当 GaAs 浓度达到 360ppm/g MLSS 时，可使活性污泥中总氨基酸含量减少 20.9%，表现出明显的抑制影响，特别是半光氨酸、酪氨酸、精氨酸和脯氨酸量分别减少了 43.4%、31.4%、27.7% 和25.9%。

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关于厌氧流化床稳态机理模型和参数估计模型的推理性研究

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摘要 本研究采用化繁为简的模型图式、质量平衡原理和实验中的经验数据进行了厌氧流化床消化有机废液过程稳态机理模型的推理，继而对机理模型作了线性化处理，得到厌氧流化床运行的稳态参数估计模型. 这些模型可用于厌氧流化床运行的在线控制，具有理论和实用价值.

关键词 厌氧流化床，稳态机理模型，参数估计模型.

关于厌氧流化床技术研究的重要性，已得到国际上许多学者的公认，在有关厌氧处理的全球动态报告中表明厌氧流化床反应器（AFBR）属于高效厌氧反应器[1-3].

有关厌氧流化床运行的动态模型不多. 为了便于 AFBR 动态过程的控制，本研究结合外循环石英微粒载体厌氧流化床处理酒精蒸馏残液滤出液工程试验的结果，进行了 AFBR 运行动态模型的推理性研究，并用试验数据进行了初步验证.

一、构建模型的要旨

AFBR 为复杂的三相流反应器，且除液中悬浮微生物外，还有流化态载体上附着的微生物，其降解有机废液的特异性远优于悬浮微生物. 附着微生物相形成的微生物膜与基质界面间的物化和生化效应较复杂，同时微生物膜作为微生物集团，从整体而言其组成、功能、特性、菌龄和生长量因环境因素的差异随时间而变化.

从微观着手构造模型较难. 本研究从宏观着眼，其构造模型的要点是：① 由工程试验得知厌氧流化床流化态时传质效应好，故可将其简化为均匀混合态处理. 为了实验中易于计值和数学上处理方便，可把这样的多相反应按照均相反应来分析[4]. ② 床内厌氧微生物既分布在载体的附着膜上，又悬浮在液体中，且两者功能差异大，但由工程试验得知载体上微生物膜约占反应器中全部微生物量的 93% 以上，因而在模式处理上可把载体上微生物作为消化过程的主导因素，比率甚少的悬浮菌折合为挂膜微生物. 这样既不失根本，又简化问题. ③ 因厌

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氧微生物变化缓慢，可将厌氧流化运行当作稳态过程处理，并以基质和微生物变化中的质量平衡原理、线性化处理及辨识方法建立单输入输出模型.本工作吸取了柯益华先生的经验，结合厌氧流化床特有的状况作模型的构筑*.

厌氧流化床运行的物理模型如图 1 所示.

模型建立中有如下关系式*

$$S_e = S_{je} + 1.42X_e$$

式中，1.42gCOD/g微生物 为微生物折成 COD 的换算系数.

$$X_e = X'_a + X_i,$$

其中

$$X_i = 0.2bT_c(X'_a + X_b)$$

式中，b 为微生物腐解速率系数 (d^{-1})；腐解微生物中约有 20% 是难分解；T_c 为处理液在床中的滞留时间(d).

$$G = p(S_0 - S_e)Q$$

式中，G 为转换系数即反应器每日消化 COD 所产生的 CH_4 量 (lCH_4/d)；$p = 0.35lCH_4/gCOD$.

此外，由工程实验得知悬浮微生物浓度约为载体上活性微生物浓度的 0.05 倍，因此有关系式 $X'_a = 0.05X_b$.

同时，排水和床内均有相同的 S_e、X_e 值，微生物和出水浓度的变化率甚小，系统满足稳态运行条件.

