

柱温 80℃,汽化室温 130℃,检测器热导池 140℃,载气(N₂)流速 50ml/min,进样量 10μl。

2 方法

2.1 试验菌液的准备

取一定量 *E. Coli* 斜面培养物接种于 50ml 含 20ml 培养液的锥形瓶中,37℃摇床培养 10h,使菌悬液的浓度达 10¹⁰个/ml,即在 600nm 波长下测得光密度为 0.18—0.20。

2.2 实验条件选择

2.2.1 CO₂ 标准曲线校正

0.5ml 不同浓度 NaHCO₃ 和 13.5ml 培养液中加入 0.5ml 等摩尔浓度 HCl,迅速拧紧管盖,测定得 CO₂ 的峰高,绘制 HCO₃⁻ 浓度对应 CO₂ 峰高曲线,确定试验时控制管内 CO₂ 浓度在 1—35mol/L 范围。

2.2.2 色谱条件

实验要求所选择的色谱条件能迅速分离准确定量 CO₂,为此分别选用了 2mX3mmGDX-103,1mX3mmTDX-01,以及 1mX3mm 的 TDX-01 和 GDX-103 3 种不同的不锈钢柱,不同实验条件下测定 CO₂ 分离效果,确定色谱条件见 1.5。

2.3 毒物测定步骤

不同浓度系列的毒物和营养液 14ml 加入到容积为 20ml 的顶空管内,无菌条件下加入经增菌培养的试验菌液 0.5ml,拧紧管盖,摇匀,置入

JE-01 型顶空取样器内,37℃温度培养 4h。用微量进样器迅速抽取顶空气体 10μl,注入气相色谱仪,记录 CO₂ 和 O₂ 的峰高,每管重复 3 次进样,取平均值。同时设置试剂空白(未加菌液和毒物)和细菌空白(未加毒物)。根据以下公式计算 CO₂ 抑制率(%),绘制浓度对应 CO₂ 抑制率(%),经统计学处理,求出毒物的 IC₅₀值。

$$\text{CO}_2 \text{ 抑制率}(\%) = \frac{(A-C)-(B-C)}{A-C} \times 100\%$$

式中,A 为细菌空白管 CO₂ 峰高;B 为毒物管 CO₂ 峰高;C 试剂空白管 CO₂ 峰高。

3 结果

3.1 细菌培养条件

3.1.1 糖利用

E. Coli 既能分解葡萄糖又能分解乳糖,产生 CO₂ 和耗氧是建立该方法的物质基础。试验分 3 组(未加糖、葡萄糖、乳糖)进行,测定了不同时刻 CO₂ 的峰高,结果见表 1。统计分析表明:①加糖明显高于不加糖;②葡萄糖优于乳糖,表现为葡萄糖比乳糖易分解,即短期内同一时刻 CO₂ 的生成率前者高于后者;③加 2.5g、3.5g、4.5g 之间差异无显著意义(P>0.05),且明显高于加 1.5g 葡萄糖组。但考虑到实际情况,细菌培养液中葡萄糖的加入量为 3.0g/L。

3.1.2 毒物实验培养时间

表 1 *E. Coli* 对不同糖的利用情况(CO₂ 峰高×10⁻²mV)

时间 (h)	未加糖	葡萄糖(g)				乳 糖(g)			
		1.5	2.5	3.5	4.5	1.5	2.5	3.5	4.5
1	0	0	0	0	0	0	0	0	0
3	1.64	16.54	22.22	21.82	20.61	15.78	17.59	19.40	20.00
5	2.70	39.37	47.15	50.95	50.33	39.07	36.56	37.59	39.07
7	3.00	43.09	53.36	53.56	54.17	45.72	45.30	44.84	45.95
10	3.46	48.17	60.22	59.22	59.88	49.67	49.70	48.21	49.00
18	4.97	56.25	64.80	64.40	65.80	51.70	57.86	57.25	61.78
24	6.00	58.28	65.42	66.42	66.00	53.50	61.80	64.60	63.10

