表 5　水洗引起大米放射性含量的变化

样品号	U		Th		^{226}Ra		^{40}K	
	水洗	不洗	水洗	不洗	水洗	不洗	水洗	不洗
1	4.70±0.13	0.406±0.011	0.78±0.00	6.00±0.00	1.43±0.15	4.91±0.37	8.70±0.07	15.73±0.50
2	1.41±0.07	1.12±0.23	2.10±0.32	8.98±0.59	3.00±0.34	6.98±0.19	15.05±0.13	26.74±0.84
3	2.48±0.12	0.564±0.029	2.14±0.04	8.23±0.47	3.08±0.07	21.32±0.40	12.05±0.10	23.58±0.47
4	7.33±0.00	0.688±0.070	1.36±0.11	14.21±0.28	0.35±0.49	12.1±1.3	13.44±0.11	25.25±0.50
5	2.58±0.11	0.608±0.027	2.42±0.11	11.08±0.47	<MDL	3.78±0.23	13.81±0.12	29.58±1.4
6	2.50±0.11	0.76±0.13	2.25±0.34	8.57±0.57	0.50±0.70	<MDL	11.36±0.10	21.4±1.0
$\bar{X}\pm S$	3.5±2.2	0.69±0.24	1.84±0.63	9.5±2.8	1.4±1.4	8.2±7.6	12.4±2.2	23.7±4.8
去污率(%)	−407%		81%		83%		48%	

样品号	^{90}Sr		^{137}Cs		总β	
	水洗	不洗	水洗	不洗	水洗	不洗
1	0.0429±0.0207	0.0100±0.0071	0.0347±0.0000	0.0134±0.0000	8.99±0.11	14.7±0.2
2	0.0455±0.0213	0.0820±0.0201	0.0411±0.0043	0.1002±0.0028	12.40±0.10	23.1±0.2
3	0.0540±0.0232	0.0492±0.0222	0.0189±0.0027	0.0288±0.0026	16.31±0.20	28.3±0.3
4	0.0551±0.0235	0.0466±0.0216	0.0316±0.0011	0.0188±0.0029	13.75±0.20	23.7±0.3
5	0.0296±0.0172	0.0311±0.0176	0.0293±0.0000	0.0463±0.0048	14.60±0.20	27.5±0.3
6	0.0385±0.0196	0.0396±0.0199	0.0242±0.0000	0.0292±0.0055	14.40±0.20	28.8±0.3
$\bar{X}\pm S$	0.0443±0.0096	0.0431±0.0237	0.0300±0.0078	0.0394±0.0318	13.4±2.5	24.4±5.3
去污率(%)	−2.8%		24%		45%	

注：所用单位与表 4 相同，参加本工作的还有：李辑银、李建萍、张淑身、李天来.

证明大米对水中 U 具有强的富集能力。

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京津大气颗粒物区域性的污染特征

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摘要　本文研究了京津地区大气颗粒物及其化学组成，介绍 12 种元素 Cd、Cu、K、Mn、Pb、Zn、Fe、Na、Ni、Cr、Sr、Ba；5 种离子 F^-、Cl^-、NO_3^-、SO_4^{2-}、NH_4^+ 和 26 种有机污染物的区域分布. 用有机物的奇/偶碳数比值估计了大气颗粒物的来源. 用无机元素的判别法分析了北京、天津、廊坊和蓟县之间大气污染的相互影响.

京津地区大气污染基本上属煤烟型，颗粒物的污染显得突出和严重. 但是以往本地区的研究多是将采样器放在离地面 1.5 米左右的呼吸带处，其结果是受地面风砂的直接

影响很大[1]. 为此,本次研究采样器均设在各采样点高层建筑的楼顶上以期避免受地面风砂大颗粒的直接影响，研究大气的物理化学特性、污染来源以及各大污染源之间及其对周围地区的影响. 现将所得结果报道如下:

实　验　部　分

1. 采样点的设置

考虑京津地区的地理位置及其相互的影响选定以下五处作定点采样,示于图 1.