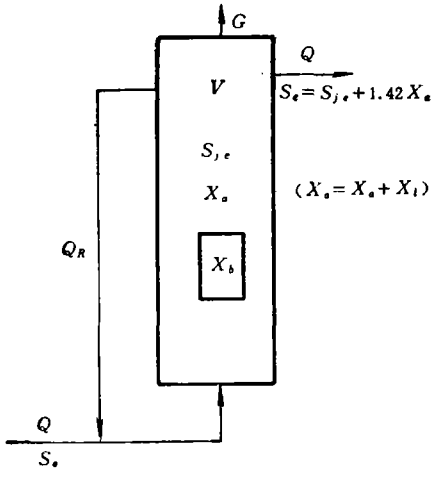

图 1　厌氧流化床的模型图示

S_0 进水 COD 浓度 (g/L)、S_{je} 出水 COD 浓度 (g/L)、X_e 液中悬液微生物浓度 (g/L)、X_b 载体上附着微生物g/L)、X'_a 悬浮微生物中活性微生物浓度(g/ 腐解后难分解微生物组分的浓度 (g/L)、中总 COD 浓度，即排水 COD 总浓度，V 容积(L)、Q 进出水流量 (L/d)、G 为 CH_4 (L/d)、Q_R 循环流量 (L/h)..

二、稳态机理模型的建立

由床内微生物降解时 COD 质量平衡关系得到:

$$QS_0 = V\left(\frac{dF_a}{dt} + \frac{dF_b}{dt}\right) + QS_{je}$$

即

$$\frac{dF_a}{dt} + \frac{dF_b}{dt} = \frac{Q}{V}(S_0 - S_{je})$$

$$\frac{dF_a}{dt} + \frac{dF_b}{dt} = \frac{S_0 - S_{je}}{T_c} \qquad (1)$$

式中，$\frac{dF_a}{dt}$ 为悬浮液中活性微生物的消化速率 (gCOD/l·d)；$\frac{dF_b}{dt}$ 为床中载体上附着微生物的消化速率 (gCOD/l·d).

由 Michaelis-Menten 酶促反应动力学得知:

$$\frac{dF_a}{dt} + \frac{dF_b}{dt} = \frac{KS_{je}(X'_a + X_b)}{K_m + S_{je}} \qquad (2)$$

式中，K 为最大速率利用系数 (g COD/g 微生物 · d)；K_m 为半速度系数 (g COD/L).

由(1)、(2)式得:

$$\frac{S_0 - S_{je}}{T_c} = \frac{KS_{je}(X'_a + X_b)}{K_m + S_{je}}$$

$$(S_0 - S_{je})(K_m + S_{je}) = T_cKS_{je}(X'_a + X_b)$$

即

$$(S_0 - S_{je})(K_m + S_{je}) = 1.05T_cKS_{je}X_b \qquad (3)$$

由床内微生物质量平衡关系得:

$$\frac{dX'_a}{dt} + \frac{dX_b}{dt} = L\left(\frac{dF_a}{dt} + \frac{dF_b}{dt}\right) - b(X'_a + X_b) - \frac{X'_a}{T_c} \qquad (4)$$

式中，$\frac{dX'_a}{dt}$ 为悬浮微生物的生长速率；$\frac{dX_b}{dt}$ 为

* 中国沼气协会 1983 年学术年会论文.

载体上附着微生物的生长速率；L 为微生物生长系数 $g_{微生物}/gCOD$.

稳态时 $$\frac{dX'_a}{dt}+\frac{dX_b}{dt}=0 \tag{5}$$

故由(4)、(5)式得:

$$L\left(\frac{dF_a}{dt}+\frac{dF_b}{dt}\right)-b(X'_a+X_b)-\frac{X'_a}{T_c}=0 \tag{6}$$

将(1)式代入(6),得:

$$L\left(\frac{S_0-S_{ie}}{T_c}\right)-b(X'_a+X_b)-\frac{X'_a}{T_c}=0$$

$$L\left(\frac{S_0-S_{ie}}{T_c}\right)=\left(b+\frac{1}{T_c}\right)0.05X_b+bX_b$$

$$X_b=\frac{L(S_0-S_{ie})}{1.05bT_c+0.05} \tag{7}$$

$$X'_a=0.05X_b=\frac{L(S_0-S_{ie})}{21bT_c+1}$$

$$X_e=X'_a+X_i=X'_a+(X'_a+X_b)0.2bT_c$$

$$=(1+0.2bT_c)\frac{L(S_0-S_{ie})}{21bT_c+1}$$

$$+\frac{L(S_0-S_{ie})}{1.05bT_c+0.05}\times 0.2bT_c$$

$$=\frac{L(S_0-S_{ie})(1+4.2bT_c)}{21bT_c+1} \tag{8}$$

将(7)式与(3)式相除求得 S_{ie}:

$$\frac{(1.05bT_c+0.05)(S_0-S_{ie})(K_m+S_{ie})}{L(S_0-S_{ie})}$$

$$=\frac{1.05T_cKS_{ie}X_b}{X_b}$$

即

$$S_{ie}=\frac{K_m(1.05bT_c+0.05)}{1.05LT_cK-1.05bT_c-0.05} \tag{9}$$

再将(8)、(9)代入 $S_e=S_{ie}+1.42X_e$

则

$$S_e=\frac{K_m(1.05bT_c+0.05)}{1.05LT_cK-1.05bT_c-0.05}$$

$$-1.42\frac{L(S_0-S_{ie})(1+4.2bT_c)}{21bT_c+1} \tag{10}$$

因为 $\frac{G}{Q}=0.35(S_0-S_e)$，将(9)、(10)式代入该式,得到甲烷产气率稳态机理模型:

$$\frac{G}{Q}=S_0\left(0.35-0.497L\frac{1+4.2bT_c}{1+21bT_c}\right)$$

$$+\frac{K_m(21bT_c+1)}{21LT_cK-21bT_c-1}$$

$$\times\left(0.497L\frac{1+4.2bT_c}{1+21bT_c}-0.35\right) \tag{11}$$

因为 COD 去除率 $z=\frac{S_0-S_{ie}}{S_0}$,将(9)式代入该式,得到 COD 去除率稳态机理模型:

$$z=1+\left\{K_m(21bT_c+1)\cdot\left[\frac{1.42L(1+4.2bT_c)}{21bT_c+1}-1\right]\right\}\Big/[S_0(21LT_cK-21bT_c-1)]$$

$$-\frac{1.42L(1+4.2bT_c)}{21bT_c+1} \tag{12}$$

因为比去除率 $w=\frac{S_0\cdot z}{T_c}$，则比去除率稳态机理模型为:

$$w=\frac{S_0}{T_c}\left\langle 1+\left\{K_m(21bT_c+1)\cdot\left[\frac{1.42L(1+4.2T_cb)}{21T_cb+1}-1\right]\right\}\Big/\{S_0(21LT_cK-21T_cb-1)\}-\frac{1.42(1+4.2T_cb)}{21T_cb+1}\right\rangle \tag{13}$$

(11)、(12)、(13)三式为厌氧流化床消化有机废液的稳态机理模型,其表达方式繁琐,式中许多动力学参数受多种因素影响，这些参数不能用简单方法得到,无法得知在线的参数值,从而使机理模型在线的实用性受到阻碍，但机理模型毕竟给出了模型的基本结构形式，提供进一步研究并使之实用的基础.

三、稳态参数估计模型的构建

厌氧流化床内多种微生物形成复杂的群体，在厌氧流化这一特殊空间构成了一个特定的生态环境，其错综复杂的变化关系组成了一种生态系统. 设想运用反映该系统的一系列实验数据来求取有关参数，这样它们便具有反映流化床运行在线的客观性和准确性，并兼具综

合的生态意义。

基于如上思想，借助辨识方法建模，即以实验数据为依据建立估计参数的模型。为了得到该模型的结构，应从原始的机理模型着手，这样使辨识方法建模具有双重特性：既有包含消化过程本质的生态学内涵，又有反映系统运行在线的客观性的实用价值。因此，该模型推导进行如下：①以厌氧流化床稳态机理模型为出发点；②使机理模型线性化，从而得到简明实用的参数估计模型；③ 以可控量 S_0、T_c 为已知量建立甲烷产气率、COD 去除率等重要结果的稳态参数估计模型。其推理如下：

（一）厌氧流化床产气率（按进液量计）的稳态参数估计模型的推断

现对甲烷产气率稳态机理模型(11)式中的若干代数式作如下考查：

据柯益华在35℃时有关的厌氧试验数值通常为 $K = 6.67(\text{g COD/g}_{\text{微生物}}\cdot\text{d})$；$L = 0.103(\text{g}_{\text{微生物}}/\text{gCOD})$；$b = 0.03(\text{d}^{-1})$。