该时间应满足:灵敏度最高;培养时间尽可能短。实验分 3 组:1. 细菌空白(不加任何毒物); 2. 加入有机混合毒物(100×10⁻⁶硝基废水);3. 无机离子(10×10⁻⁶Cu²⁺)。测定不同时刻 CO₂ 和

O₂ 的峰高,CO₂ 峰高曲线分为迟缓期、对数生长期、平台期,不同时刻产生 CO₂ 的速率不同,速率由公式: $F_{CO_2}=dF/dt\approx\Delta F/\Delta t$ 求得,见表 2。由表 2 知 4h 生成率最大,确定培养时间为 4h。

表 2 3 种不同培养 CO₂ 生成速率的变化

时间(h)	硝基废水	Cu ²⁺ 溶液	细菌空白
-1.5	1.2	1.0	2.2
-2.5	1.4	1.5	3.8
-3.5	7.2	3.7	10.4
-4.5	8.2	7.3	28.6
-5.5	5.0	4.0	8.5
-6.5	1.8	1.5	1.6
-7.5	1.0	0.8	0.4

3.1.3 正交试验设计确定细菌浓度、pH 值和气

液比

影响 CO₂ 检测灵敏度的主要因素有试验菌液的浓度、pH 值和气液比,分别选取 3 个水平,pH 值 6.2、7.2、8.2;气液比 1:2.0,1:2.5,1:3.0;细菌浓度(个/ml)10⁷,10⁸,10⁹,通过正交实验设计方法,检测 CO₂ 产量,最终确定 pH 值 7.2,细菌浓度 10⁹(个/ml),气液比 1:2.5。

3.2 单个物质毒性测定

通过以上方法,检测了 8 种离子的毒性,IC₅₀ 值结果见表 3。毒性大小顺序为 Hg²⁺>Cu²⁺>Cd²⁺>CN⁻>Pb²⁺>Zn²⁺>Sn²⁺>Ni²⁺。统计分析发现 CO₂ 抑制率(%)与其相应浓度的对数成线性关系。

表 3 8 种离子的毒性检测结果

离子	IC ₅₀ 值(×10 ⁻⁶)	直线回归方程	相关系数γ
Hg ²⁺	0.86	$y=0.195+1.120lg(x+1)$	0.996
Cu ²⁺	8.00	$y=-0.118+0.648lg(x+1)$	0.986
Cd ²⁺	8.39	$y=-0.288+0.732lg(x+1)$	0.997
CN ⁻	10.20	$y=-0.241+0.705lg(x+1)$	0.992
Pb ²⁺	11.20	$y=-0.233+0.687lg(x+1)$	0.996
Zn ²⁺	15.00	$y=-2.866+2.763lg(x+1)$	0.996
Sn ²⁺	20.10	$y=-0.97+1.092lg(x+1)$	0.999
Ni ²⁺	39.70	$y=-1.84+1.495lg(x+1)$	0.995

3.3 联合毒性测定

环境毒物的相互作用可表现为相加、协同和拮抗,即一种毒物的存在往往增加或降低另一物质的毒性。本次研究了 Hg²⁺、Cd²⁺、Cu²⁺、Zn²⁺和 CN⁻ 5 种离子间的联合作用,依据各离子的 IC₅₀ 值,按一定的比例混合成等毒性的混合物,测定 IC₅₀ 值,并与预期的 IC₅₀ 值比较。判断联合作用类型^[19]:

$$\frac{\text{预期 IC}_{50}}{\text{实测 IC}_{50}} = \begin{cases} <0.4 & \text{拮抗作用} \\ 0.4-2.5 & \text{相加作用} \\ >2.5 & \text{协同作用} \end{cases}$$

5 种离子联合作用检测结果见表 4,根据以上判断标准得到具协同作用的有 Cu²⁺+CN⁻。具拮抗作用的有:Cu²⁺+Hg²⁺,CN⁻+Hg²⁺,CN⁻+Zn²⁺;其余均表现为相加作用。

