibin Jiang .................. 69

Influencing factors and degradation products of antipyrine chlorination in water with free chlorine
Meiquan Cai, Liqiu Zhang, Fei Qi, Li Feng ............................................. 77

Characterization of dissolved organic matter as N-nitrosamine precursors based on hydrophobicity, molecular weight and fluorescence
Chengkun Wang, Xiaojian Zhang, Jun Wang, Chao Chen .............................................. 85

Simultaneous removal of selected oxidized contaminants in groundwater using a continuously stirred hydrogen-based membrane biofilm reactor
Siqing Xia, Jun Liang, Xiaoyin Xu, Shuang Shen ........................................ 96

Effect of dissolved organic matter on nitrate-nitrogen removal by anion exchange resin and kinetics studies
Haiou Song, Zhijian Yao, Mengqiao Wang, Jinman Wang, Zhaolian Zhu, Aimin Li ......................................................... 105

Natural organic matter quantification in the waters of a semiarid freshwater wetland (Tablas de Daimiel, Spain)
Montserrat Filella, Juan Carlos Rodríguez-Murillo, Francisco Quentel ................................. 114

### Atmospheric environment
Carbon dioxide capture using polyethylenimine-loaded mesoporous carbons
Jitong Wang, Huichao Chen, Huanhuan Zhou, Xiaojun Liu, Wenming Qiao, Donghui Long, Licheng Ling .................. 124

Simultaneous monitoring of PCB profiles in the urban air of Dalian, China with active and passive samplings
Qian Xu, Xiuhua Zhu, Bernhard Henkelmann, Karl-Werner Schramm, Jiping Chen, Yuwen Ni, Wei Wang, Gerd Pfitzer, Jun Mu, Songtao Qin, Yan Li .............................................. 133

### Terrestrial environment
Profiling the ionome of rice and its use in discriminating geographical origins at the regional scale, China
Gang Li, Luis Nunes, Yijie Wang, Paul N. Williams, Maozhong Zheng, Qiufang Zhang, Yongguan Zhu ................................. 144

### Environmental biology
Effects of solution conditions on the physicochemical properties of stratification components of extracellular polymeric substances in anaerobic digested sludge
Dongqin Yuan, Yili Wang ................................................................. 155
Environmental health and toxicology

In vitro cytotoxicity of CdSe/ZnS quantum dots with different surface coatings to human keratinocytes HaCaT cells
   Kavitha Pathakoti, Huey-Min Hwang, Hong Xu, Zoraida P. Aguilar, Andrew Wang .................................................. 163

Effect of heavy metals and phenol on bacterial decolourisation and COD reduction of sucrose-aspartic acid Maillard product
   Sangeeta Yadav, Ram Chandra ......................................................................................................................... 172

Environmental catalysis and materials

Mesoporous silicas synthesis and application for lignin peroxidase immobilization by covalent binding method
   Zunfang Hu, Longqian Xu, Xianghua Wen ........................................................................................................... 181

Adsorption of naphthalene onto a high-surface-area carbon from waste ion exchange resin
   Qiangian Shi, Aimin Li, Zhaolian Zhu, Bing Liu ................................................................................................... 188

Adsorption of lead on multi-walled carbon nanotubes with different outer diameters and oxygen contents:
   Kinetics, isotherms and thermodynamics
   Fei Yu, Yangming Wu, Jie Ma, Chi Zhang .......................................................................................................... 195

Environmental analytical methods

Application of comprehensive two-dimensional gas chromatography with mass spectrometric detection for the analysis of
   selected drug residues in wastewater and surface water
   Petr Lacina, Ludmila Mravcová, Milada Vávrová ............................................................................................... 204

Determination of gaseous semi- and low-volatile organic halogen compounds by barrier-discharge atomic emission spectrometry
   Yifei Sun, Nobuhisa Watanabe, Wei Wang, Tianle Zhu .................................................................................... 213

Electrochemical treatment of olive mill wastewater: Treatment extent and effluent phenolic compounds monitoring
   using some uncommon analytical tools
   Chokri Belaid, Moncef Khadraouii, Salma Mseddi, Monem Kallel, Boubaker Elleuch, Jean François Fauvarque .......... 220