由工程实验得知 T_c 取 2—4 日，

$$\frac{1 + 4.2bT_c}{1 + 21bT_c} \approx 0.5. \tag{14}$$

因为 $21LT_cK - 21bT_c \gg 1$，所以

$$21LT_cK - 21bT_c - 1 \approx 21LT_cK - 21T_cb \tag{15}$$

将以上关系式均代入(11)式，得到：

$$\frac{G}{Q} = S_0(0.35 - 0.249L) + \frac{K_m(21bT_c + 1)}{T_c(21LK - 21b)}\cdot(0.249L - 0.35)$$

即

$$\frac{G}{Q} = S_0(0.35 - 0.249L) + \frac{1}{T_c}\cdot\frac{K_m(0.249L - 0.35)}{21(LK - b)} + \frac{bK_m(0.249L - 0.35)}{21(LK - b)} \tag{16}$$

令(16)式中 $S_0 = u_1$，$\frac{1}{T_c} = u_2$，$\frac{G}{Q} = y$

$$0.35 - 0.249L = \alpha_1,\ \frac{K_m(0.249L - 0.35)}{21(LK - b)} = \alpha_2$$

$$\frac{K_m b(0.249L - 0.35)}{21(LK - b)} = \alpha_0$$

则(16)式成为可用辨识方法作参数估计的甲烷产气率线性稳态模型：

$$y = \alpha_0 + \alpha_1 u_1 + \alpha_2 u_2 \tag{17}$$

上式用参数估计方法求得估计参数值为 $\hat{\alpha}_0$、$\hat{\alpha}_1$、$\hat{\alpha}_2$；若知厌氧流化床运行中的 n 组稳态试验数据 $\{y(k)、u_1(k)、u_2(k),\ k = 1,2,3,\cdots\cdots n\}$，则由(17)式可构成 n 组线性方程，该方程组的矩阵式为：$Y = U\hat{\alpha}$。

其中

$$Y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix}\quad U = \begin{bmatrix} 1 & u_1(1) & u_2(1) \\ 1 & u_1(2) & u_2(2) \\ & & \\ 1 & u_1(n) & u_2(n) \end{bmatrix}\quad \hat{\alpha} = \begin{bmatrix} \hat{\alpha}_0 \\ \hat{\alpha}_1 \\ \\ \hat{\alpha}_2 \end{bmatrix}$$

则 $\hat{\alpha} = (U^TU)^{-1}U^TY$ 为估计参数的结果[7]。

（二）厌氧流化床 COD 去除率的稳态参数估计模型结构的推导

与厌氧流化床产气率的稳态参数估计模型的求法相同。现对 COD 去除率稳态机理模型(12)式作如下考查：该式中同样有(14)、(15)式的关系，将这些关系式也代入(12)式中，得到：

$$z = (1 - 0.71L) + \frac{1}{S_0}\frac{bK_m}{b - LK} + \frac{1}{T_cS_0}\frac{K_m}{21(b - LK)} \tag{18}$$

令(18)式中：

$$u_1 = \frac{1}{S_0},\quad u_2 = \frac{1}{S_0T_c},$$

$$\beta_0 = 1 - 0.71L,\ \beta_1 = \frac{bK_m}{b - LK}$$

$$\beta_2 = \frac{K_m}{21(b - LK)}$$

则(18)式便成为可用辨识方法作参数估计的 COD 去除率线性稳态模型：

$$z = \beta_0 + \beta_1 u_1 + \beta_2 u_2 \tag{19}$$

对上式用参数估计方法求得估计参数值为

$\hat{\beta}_0$、$\hat{\beta}_1$、$\hat{\beta}_2$；若知厌氧流化床运行中的 n 组稳态试验数据 $\{y(k)、u_1(k)、u_2(k),\ k=1、2、3、\cdots n\}$，则由(19)式可构成 N 组线性方程，该方程组的矩阵式为 $Y=V\hat{\beta}$。

式中

$$Y=\begin{bmatrix} z_1 \\ z_2 \\ \vdots \\ z_n \end{bmatrix} \quad V=\begin{bmatrix} 1 & u_1(1) & u_2(1) \\ 1 & u_1(2) & u_2(2) \\ \vdots & \vdots & \vdots \\ 1 & u_1(n) & u_2(n) \end{bmatrix} \quad \hat{\beta}=\begin{bmatrix} \hat{\beta}_0 \\ \hat{\beta}_1 \\ \\ \hat{\beta}_2 \end{bmatrix}$$