3.4 芳香族化合物结构与毒性关系研究

物质结构与毒性有着密切的关系,结构不

表 4 5 种离子的联合作用

组 别	预期 IC ₅₀ (10 ⁻⁶)	实测 IC ₅₀ (10 ⁻⁶)	预期 IC ₅₀	判断
			实测 IC ₅₀	
Hg ²⁺ +Cd ²⁺	4.63	3.57	1.32	相加
Hg ²⁺ +Cu ²⁺	4.43	13.00	0.34	拮抗
Hg ²⁺ +Zn ²⁺	8.03	4.82	1.68	相加
Cd ²⁺ +Cu ²⁺	8.19	7.31	1.12	相加
Cd ²⁺ +Zn ²⁺	11.49	7.71	1.49	相加
Cu ²⁺ +Zn ²⁺	11.60	7.34	1.58	相加
CN ⁻ +Hg ²⁺	5.55	18.50	0.30	拮抗
CN ⁻ +Cd ²⁺	9.82	11.20	0.88	相加
CN ⁻ +Zn ²⁺	12.70	33.50	0.38	拮抗
CN ⁻ +Cu ²⁺	9.12	3.56	2.56	协同

同毒性各异。实验检测了 7 种芳香族化合物 IC₅₀,它们分别是苯(429.0×10⁻⁶),氯苯(63.3×10⁻⁶)、苯胺(215.3×10⁻⁶)、硝基苯(84.3×

10^{-6})、4-氯甲苯(18.7×10^{-6})、1,4-二氯甲苯(38.1×10^{-6})、1,2,4-三氯(26.6×10^{-6})苯。结果:①随取代基不同毒性大小不一,—Cl、—NH₂、—NO₂,分别取代苯环上一个氢原子,表现为:氯苯>硝基苯>苯胺>苯;②氯代苯类随取代基数目增多毒性增强,三氯苯>二氯苯>氯苯;③毒性随取代基种类增多而增强。氯甲苯同时具备有—Cl和—CH₃,毒性大于苯、氯苯以及硝基苯。

3.5 硝基废水处理效果的评价

硝基废水来自武汉市易家墩制药厂废水,主要成分有:间-硝基乙苯,对-硝基乙苯,邻-硝基乙苯,2,4-二硝基苯酚,对硝基苯乙酮。该废水采用兼性-好氧串联生物法进行处理,即向废水中投入经驯化的活性污泥,先兼性处理 24h,然后曝气。用还原-偶氮光度法^[20]和重铬酸钾法分别测定了处理不同时刻硝基苯类化合物的浓度(10^{-6})和 COD 值(10^{-6})。同时取一定量硝基废水运用细菌培养顶空气相色谱法测定 CO₂ 抑制率(%),结果见表 5。由表 5 可知,硝基化合物的浓度和 COD 值随处理时间的延长而降低,CO₂ 抑制率(%)亦下降。该废水硝基苯类化合物的起始浓度为 157.0×10^{-6} ,COD 值为 2312.8×10^{-6} 。处理 5d 后,硝基苯类化合物的浓度下降为 55.2×10^{-6} ,降解率为 64.8%;COD 值下降为

表 5 兼性-好氧串联系统处理硝基废水降解情况

时间 (h)	硝基苯类化合物		COD		CO ₂ 抑制 率(%)
	浓度 (10 ⁻⁶)	降解率 (%)	浓度 (10 ⁻⁶)	降解率 (%)	
兼性					
10	117.5	25.4	2000	15.3	88.2
24	115.0	27.0	1938	16.2	73.2
好氧					
10	112.5	28.6	1520	34.3	66.1
24	90.0	42.9	1292	44.1	57.9
30	84.5	46.4	1200	48.1	51.8
48	67.5	57.1	1120	51.6	50.8
96	55.2	64.8	668	71.1	38.2

668.0×10^{-6} ,降解率为 71.1%;相应的 CO₂ 抑制率亦下降为 38.2%。统计分析硝基苯类化合物浓度、COD 值和 CO₂ 抑制率(%)3 者之间关系得知:①硝基苯类化合物浓度对应的 CO₂ 抑制率(%)直线加归方程为: $y_1 = -1.700 + 1.186 \lg x_1$,