Municipal solid waste and green chemistry

Evaluation of PCDD/Fs and metals emission from a circulating fluidized bed incinerator co-combusting sewage sludge with coal
   Gang Zhang, Jing Hai, Jiang Cheng, Zhiqi Cai, Mingzhong Ren, Sukun Zhang, Jieru Zhang ....................... 231

Serial parameter: CN 11-2629/X*1989*m*235*en*P*26*2013-1
Influence of oxygen flow rate and compost addition on reduction of organic matter in aerated waste layer containing mainly incineration residue

Hiroshi Asakura¹,², Kei Nakagawa¹, Kazuto Endo², Masato Yamada², Yusaku Ono³, Yoshiro Ono⁴

¹. Nagasaki University, 1-14 Bankei-machi, Nagasaki 852-8521, Japan
². National Institute for Environmental Studies, Onogawa 16-2, Tsukuba, Ibaraki 305-8506, Japan
³. Nippon Institute of Technology, 4-1 Gakuendai, Miyashiro-machi, Minamisaitama-gun, Saitama 345-8501, Japan
⁴. Kyoto Institute of Technology, Matsugasaki, Sakyo-ku, Kyoto 606-8585, Japan

Received 22 March 2012; revised 03 July 2012; accepted 06 July 2012

Abstract

Landfilling municipal solid waste incineration (MSWI) residue alkalizes the waste layer, causing a subsequent decrease in microbial activity and a delay in the decomposition of organic matter. In this study, efficiencies of neutralization of the leachate and organic matter decomposition in the waste layer in a column filled with MSWI residue using aeration and compost addition were evaluated. Total organic carbon (TOC) reduction in the waste layer is large at high oxygen flow rate (OFR). To effectively accelerate TOC reduction in the waste layer to which compost was added, a high OFR exceeding that by natural ventilation was required. At day 65, the pH of the leachate when OFR was above 10^{-2} mol-O_2/(day·m^3) was lower than that when OFR was below 10^{-1} mol-O_2/(day·m^3). At the same OFR, the pH of waste sample was lower than that of waste sample with compost. Although leachate neutralization could be affected by compost addition, TOC reduction in the waste layer became rather small. It is possible that humic substances in compost prevent the decomposition of TOC in MSWI residue.

Key words: waste; landfill; aeration; neutralization; acceleration of stabilization

DOI: 10.1016/S1001-0742(12)60022-9

Introduction

Landfilling municipal solid waste incineration (MSWI) residue alkalizes the waste layer, causing a subsequent decrease in microbial activity and a delay in the decomposition of organic matter. Landfilling MSWI ratios (incineration/generation) were higher than 50% in Japan, Switzerland, Sweden, and Denmark from 2003 to 2005 (OECD, 2008). However, the waste layer of MSWI residue or incombustible waste still contains organic matter in the form of unburned organic matter (Matsufuji et al., 1980) or wood as contaminant (Sekito et al., 1997). Actually, leachate from the waste layer (MSWI residue and/or incombustible waste) contains organic matter (Hjelmar, 1996; Tanaka and Koyama, 1987; Inanc et al., 2007). The leachate alkalizes the waste layer, causing a subsequent decrease in microbial activity (Matsufuji et al., 1980; Asakura et al., 2007b).

Therefore, from the viewpoint of accelerating landfill stabilization (Stegmann et al., 2003), the waste layer must be neutralized to accelerate the decomposition of organic matter. The authors propose two ways to neutralize the waste layer, i.e., aeration and addition of organic matter. Aeration supplies CO_2 to the waste layer, causing the subsequent neutralization of the alkalized layer and accelerating microbial activity in the aerobic condition (CO_2 should be regenerated by microbial activity). Organic matter can play the role of a buffer (Cory and McKnight, 2005) and generate CO_2 during decomposition.