则 $\hat{\beta}=(V^TV)^{-1}V^TY$ 为(19)式中估计参数的结果。

四、结 论

用有效容积为 100L 的厌氧流化床反应器处理酒精蒸馏残液滤出液高浓度有机废水，并用工程试验数据对模型作初步验测，结果是模型的输出值与试验值日均相对误差为 1.74—11%。因此，厌氧流化床处理有机废水运行过程的参数估计模型是适用的，如把这些模型用于计算机控制系统，再加反馈、滤波等一系列修正处理，效果会更臻完美。

综上所述，这些模型的特点是：结构简明且实用。其估计参数的计算法由某种目标函数极小化而求得，有最佳性。由时间区间求得的稳态参数估计模型，其估计参数具有随应现时新状态的特点，故对厌氧流化床内缓慢变化的拟稳态过程运用该模型十分有利，即模型具有在线的客观效应，其参数包含了对随机因素的补偿作用，又可随系统的变化不断得以修正。这些模型可作为计算机控制系统的基础模型。厌氧流化床处理有机废液运行系统的参数估计模型兼具理论和实用价值。

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海河流域土壤中碳的分布特征

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摘要 通过对海河流域土壤中碳及其形态含量的分析，研究了该区不同土壤类型的水平与垂直分布规律，普遍具有表层含量高于下层含量的垂直分布，盐化湖土>潮土>褐土含量的水平分布特点；并探讨了影响其含量的地貌特征和施肥因素，具有西部丘陵地区含量分散，冲积淤积区元素富积，以及施用农家肥的蔬菜地含量增高的规律；并探讨了各形态间相互制约的相关性；同时参照其它地区该元素含量，确立本区基本没受人为干扰的含量水平，在此基础上，作出该区土壤中总碳、无机碳、有机碳，有机质含量分布图. 为研究本区碳的生物地球化学循环奠定基础.

关键词 土壤，碳含量，分布规律.

环境中的碳不仅是生命元素，又是植物的营养和调节元素. 是自然界中生命及其有机物的重要组分，并在有机物的合成、转化和调节植物体内的生理现象以及对环境的影响等方面起着重要作用. 弄清土壤中碳及其各形态的分布特征，对研究碳在自然界中各要素的循环尤为重要.

一、样 品 来 源

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Abstracts

Study on the Sanitary Programme for the Migration Plan in the Hydro-conservation Project of the Yangtze River. Lu Shengye, Chen Jingquan, Jiang Ling, Yang Xiaoping(Institute of Environmental Medicine, Tongji Medical University and National Environmental Agency); Han Yufu, Liu Qinghua (Sanitary and Anti-epidem ic Station of Zi Gui County, Hubei). *Chin. J. Environ. Sci.*,13(2), 1992,pp.2—7

According to the three gorge project, Gui Zhou town which will be flooded and have the largest migration population and Maoping town into which the migrants will move were chosen as the objects of the study of sanitary programme for the migrats. Investigations were carried out on natural environment, medical background, sources of sanitary water and population health etc. In the mean time, the content of iodine, fluorite, hardness in water and γ-ray intensity in rooms were measured. The method of serological epidemiology was used to examine the health condition of the original population of 48000 and the migrants of 11000. On the basis of a great number of examination and monitoring, sufficient medical information has been provided for working out a sanitary programme and taking measures for disease prevention.

Key Words: hydro-conservation, project of the Yangtze River, sanitary plan for migration.

Study on an Examplary Project of Wetland Waste Water Treatment. Ding Tinghua (Beijing Municipal Research Institute of Environmental Protection): *Chin. J. Environ. Sci.*, 13(2), 1992, pp. 8—13

The examplary project under study possessed a capacity for treating 500m³ of municipal and industrial waste water a day.

The study demostrated that the average removal rates for BOD_5, SS, total nitrogen and coliform could reach 85.8%, 93.8%, 64.6% and 99.9% respectively, at a hydrolic loading rete of 5cm/d. The average effluent concentration of BOD_5, SS, total nitrogen and coliform were 17.8 mg/L, 17.0 mg/L, 5.1 mg/L and <8.1/100 ml, respectively. The total operation cost of this system accounted for only 1/5—1/2 of the cost of conventional sewage treatment processes. Studies on the mechanism and kinetic of the reactions involved in the process were also carried out. The design and technique parameters of the project were screened and optimized and a wetland ecological model was built.

Key Worlds: constructed wetland system, wetland ecological model, waste water treatment.