相关系数 $r_1 = 0.906 (P < 0.01)$;②COD 值对应的 CO₂ 抑制率(%)直线回归方程为: $y_2 = -2.372 + 0.995 \lg x_2$;相关系数 $r_2 = 0.941 (P < 0.01)$ 。由此可见,该方法可间接指示硝基废水的处理效果。

4 讨论

建立在 *E. Coli* 呼吸抑制基础上的细菌培养顶空气相色谱法具有以下特点。①重现性好。通过 6 次测定 Cu²⁺ 的 IC₅₀ 值,分别为 8.66×10^{-6} 、 7.20×10^{-6} 、 7.42×10^{-6} 、 8.08×10^{-6} 、 7.88×10^{-6} ,平均值为 7.92×10^{-6} ,变异系数(CV)为 6.9%。②实验周期短。该方法培养的时间为 4h 而一般的急性鱼类毒性实验、藻类毒性实验通常需要 48h 甚至 72h,也比动物实验所需要的时间短。③运转费用低。动物实验、急性鱼类毒性实验均需特殊场所,而酶活性测定的价格昂贵。④实验结果可靠。将方法测得的结果与急性鱼类毒性实验,细菌微毒发光技术和胞内脱氢酶活性测定所得到的结果基本一致,见表 6。故可通过该方法正确评价环境污染物的毒性。

表 6 与其它毒性实验方法比较

方 法	离子(10^{-6})			
	Hg ²⁺	Cu ²⁺	Zn ²⁺	Ni ²⁺
细菌培养顶空色谱法	0.86	8.00	15.20	39.70
急性鱼类毒性实验	0.82	6.80	14.60	31.20
细菌发光技术	0.05	7.40	12.20	23.00
脱氢酶活性测定	0.80	5.68	14.20	29.90

该方法的建立具有广阔的应用前景,可以通过设计制作自动培养进样器,并与带有计算机设置参数的气相色谱仪联用,实现监测自动化;该方法不仅可用于单个毒物的毒性检测,而且能用于毒理学上毒物联合作用以及结构与毒性关系的研究;它还能用于指示工业废水有毒物质的排放情况,评价废水处理的效果。总之,细菌培养顶空气相色谱法是一种环境毒物快速监测较为理想的方法。有关该方法的标准化以及与目前已公认的毒物监测方法的对比分析有待进一步研究。(下转第 79 页)

表 2 亚硝酸根回收结果(μg)

样品	原样含量	加入量	测得量	回收率(%)
雨水	1.17	1.00	2.23	106.0
		2.00	3.21	102.0
塘水	1.08	1.00	2.04	96.0
		2.00	3.01	97.5
江水	0.73	1.00	1.66	93.0
		2.00	2.81	104.0

(上接第 74 页)

5 小结

(1)细菌培养顶空气相色谱法是环境毒物快速监测较为理想的方法,具有重现性好、实验周期短、运转费用低等优点。

(2)细菌代谢产物 CO₂ 的分离、定量用 1mX3mm 填充有 GDX-103 和 TDX-01 混合不锈钢柱。

(3)测试条件为:pH 值 7.2,细菌浓度 10⁹ 个/ml,顶空管内气液比 1:2.5,培养时间 4h。

(4)检测 8 种离子毒性(IC₅₀)大小顺序为: Hg²⁺> Cu²⁺> Cd²⁺> CN⁻> Pb²⁺> Zn²⁺> Sn²⁺>Ni²⁺。

(5)5 种离子联合毒性作用结果为:具协同作用的有 Cu²⁺+CN⁻;具拮抗作用的有 Cu²⁺+Hg²⁺,CN⁻+Hg²⁺,CN⁻+Zn²⁺;其余均表现为相加作用。

(6)探讨了芳香族化合物苯、氯苯、苯胺、硝基苯、4-氯甲苯、1,4-二氯苯、1,2,4-三氯苯等结构与毒性的关系。

(7)该方法可间接指示硝基废水的处理效果。

该方法相对标准偏差小于 4.3%,加标平均回收率为 99.7%。

参考文献

1 高甲友等. 分析化学. 1991,19(11):1329
2 Sarantonis E G et al. Analyst. 1990,115:977
3 美国公共卫生协会等编. 宋仁元等译. 水和废水标准检验法. 北京:中国建筑工业出版社,1985:351