In the aerobic condition, neutralization of the waste layer containing mainly MSWI residue (Inanc et al., 2007) and acceleration of organic matter decomposition (Asakura et al., 2007a) can be expected. Many researchers have reported that aeration accelerated organic matter decomposition in landfill that contained much organic waste (Hanashima, 1999; Heyer et al., 1999, 2005; O’Keefe and Chynoweth, 2000; Cossu et al., 2001; Read et al., 2001; Ritzkowski and Stegmann, 2005; Tesar et al., 2005; Prantl et al., 2006; Ritzkowski et al., 2006; Bilgili et al., 2008; Erses et al., 2008). However, the oxygen flow rate (OFR) required to accelerate the decomposition has not been
It was reported that a mixture of MSWI residue and compost had a lower pH (Ono et al., 2008) and a larger bacterial population (Watanabe et al., 2006) than MSWI residue alone. Therefore, the addition of compost to the MSWI residue can increase microbial activity. The purpose of using compost and not fresh organic matter, such as food waste, is to avoid the drastic generation of landfill gas and organic leachate. In addition, compost contains humic substances, providing pH buffering (García-Gil et al., 2004; Mackowiak et al., 2001). The addition of compost increases organic matter content in the waste layer. Nevertheless, if the addition of compost could neutralize pH in the waste layer to promote microbial activity and accelerate the decomposition of organic matter, the addition would be beneficial.

In this study, efficiencies of neutralization and organic matter decomposition in MSWI residue using aeration and compost addition were evaluated.

1 Materials and methods

1.1 Waste samples

MSWI residue (bottom ash from an incinerator with a grate firing system), shredded municipal bulky solid waste (SBW), shredded industrial incombustible solid waste (SIW), and compost were collected as waste samples from solid waste treatment facilities in Japan. SBW and SIW mainly contained plastic, rubber, metal, glass, and ceramic. Shredded vending machine was used as SIW in this study. Compost was made from sludge of treated night soil and food waste. Samples for examination were prepared by mixing the waste samples. MSWI residue, SBW, and SIW were mixed to yield mixed inorganic waste (MIW). Mixed organic waste (MOW) was prepared by mixing MIW (95 vol.%) and compost (5 vol.%). MIW and MOW are called “mixed samples” hereafter. The mixing ratio of compost was determined with reference to the report of Ono et al. (2008). The mixing ratios of MSWI residue, shredded municipal bulky solid waste, shredded industrial incombustible solid waste, and compost were (MOW:MIW, vol.%:vol.%) 47.6:50.0, 19.0:20.0, 28.6:30.0, and 4.8:0, respectively.

1.2 Experimental method

A column was filled with the mixed samples and known quantities of water (simulating rainfall) and air were introduced into it. Then, to evaluate the effect of aeration and compost addition on the acceleration of organic matter decomposition, the characteristics of exhaust gas, leachate, and filled sample were measured.

The column (inner diameter 10.0 cm, height 34.8 cm, volume for waste layer 2733 cm³) was filed by MOW (2873 g-dry weight) or MIW (2912 g-dry weight) with dry bulk density of 1.1 for both MOW and MIW, and porosity 0.50 for MOW and 0.51 for MIW. The mixed samples (<1 cm) were prepared in the wet state by adding water and mixed to obtain the desired field capacity as determined in a preliminary examination (volumetric moisture content: 0.3). Then, using a tamper, the samples were packed densely and piled to 34.8 cm height in seven steps of approximately 5 cm each. The total number of columns was eight; one set of four columns were filled with MOW and another set of four columns were filled with MIW.

The filled columns were put in a chamber thermostated at 35°C on the assumption of a mesophile to simulate the high temperature of an actual waste layer, as it is known that waste layer temperatures are often higher than the surrounding temperature (Collins and Muennich, 1993; Houi et al., 1997; Tokyo Metropolitan Government, 1996). The temperatures of the waste layer were reported to be from 33±4°C to 55±5°C in France and from 30 to 65°C in Japan.

Air was introduced into the columns from the bottom by a pump or a syringe. The syringe was used for low air flow rate because it was difficult for the pump to maintain the low air flow rate. Air flow rates for one set of MOW or MIW columns were set at four stages, i.e., 5.0×10⁻¹ or 5.0×10⁻² mL-air/day by the syringe, and 7.2×10⁻³ or 4.3×10⁻⁵ mL-air/day by the pump at 1.0 kg/cm² pressure. These rates corresponded to OFR of 1.7×10⁻¹, 1.7×10⁻⁰, 2.5×10⁻¹, and 1.5×10⁻³ mol-O₂/(day-m³) (where, m³ indicates waste volume). Exhaust gas was released from the top of the column.