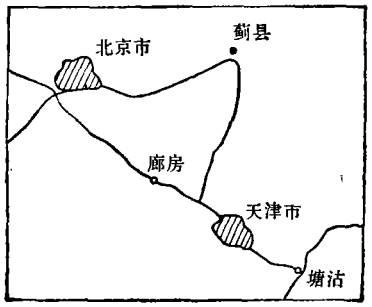

图 1　京津地区大气采样位置

北京点　中国科学院办公楼顶(六层上)
廊房点　廊房地区监测站楼顶(四层上)
天津点　口腔医院楼顶(六层上)
蓟县点　蓟县气象站屋顶(三层上)
塘沽点　港口医院楼顶(六层上)

2. 采样日期

自 1984 年 9 月到 1985 年 8 月，每个采样点每月采样两次，即 5 至 10 日；20 至 25 日.

3. 采样方法:

使用 1 m^3/min 的大容量采样器，玻璃纤维膜(160mm × 200mm),使用前经 500℃ 灼烧,再用 1:1 硝酸浸泡一昼夜,用去离子水洗涤至中性,烘干备用. 使用前后均称重,根据其差确定采集样品重量. 每次连续采样 24 小时，计 1440 立方米空气中所含的颗粒物. 样品一半用于无机元素和无机离子分析,另一半用于有机物的分析,并在采样过程中同步记录气象要素,气温、风速、风向等.

4. 分析方法:

无机元素分析　用等离子体发射光谱法

无机离子分析　用离子色谱法. 标准样品定性、定量.

有机物分析　用气相色谱法，标准样品定性、定量.

实验结果与讨论

1. 大气中总悬浮颗粒物的浓度年平均值.

现将一年中大气总悬浮颗粒物的浓度测定值经计算得出其年平均值列于表 1 中.

表 1　京津地区大气总悬浮颗粒物的年平均值

($\mu g/m^3$)

采样点	北京	廊坊	天津	塘沽	蓟县	平均值
总悬浮颗粒浓度	545	533	720	248	529	515

从表 1 中可以看出就大气中悬浮总颗粒物的浓度而言,其年平均值天津最高,塘沽最低.

2. 大气颗粒物中无机元素的年平均浓度

现将所测定的大气颗粒物中无机元素的年平均浓度列于表 2 中.

表 2　京津地区颗粒物中无机元素的年平均浓度 ($\mu g/m^3$)

元素名称 \ 采样点	廊坊	北京	天津	塘沽	蓟县
Cd	0.0025	0.0043	0.0045	0.0033	0.0052
Cu	0.0491	0.3269	0.0895	0.0583	0.0713
K	2.0137	1.6211	2.3210	1.4566	2.3657
Mn	0.1978	0.1912	0.1994	0.0876	0.6911
Pb	0.1174	0.2166	0.2436	0.1160	0.1116
Zn	0.1661	0.3550	0.7098	0.1926	0.1949
Fe	5.9652	4.9978	7.1549	2.5973	4.2464
Na	0.7916	0.6408	0.9964	0.9111	0.5049
Ni	0.0144	0.0183	0.0238	0.0155	0.0103
Cr	0.0162	0.0277	0.0259	0.0135	0.0101
Sr	0.0990	0.1925	0.1138	0.1197	0.1203
Ba	0.0184	0.0133	0.0181	0.0145	0.0319

总的来说，从表 2 中可以看到本地区的大气颗粒物中无机元素的分布是比较均匀的，但就其平均浓度而言还是发现一些差异，如所列的 12 种元素中与燃煤和汽车燃油有关的元素 Zn 和 Pb 在天津和北京较高；与土壤有关的 Mn 蓟县偏高；而与海盐有关的 Na 确实是天津和塘沽较高；至于北京地区的 Cu 突出的高这可能与该地区工业生产形成的 Cu 的污染源有关。