A Study on the Assessment of Environmental Quality in Taopu Industrial District, Shanghai. Gao Weisheng(Department of Geography, East China Normal University, Shanghai); Yu Zhendong(Research Center for Eco-Environmental Sciences, Academia Sinica) Xiang Lei (Institute of Environmental Protection An HuiProvince): *Chin. J. Environ. Sci.*, 13 (2), 1992, pp 13—18

Taopu Industrial District, located in the northwestern suburbs of Shanghai, was established in the 1950s and has gradually developed into an important base of pharmaceutical and chemical industries of Shanghai. Because of rapid growth of industry and ineffective control of pollution, the environment of the district has long been endangered. Based on the investigation of pollution sources and field monitoring, single-item assessments were made on 6 environmental elements, i.e. atmosphere, surface water, ground water, soil, vegetables and human health by using the principal component-factor analysis weighting method. Moreover, what was carried out includes the comprehensive environmental quality assessment by using Pij values of the 6 environmental elements; analysis and prediction of economic system by using real-object type input-output model; and optimized selection of environment-economic system by using goal programming approach. On this basis multi-goal optimization schemes about economic development and pollution control were worked out.

Key Words: environmental quality, simulated analysis, multi-goal optimization, forecast and decisions, pollution control.

Influence of GaAs, Ga^{3+} and Ge^{4+} in Waste Water from Semiconductor Material Production on DNA or RNA and Amine Acids in Activated sludge. Liao Su (Zhejiang Economic Construction Investment Crop.), Ye Zhojie (Zhejing Agriculture University): *Chin. J. Environ. Sci.*, 13(2), 1992, pp.18—22

Influence of GaAs Ga^{3+},Ge^{4+},Hg^{+},Hg^{2+}, and Cr^{6+} on DNA Or RNA and that of GaAs on amino acid in activated sludge were studied. It was found that Hg^{2+} and Cr^{6+} mainly reduce the content of DNA and GaAs mainly meduces the content of RNA in activated sludge, respectively. Strong inhibition effect on the synthesis of either DNA or RNA was observed at concentrations of Ge^{4+} above 300 mg/L/gMLSS. Low concentration of GaAs did not exert considerable influence on the content of amino acid in the sludge, while high concentration of GaAs reduced the content of amino acid drasticly.

Key Words: gallium arsenide, gallium, germanium, mercury, chromium, activated sludge, DNA, RNA, amino acids, DNA, RNA synthesis inhibition.

A Study on the Inference of Steady Theoretical Models and Parameter Estimation Models in the Process of AFBR. Xie Hanfang, Su Xi, Yang Zhirong (Liaoning Provincial Research Institute of Environmental Protective Science, Shenyang): *Chin. J. Environ. Sci.*, 13(2), 1992, pp. 22—26

Theoretical models of the degestion process of organic wastes in Anaerobic Fluidized Bed Reactor (AFBR) were infered through simplifying the complex system and using the mass balance correlation and some experimental coefficients. Afterwards the theoretical models were linearized and the steady models for parameter estimation were deduced. The models have theoretical and practical significance in engineering and can be used in online control of AFBR.

Key Words: Anaerobic Fluidized Bed Reactor(AFBR), Steady theoretical model, Model of parameter estimation.

Characterization of Distribution of Carbon in Haihe River Valley. Liu Quanyou, Sun Jianzhong, Wang Zijian (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences): *Chin. J. Environ. Sci.*, 13(2), 1992, pp.26—32

This paper approaches the distribution of corbon content in different types of soil in Haihe River valley and the horizontal and vertical changes of various forms of carbon in the soils, studies the ways of natural enrichment, increasing or decreasing, the environment for self-cycling and characteristics of carbon in soil under given conditions and therefore lays a foundation for the study of inventory and flux cycling system of carbon in this region.

Key Words: carbon distribution in soil, carbon cycling.

Characteristics of Temperature Profile in the Polluted Urban Atmosphere of Lanzhou. Wang Haixiao, Gao Huiwang, Chen Changhe (Atmospheric Science Department of Lanzhou University): *Chin. J. Environ. Sci.*, 13(2), 1992, pp.33—35

Based on the comparison of temperature profiles of Polluted urban atmosphere in Lanzhou with those of rural atmosphere in Gaolan, the urban island effect and the influence of air pollutants on lower atmospheric layer at different altitudes were analysed. An analysis of regression was carried out with the data of temperature increment in middle lower atmosphere and lower atmospheric turbidity during daytime. A linear correlation was observed.