(8)该方法有待进一步标准化。

参考文献

1 Mowat A J. Wat. Pollut. Control. Fed. . 1981,48:853
2 Liu D. Bull. Environ. Contam. Toxicol. . 1981,26:1451
3 Trevors J T et al. Bull. Environ. Contam. Tixicol. . 1981,26:433
4 Van Dijk et al. Bull. Environ. Contam. Toxicol. . 1977,17:662
5 Wong P T S et al. Bull. Environ. Contam. tixicol. . 1979,23:487
6 Honig R A et al. Environ. Contam. Toxicol. . 1980,25:169
7 Sastry K V et al. Bull. Environ. Contam. Toxicol. . 1979,22:38
8 Bitton G et al. Bull. Environ. Contam. Toxicol. . 1984,32:80
9 Rogers J E et al. Bull. Environ. Contam. Tixicol. . 1985,34:858
10 Patterson J W et al. Environ. Sci. Technol. . 1970,114:569
11 Chang E et al. Bull. Environ. Contam. Toxicol. . 1981,28:150
12 戴继森,朱继佩. 环境科学,1988,10(1):59
13 Liu D. Bull. Environ. Contam. Toxicol. . 1985,34:331
14 Perry B F et al. J. Appl. Bacteriol. . 1983,54:183
15 Dorwand E J et al. Environ. Sci. . Technol. . 1984,18:967
16 Anderson J R. Bull. Ecol. Res. Comm. . 1973,17:470
17 Simpson D L et al. Analyt. Chem. . 1983,55:1974
18 Jardim W F et al. Water Res. . 1990,24(3):351
19 上海第一医科大学等. 工业毒理学实验方法. 上海:上海科学技术出版社,1977:70
20 国家环保局. 水和废水监测方法. 北京:中国环境科学出版社,1989:322

• 环境信息 •

欧洲饮用水农药污染标准可放宽

根据对欧洲联盟(EU)法律的复审,可以放宽 70 年代制定的欧洲饮用水农药污染标准。过去 20 年分析技术方面的进步意味着,现在可以检测浓度低得多的农药,水厂正在不得不大量投资来更新其处理装置。欧洲委员会已接受关于复审 EU 水质法的要求。这项复审将允许几个成员国力图降低农药标准,但对其他污染物如铅的控

制可能会更严。另外,这项复审将会使目前混杂的指令单一化,并给成员国实施 EU 标准的更大自由。该委员会把这项复审的作用看作是制定关键性的环境与健康目标,而不是规定实现这些目标的方法。

小康译自 ES&T,1994,28(2):56A

Abstracts

Chinese Journal of Environmental Science

of pollutants at a measuring site being a sum of the contributions from all the short line sources divided. As compared with other models such as CLINE2, this method is applicable to all the line sources of finite length in an arbitrary wind direction and can be used to calculate for a reach with different intensities of sources on a road. The results of modelling calculations are consistent well with the data from field tracing and really measuring the pollution by vehicles exhausts.

Key words: line source, air pollution, modelling calculation.

Effects of exhaust gas from diesel vehicles on urban air quality. Yao Weixi, Zhang jinchun et al. (Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085); *Chin. J. Environ. Sci.*, **15**(3), 1994, pp. 61—64

The changes in the concentration of polycyclic aromatic hydrocarbons (PAHs) in exhaust gas emitted from diesel vehicles under different working conditions and their effects on urban air quality were reported in this paper. The PAHs emissions were found to be related to the types of engine and their conditions, with the lowest emission generated upon an operation load of between about 2%—5%. Cyclopenta (c,d)pyrene was measured respectively in the exhaust gases and urban air, and was found to have a much higher mutagenicity than benzo(a) pyrene.

Key words: diesel vehicles, polycyclic aromatic hydrocarbons, air quality, cyclopenta (c,d)pyrene.