When syringe aeration was adopted, the bottom and top of the column were kept closed. Two syringes were connected to the bottom (for air flushing; filled with air) and the top (for gas collection; empty) of the column. Air corresponding to the daily volume was introduced for one minute from the column bottom every day. The volume of exhaust gas in the top syringe was measured and the gas was analyzed by gas chromatography.

In regard to the column set with the pump, the top of the column was always open. Air was humidified by forcing the air flow to pass through a bottle containing distilled water and then introduced into the columns from bottom to top continuously to prevent drying of the filled sample (in the case of syringe pumping, humidification of air flow was not required due to the low air flow rate adopted). Exhaust gas was collected with the syringe that was inserted into the exhaust gas outlet and analyzed by gas chromatography.

When the pump was stopped for a few minutes or immediately after aeration by the syringe, distilled water was injected by the syringe from the top of the column every day and the leachate was collected from the column bottom. The volume of injected water was 35 mL/day, which corresponded to the annual precipitation in Japan, i.e., approximately 1600 mm/year. The aeration test period was 65 days. A schematic diagram of the aeration appara-
Changes in the concentrations of oxygen and CO$_2$ in the exhaust gas are shown in Fig. 2a–d. Oxygen concentrations in the exhaust gas were approximately equal to that in the outside air when OFR was above $10^2$. Below $10^1$ OFR, oxygen concentrations decreased around days 10 to 30 and increased thereafter. The oxygen concentrations of MIW were low compared with those of MOW during the aeration test below $10^1$ OFR. Meanwhile, the CO$_2$ concentrations of MIW were higher than those of MOW. The maximum concentrations of CH$_4$ were 25 ppmV for MOW and 35 ppmV for MIW at $1.7\times10^{-1}$ OFR (data not shown). In regard to injection gas, the average concentrations of oxygen, CO$_2$, and CH$_4$ were 20.9 vol.%, 380 ppmV, and 2 ppmV, respectively ($n = 13$).

Changes in pH and TOC of the leachate are shown in Fig. 2e–h. At day 65, the pH of the leachate when OFR was above $10^2$ was lower than that when OFR was below $10^1$. At the same OFR, the pH of MOW was lower than that of MIW at day 65. When OFR was below $10^1$, TOC increased up to day 20 and decreased thereafter. The maximum values of TOC were 880 mg-C/L for MOW and 370 mg-C/L for MIW when OFR was above $10^2$, and 2700 mg-C/L for MOW and 2030 mg-C/L for MIW when OFR was below $10^1$. Therefore, the maximum TOC in the leachate when OFR is above $10^2$ could be reduced to less than half of the maximum TOC when OFR is below $10^1$.

### 2.2 Carbon balance

Carbon balance around the column before and after the aeration test, i.e., input (carbon in the original sample and inflow as CO$_2$ in air) and output (carbon in the aerated residue and outflow as exhaust gas and leachate), was determined by measuring, IC$_{solid}$- and weight of filled sample; CH$_4$ and CO$_2$ concentrations in inflow and outflow gas and the mixed gas volume; and TOC and IC in leachate and the leachate volume. The carbon balances are summarized in Table 1 and Fig. 3.

The ratio of carbon output to input ranged from 98% to 101%. Therefore, the authors considered that the measured items and the obtained values for carbon were reasonable, and gas containing carbons other than CH$_4$ and CO$_2$ in the exhaust gas, i.e., volatile fatty acid, was negligible in this study. The difference in TOC$_{solid}$ (14.5 kg-C/m$^3$) between the original filled MOW and MIW samples was a result of the addition of compost. The amount of CO$_2$ in the outflow gas was smaller than that in the inflow gas. Especially in regard to MIW, IC$_{solid}$ increased as TOC$_{solid}$ decreased. The amount of increased IC$_{solid}$ was larger than that of carbon in the outflow gas and the leachate.