3. 大气颗粒物中无机离子的年平均浓度值

现将所测定的 F^-、Cl^-、NO_3^-、SO_4^{2-}、和 NH_4^+ 几个离子的年平均浓度列于表 3 中。

表 3　大气颗粒物中无机离子的年平均浓度（μg/m³）

无机离子	廊坊	北京	天津	塘沽	蓟县
F^-	0.54	0.87	1.30	0.26	0.72
Cl^-	4.31	3.62	17.70	5.57	4.26
NO_3^-	5.02	5.78	6.29	6.66	4.31
SO_4^{2-}	9.10	15.00	19.50	11.90	12.70
NH_4^+	1.52	2.46	2.91	2.46	2.29

从表 3 中可以看出无机离子 F^-，总的来说在京津地区的分布亦是较均匀的，但是仍然可以看出，北京、天津两地区一般来讲比廊坊、蓟县、塘沽三地区污染稍重，特别是与燃煤有关的 SO_4^{2-} 的浓度，天津与北京两市突出的高，而与海盐有关的 Cl^- 却是天津与塘沽两地较高。

4. 大气颗粒物中有机成分的年平均浓度

现将所测定的大气颗粒物中有机成分的年平均值列于表 4 中。

对于表 4 检出的 C_{10}—C_{38} 的正构烷烃，用奇/偶碳数的烷烃浓度比值进行判断[2]，均未发现有明显的奇数碳烷烃的优势，加之发现碳氢化合物的浓度分别在 C_{15} 和 C_{25} 附近有两个高峰，依此判断，本地区大气颗粒物质的有机成分主要来源于煤碳的不完全燃烧和汽车的排气，而与自然来源关系甚少。由此

表 4　大气颗粒物中有机成分的年平均值（μg/m³）

化合物＼采样点	北京	天津	廊坊	蓟县	塘沽
癸烷	0.0022	0.008053	0.008459	—	—
十一烷	0.01426	0.02373	0.0087	0.02627	0.01276
萘	0.011599	—	—	—	—
十二烷	0.037727	0.11052	0.01529	0.04194	0.03166
十三烷	0.070048	0.03983	0.03333	0.04755	0.04547
联苯	0.01873	0.0134	—	0.01655	0.01245
十四烷	0.1269	0.07072	0.06072	0.09709	0.12317
十五烷	0.27371	0.1934	0.1285	0.1940	0.2028
十六烷	0.1510	0.06211	0.05469	0.13913	0.2290
十七烷	0.02916	0.01812	0.02412	0.1221	0.015298
蒽	0.10566	0.01099	0.04101	0.081112	0.02294
菲	0.10456	0.05554	0.1393	0.4335	0.04064
十八烷	0.08966	0.03815	0.05343	0.4157	0.033596
异丁酯	0.05802	0.02288	0.04752	0.2178	0.032445
十九烷	0.08530	0.07676	0.1737	0.5807	0.12117
正一丁酯	0.2412	0.13589	0.13693	0.3325	0.06611
二十烷	0.1324	0.13552	0.2702	0.80736	0.07001
二十一烷	0.19149	0.17938	0.23531	0.77933	0.0998
二十二烷	0.21953	0.25377	0.3186	0.9566	0.09719
二十三烷	0.2050	0.228	0.27395	0.8584	0.11395
二十四烷	0.3176	0.23399	0.3219	0.8640	0.10489
二十五烷	0.17926	0.044231	0.08846	0.5222	0.07398
正一辛烷	0.06805	0.1868	0.4123	1.1211	—
二十六烷	0.14205	0.1565	0.18155	0.7405	—
二十七烷	0.11396	0.08519	0.07626	0.34501	0.0468
二十八烷	0.09313	0.05793	0.032451	0.23407	0.05565

在本地区对大气污染的防治中注意煤碳的燃烧是正确的，但汽车尾气的防治也要提到日程上来[3]。

5. 京津两市之间及其对周围地区大气颗粒物污染的影响

根据判别分析方法[4]，按下式：

$$P_l(x_1, x_2, \cdots, x_p) = \frac{|D|^{-\frac{1}{2}}}{(\sqrt{2\pi})^p} \cdot e^{-\frac{1}{2}} \cdot \sum_{\alpha=1}^{p} \cdot \sum_{\beta=1}^{p} \cdot d_{\alpha\cdot\beta}(x_\alpha^{[l]} - \bar{x}_{l\cdot\alpha}) \cdot (x_\beta^{[l]} - \bar{x}_{l\cdot\beta})$$

从所测得大气颗粒物中元素浓度经计算找出各个地区的判别元素，为避免天气过程等的影响使用了判别元素的浓度比值建立了判别

函数，据此经计算得出各个地区样品的分类结果示于表 5 中.