Extraction and Synchronous Fluorescent Spectrometry for the Determination of Benzo (a) pyrene in Airborne Particulates. Lei Shihuan, Zhao Zhenhua (Beijing Municipal Research Institute of Environmental Protection, Beijing 100037); *Chin. J. Environ. Sci.*, **15**(3), 1994, pp. 65—67

A rapid and effective method for detecting benzo(a) pyrene in airborne particulates was developed, in which benzo (a) pyrene was extracted in one minute step with concentrated sulfuric acid from a cyclohexane extracted solution from the airborne particulates, and then determined with a synchronous fluorescent spectrometry. The best results were obtained at $\Delta\lambda$ of 20nm. Benzo(a)pyrene in the concentrated sulfuric acid phase was stable within 1 hour. The recovery was found to be 85% for 0.10 μg of benzo(a)pyrene standard. No interference with other polynuclear aromatic hydrocarbons was found in the range of 530—600 nm of synchronous fluorescent spectra. For a comparison, the samples were also determined by using the unified method of acetylated paper TLC/ fluorescent photospectrometry, with the results in a variance of 15% between

both methods. The analytical cycle for the present method can shorten by 1 hour.

Key words: benzo (a) pyrene, synchronous fluorescent spectrometry, extraction, airborne particulates.

Plasma Decomposition of Sulfur Dioxide (SO₂). Yi Chengwu, Liu Hengquan, Bai Xiyao et al. (Anshan Research & Design Institute of Electrostatic Technology, Anshan 114011); *Chin. J. Environ. Sci.*, **15**(3), 1994, pp. 68—70

The results were reported for the decomposition of the noxious gas SO₂ by using a plasma technique under the conditions of ambient temperature and atmospheric pressure. The effects of SO₂ concentrations, gas flow rates and fume temperatures on the decomposition of SO₂ were examined and a comparison was made for the energy consumption of SO₂ decomposition and the amount of SO₂ decomposed by the plasma generated by pulse-superposed positive or negative DC voltages. The results show that this process has a much lower energy consumption and a higher rate of SO₂ decomposition, with 1.61—1.97 kg of SO₂ decomposed per kW · h of electric power at a decomposition rate of over 80%.

Key words: plasma, decomposition, sulfur dioxide, high voltage pulse.

Study on the Method for Detecting Environmental Toxicants and Its Application; Bacterial Culture/ Head Space Gas Chromatography. Cheng Jinquan et al. (Shenzhen Public Health and Anti-epidemic Station, Shenzhen 518020); *Chin. J. Environ. Sci.*, **15**(3), 1994, pp. 71—74

Aiming to explore a rapid, sensitive method for monitoring environmental toxicants, a head space gas chromatographic technique was used to determine the extent to which the environmental toxicants have inhibited carbon dioxide (CO₂) as a product of the bacteria *E. Coli* metabolism and IC₅₀, a concentration of an environmental toxicant being tested that has an effect of 50% inhibition, was used as a measure of the toxicity of the environmental toxicant. The optimized conditions in this test include, a bacteria concentration of 10⁹/ml, pH 7.2—7.4, a ratio of gas/liquid of 1 : 2.5 in head space tube, a culture time of 4 hours, and the operation conditions of chromatograph suitable for CO₂ determination. This method has been used to test the toxicities of 8 ions, with an order of decreasing toxicity in terms of IC₅₀ value as follows; Hg²⁺ (0.86 ppm), Cu²⁺ (8.00 ppm), Cd²⁺ (8.39 ppm), CN⁻ (10.20 ppm), Pb²⁺ (11.20), Zn²⁺ (15.20 ppm), Sn²⁺ (20.10 ppm), Ni²⁺ (39.70 ppm). The joint toxicities among Cd²⁺, Hg²⁺, Cu²⁺, Zn²⁺ and CN⁻

Abstracts

Chinese Journal of Environmental Science

ions were also studied and it was found that most of them exhibited an additive, antagonistic or synergistic action. Aromatic compounds were found to have a close relationship between their structures and toxicities, and those with different numbers and types of substituent had different toxicities. It was also found that in the process of treating the wastewater containing nitro- compounds, the toxicities of wastewater reduced with reducing concentrations of nitrobenzenes and COD.