### 3 Discussion

In this section, two problems in the acceleration of the decomposition of organic matter in the alkalized waste layer containing mainly MSWI residue, i.e., the relation-
Table 1  Characteristic change of mixed samples by aeration

<table>
<thead>
<tr>
<th>Oxygen flow rate</th>
<th>Mixed organic waste</th>
<th>Mixed inorganic waste</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Original</td>
<td>After aeration</td>
</tr>
<tr>
<td></td>
<td>(mol-O_2/(day·m^3))</td>
<td>(mol-O_2/(day·m^3))</td>
</tr>
<tr>
<td>Moisture content (%)</td>
<td>15.2 24.9 19.6 19.8 18.5 13.4 18.6</td>
<td>22.3 21.4 20.9</td>
</tr>
<tr>
<td>Particle density (kg/L)</td>
<td>2.1 2.3 2.2 2.3 2.2 2.2 2.2</td>
<td>2.3 2.4 2.2</td>
</tr>
<tr>
<td>Loss on ignition (%)</td>
<td>9.3 6.7 8.7 7.4 7.7 7.2 5.3</td>
<td>6.2 4.9 6.2</td>
</tr>
<tr>
<td>Carbon balance</td>
<td>TOC (mg-C/L)</td>
<td>IC (mg-C/L)</td>
</tr>
<tr>
<td></td>
<td>Original</td>
<td>After aeration</td>
</tr>
<tr>
<td>TOC (mg-C/L)</td>
<td>4.1 3.9 4.0 3.8 3.7 2.6 2.4</td>
<td>2.2 2.1 2.0</td>
</tr>
<tr>
<td>IC (mg-C/L)</td>
<td>1.1 1.2 1.2 1.4 1.9 1.2 1.4</td>
<td>1.6 1.9 2.4</td>
</tr>
<tr>
<td>Original and inflow</td>
<td>TOC (kg-C/m^3)</td>
<td>IC (kg-C/m^3)</td>
</tr>
<tr>
<td></td>
<td>11.9 11.9 11.9 11.9 12.8 12.8 12.8</td>
<td></td>
</tr>
<tr>
<td>CH_4 (kg-C/m^3)</td>
<td>&lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1</td>
<td></td>
</tr>
<tr>
<td>CO_2 (kg-C/m^3)</td>
<td>&lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1</td>
<td></td>
</tr>
<tr>
<td>Subtotal (A)</td>
<td>12.4 12.3 14.9 20.2 14.8 17.2 19.8 25.3</td>
<td></td>
</tr>
<tr>
<td>Residue and outflow</td>
<td>TOC (kg-C/m^3)</td>
<td>IC (kg-C/m^3)</td>
</tr>
<tr>
<td></td>
<td>0.9 0.9 0.2 0.2 0.6 0.5 0.1 0.1</td>
<td></td>
</tr>
<tr>
<td>CH_4 (kg-C/m^3)</td>
<td>&lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1</td>
<td></td>
</tr>
<tr>
<td>CO_2 (kg-C/m^3)</td>
<td>&lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1 &lt;0.1</td>
<td></td>
</tr>
<tr>
<td>Subtotal (B)</td>
<td>57.4 55.1 55.8 61.0 40.7 40.8 42.1 48.4</td>
<td></td>
</tr>
<tr>
<td>Total outflow (gas and leachate) (g)</td>
<td>1.0 0.9 0.6 2.3 0.6 0.6 0.4 1.3</td>
<td></td>
</tr>
<tr>
<td>Balance (B/A) (%)</td>
<td>100 101 100 98 100 100 100 100</td>
<td></td>
</tr>
</tbody>
</table>

* Aeration by syringe; * aeration by pump.

Oxygen flow rate (mol-O_2/(day·m^3)): 1.5 × 10^1, 2.5 × 10^2, 1.7 × 10^4, 1.7 × 10^5.

Fig. 2 Changes in concentration of oxygen (a, b), CO_2 concentration (c, d) in exhaust gas and changes in pH (e, f) and TOC (g, h) in leachate.

The relationship between OFR and organic matter reduction, and the effect of compost addition on the acceleration of organic matter reduction, are discussed. **Figure 4** shows the relationship between OFR and TOC solid reduction, with pH of leachate (at day 65) as parameter. The range of OFR by natural ventilation (amount of oxygen introduced to a semi-aerobic landfill by convection and diffusion flow) previously reported by the authors (Asakura et al.,...
2010) in the same experiment is also shown in Fig. 4. TOC solid reduction of MOW and MIW was large at high OFR. Ritzkowski and Stegmann (2003) also reported that TOC solid can be reduced by aeration. As the plot for MIW is a convex, the acceleration of TOC solid reduction could be affected at an OFR that is lower than the OFR by natural ventilation. On the other hand, as the plot for MOW is a concave, a higher OFR than that by natural ventilation is required.