Key Words: urbanisland effect, atmospheric temperature profile

Study on Biodegradability of Benzene Chlorides. Zhao Jianfu (School of Environmental Engineering, Tongji University, Shanhai): *Chin. J. Environ. Sci.*, 13(2), 1992, pp.36—38

Biodegradability of six benzene chloride compounds (chlorobenzene, 1, 2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, hexachlorobenzene) in the priority pollutants were studied with continuous, completely mixed flow activated sludge reactors. Results showed that, except hexachlorobenzene, all the other five benzene chlorides could be biodegraded by domesticated microorganisms. Biodegradation rates of the compounds decreases with the increase of chlorine substituents in the benzene ring, and hexachlorobezene could not be degaraded by the microorganisms in the test during a period of 28 days.

Key Words: priority pollutants, Benzene Chlorides, biodegradability, activated sludge process.

Changes of Content of Protein, Nucleic Acid, Free Amino Acid and Peroxide Isoenzyme in Woody Plant Leaves in Petrochemical Air Pollution Area of Daqing, Heilongjiang Province. He Shimin, He Yanling (Department of Biology, Qigihar Teachers College): *Chin. J. Environ. Sci.*, 13(2), 1992, pp.38—40

Obvious changes were observed in the content of protein, nucleic acid, free amino acid and peroxide isoenzyme in woody plant leaves in petrochemical air pollution area compared to the trees in unpolluted areas. The trees with small change in content of above chemicals possess strong pollution-resistant ability. Among the compounds mentined above, Protein and nucleic acid content decreased and free amino acid and peroxide isoenzyme content increased in the polluted tree leaves. The order of pollution-resistant ability of the trees observed is as follows; Picea koraiensis, Salix matsudana, Populus berolinensis, Ulmus pumila, Syringa obvata and Acer negundo.

Key Words: air pollution, petrochemical plant pollution, pollution indicator, protein, nucleic acid, free amino acid, peroxide isoenzyme.

Studies on Mixed Oxide Catalysts for Automobile Exhaust Control Yang Hanpei, Qiu Fali (Chengdu Institute of Organic Chemistry, Academia Sinica): *Chin. J. Environ. Sci.*, 13(2), 1992, pp.41—44

Non-noble metal containing mixed oxide catalysts used for automobile exhaust control were investigated. Results indicated that,among the mixed oxide catalysts under study, ASC(mixed oxides of rare earth, Pb, Mn, Cu, Cr, and additives) has the heighest activity and a prolonged resistence to thermal shocks, carbon deposit, and poisoning of sulphur, lead and phosphorous compounds, and therefore possesses certain prospect of application under vehicle operation conditions.

Key Words: automobile exhaust control, mixed oxide catal ysts, catalyst of non-noble metal.

RS-1 Type Catalyst for the Combustion of Sulphur-Containing Organic Waste Gases Jiang Xiaoyuan, Yu Qingrui, Jin Songshou (Hangzhuo University, Departmet of Chemistry): *Chin. J. Environ. Sci.*, 13(2), 1992, pp.44—46

In this paper, The oxidation activity of RS-1 type catalyst for ethyl mercaptan, n-butyl mercaptan, carbon disulfide, dimethyl sulfate, ethyl alcohol, and xylene etc. was discussed. Experimental results showed that the catalytic activity was excellent for those sulphur-containing organic waste gases. Oxidation product SO_x from organic sulphur did not react with the catalyst. Analytical results showed that the emission efficiency SO_x was nearly 100%. At reaction temperature of 380°C, space velocity of 10000h-1, and concentrations of ethyl mercaptan and n-butyl mercaptan equal to 4000—8000 mg/m^3 and 6000—8000 mg/m^3, respectively, purification efficiency reached as high as 99%. This catalyst is mainly applied to purify industrial exhaust sulphur-containing waste gases from pharmaceutical and agricultural chemical factories.

Key Words: sulphur-containing organic waste gases, combustion catalyst, ethyl mercaptan, butyl mercaptan, carbon disulfide, dimethyl sulfate.

Kineties of Reaction in the Process of Simulta-