Key words: toxicity assessment, structure and toxicity, toxicants interaction, head- space gas chromatography, ecological toxicology.

Automatic Smokescope for Environmental Monitoring. Xing Ding' yao, Zhu Chang' yuan et al. (Luoyang Environmental Monitoring Station, Luoyang 471000); *Chin. J. Environ. Sci.*, **15**(3), 1994, pp. 75—76

An automatic monitoring smokescope has been developed, which is a modernized instrument that can make an automatic monitoring on a day-and-night continuous basis for the blackness of smoke emitted from boilers, having the functions of automatic sampling, and data storage, processing and display. The whole machine is controlled by a monoboard computer so that it can digitally display the monitored and computed data and timely monitor whether the smoke being emitted has complied. The instrument contains a failsafe system which can preserve the data even if a power cut has lasted for as long as 6 months and allows the instrument to be automatically resumed and continuously operated with the original intact data as soon as the power supply is restored. In the machine, the available data monitored during a 6 consecutive month period can be stored. With a properly modified software, the instrument can also be used to monitor the dust and smoke emissions from cement, ceramic, chemical and other industries, with the same effectiveness.

Key words: smoke density, smokescope, monitor, environmental monitoring.

Catalytic Potentiometry Using Malachite Green Ion Selective Electrode for the Determination of Nitrite in Water. Li Guirong and Wang Yongsheng (Teaching and Research Section of Basic Chemistry, Heng' yang Medical College, Heng' yang 421001); *Chin. J. Environ. Sci.*, **15**(3), 1994, pp. 77—79

A new catalytically potentiometric method for the determination of trace nitrite in water was developed, based on the ability of nitrite to catalyze the redox reaction of malachite green with potassium bromate in a phosphoric acid (H_3PO_4) solution. A malachite green ion selective electrode was used to

indicate the change in the concentration of malachite green that determined the reaction rate which was in turn proportional to the concentration of nitrite. This method showed a high sensitivity and selectivity, and had a linear relation in the range of $0-6\mu g/50\text{ ml}$ of NO_2^- and a detection limit of $1.9 \times 10^{-9} g/ml$ of NO_2^- . It can be operated conveniently at an ambient temperature. This method has been used to determine trace nitrite in environmental water samples with satisfactory results, relative standard deviation (RSD) of less than 4.3%, and average recovery of 99.7%.

Key words: nitrite, catalytic potentiometry, malachite green ion selective electrode.

Advance in Research on the Photocatalytic Organics Oxidation over Semiconductor Materials. He Beiping, Wang Zhansheng et al. (Dept. of Environmental Engineering, Tsinghua University, Beijing 100084); *Chin. J. Environ. Sci.*, **15**(3), 1994, pp. 80—83

A review was made on the photocatalytic oxidation of organic compounds over semiconductor materials as a catalyst, based on the findings reported in the literatures, including the mechanisms of photocatalytic oxidation and degradation of organic compounds, the methods for improving photoactivity of semiconductor, and the development of fixed-phase photocatalytic oxidation process. The trend of future studies on photocatalytic oxidation was suggested and it was predicted that the process of photocatalytic oxidation may become a new, effective method for water and wastewater treatment.

Key words: semiconductor, catalyst, photocatalytic oxidation, organic compounds.

Progress in Research on the Biological Treatment of Wastewater Containing Chlorinated Aliphatics. Fu Xuqing, Wang Shuxiong and Lu Dewei (UNILAB, Branch in the Zhejiang University, Research Center for Chemical Reaction Engineering, Hangzhou 310027); *Chin. J. Environ. Sci.*, **15**(3), 1994, pp. 84—87

In order to address the issue of general concern posed by chlorinated aliphatics which are toxic or even carcinogenic and have caused underground water pollution in some locations, a review based on references was made on the biodegradation of chlorinated aliphatics, including the strains and enzyme systems involved in such a degradation, the mechanisms of degradation processes, the kinetics of degradation, and the reactors used for such a purpose. The review also relates to the conditions under which some of acclimated strains can degrade chlorinated aliphatics, the features of a strain having