The addition of compost decreased the pH of the leachate. One of the reasons is that organic matter in the added compost acted as a buffer (García-Gil et al., 2004). However, in this study, we found that the effect of increasing OFR on decreasing pH was larger than that of compost addition. The increased IC solid probably neutralized the filled samples. Furthermore, as regards the amount of compost added in this study, TOC solid reduction in the run of compost addition (MOW) was less than that of MIW. Therefore, although leachate neutralization could be affected by compost addition, TOC solid reduction became rather small. TOC solid reduction could be accelerated by increasing OFR, rather than by adding compost.

Furthermore, the oxygen concentrations of MIW were relatively low compared with those of MOW during the aeration test below 10^1 OFR. Therefore, compost addition reduced oxygen consumption. The results indicate that TOC in MSWI residue and incombustible waste could be decomposed more easily than that in compost. Compost contains stable organic matter, such as humic substances (García et al., 1991). Hamamura et al. (2009) pointed out that a larger amount of stable organic matter was contained in compost made from sewage sludge than in compost made from food waste. Piccolo and Mbagwu (1999) have shown that hydrophobic domains in humic substances prevent the microbial activity associated with water. Therefore, it is possible that humic substances in compost prevent the decomposition of TOC in MSWI residue and incombustible waste. When organic matter is used to neutralize waste layer containing mainly MSWI residue and increase microbial activity, the use of compost having a high content of humic substances should be avoided.

4 Conclusions

In this study, efficiencies of neutralization and organic matter decomposition in MSWI residue using aeration and compost addition were evaluated. The main findings are as follows: (1) Total organic carbon (TOC) reduction in the waste layer is large at high oxygen flow rate (OFR). (2) To effectively accelerate TOC reduction in waste layer to which compost is added, high OFR exceeding that by natural ventilation is required. (3) Although leachate neutralization could be affected by compost addition, TOC reduction in the waste layer became rather small.

From the above, TOC reduction in the waste layer could be accelerated by increasing OFR, rather than by adding compost. It is possible that humic substances in compost in MSWI residue and incombustible waste prevent the decomposition of TOC in MSWI residue and incombustible waste. When organic matter is used to neutralize waste layer containing mainly MSWI residue and increase microbial activity, the use of compost having a high content of humic substances should be avoided.

Acknowledgments

This study was conducted under the project “Guarantee of Safety and Security for Toxic Wastes in Landfills (FY 2004 to 2006)” supported by the Special Coordination Funds for Promoting Science and Technology of the Ministry of Education, Culture, Sports, Science and Technology, Japan.
References


Aims and scope

Journal of Environmental Sciences is an international academic journal supervised by Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences. The journal publishes original, peer-reviewed innovative research and valuable findings in environmental sciences. The types of articles published are research article, critical review, rapid communications, and special issues.

The scope of the journal embraces the treatment processes for natural groundwater, municipal, agricultural and industrial water and wastewaters; physical and chemical methods for limitation of pollutants emission into the atmospheric environment; chemical and biological and phytoremediation of contaminated soil; fate and transport of pollutants in environments; toxicological effects of terrorist chemical release on the natural environment and human health; development of environmental catalysts and materials.

For subscription to electronic edition

Elsevier is responsible for subscription of the journal. Please subscribe to the journal via http://www.elsevier.com/locate/jes.

For subscription to print edition

China: Please contact the customer service, Science Press, 16 Donghuangchenggen North Street, Beijing 100717, China. Tel: +86-10-64017032; E-mail: journal@mail.sciencep.com, or the local post office throughout China (domestic postcode: 2-580).

Outside China: Please order the journal from the Elsevier Customer Service Department at the Regional Sales Office nearest you.

Submission declaration

Submission of an article implies that the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis), that it is not under consideration for publication elsewhere. The submission should be approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out. If the manuscript accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder.

Submission declaration

Submission of the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis), that it is not under consideration for publication elsewhere. The publication should be approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out. If the manuscript accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder.

Editorial

Authors should submit manuscript online at http://www.jesc.ac.cn. In case of queries, please contact editorial office, Tel: +86-10-62920553, E-mail: jesc@263.net, jesc@rcees.ac.cn. Instruction to authors is available at http://www.jesc.ac.cn.