表 5　京津地区季节样品分类

采样点	夏秋季			冬春季		
	样品数目	北京	天津	样品数目	北京	天津
北京	11	5	6	12	7	5
天津	11	1	10	12	3	9
廊坊	11	0	11	11	7	4
塘沽	10	0	10	12	0	12

由表 5 看到，无论是夏秋还是冬春，北京、廊坊两处均受天津影响，甚至北京在夏秋季节从判别的 11 个样品中竟有 6 个样品可能受天津的影响. 一般来讲天津受北京影响较小. 这些结果与夏秋季节东南风盛行廊坊与北京均处于天津的下风向有关. 但是冬春季节西北风频度较高，其影响状况与夏秋季节截然不同.

对于塘沽来讲，因离天津太近其样品在所判别的范围内均与天津一致.

对蓟县样品进行判别，用不同的元素作分母得到不同的结果，用不同数目的样品建立的判别式也得到不同的结果，这说明蓟县样品与北京和天津的均不一样，据此认为蓟县大气颗粒物的污染基本上不受北京和天津的影响.

结　论

1. 北京和天津大气中偏小的颗粒物质主要来源于煤碳燃烧和汽车燃油，天然来源可能比人为来源偏低.

2. 北京和天津的微小颗粒物污染相互有影响，天津对北京的影响重于北京对天津的影响；同时证明天津与北京均对主导风向上的廊坊有影响. 至于处于主导风向以外的蓟县而言均不受天津和北京的影响.

致谢：本工作承蒙大气室许多同志的帮助，在有机成份的 GC 分析中，承蒙陆妙琴同志的大力协助，在此表示感谢.

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松花江哈尔滨段冰封期制糖废水污染区微生物调查及水质评价初报

战培荣　　卢晏生
(黑龙江流域监测站)

摘要　通过对松花江哈尔滨段冰封期制糖废水污染区微生物组成的调查、数学模式计算、污水优势群落生物体系和有机污染综合评价，结果表明，污染区真菌大量滋生，溶解氧迅速减少，水节霉 (*Leptumitus Lacteus*) 和囊轴霉 (*Araiospora puichra*) 形成优势种群. 监测江段被严重污染.

有关微生物在水质污染评价和水处理方面的应用研究有过许多报道[1,2]；但这些研究

Abstracts

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Controlling the Spread of Environmental Pollution and Ecological Deterioration ——Comment on the Third Conference of Environmental Protection

Guo Fang (Vice-director, The Committee of Environmental Science, Academia Sinica, Beijing)

Based on the current environmental situation in China and the environmental goals till 1992 and 2000, which have been pronounced in the Third National Conference of Environmental Protection, the author encourages environmental scientific and technological workers especially those in the Chinese Academy of Sciences should strive to fulfill the tasks. (See pp. 10—13)

Effective Factors of Deep Oxidation of Methanol on Pt/Al_2O_3 Catalyst

Jin Yun, Yu Qiquan and Cao Peilie (Department of Chemistry, Peking University, Beijing)

The effect of intraparticle diffusion of catalyst has been investigated in a flow-recirculation gradientless reactor. The kinetics of deep oxidation of methanol with 30-40 mesh catalyst on Pt/Al_2O_3 in the kinetic regime obeyed the Langmur-Hinshelwood model of adsorption of methanol and oxygen with inhibition of carbon dioxide. When the temperature of reaction increased to 80°C and the particle size of catalyst increased to 6×2 mm, the deep oxidation of methanol occurred on the regime of intraparticle diffusion. The effect of intraparticle diffusion increased as reaction temperature increased. The values of catalytic effective factors were measured as 0.44—0.22. The effect of intraparticle diffusion has been interpreted with the approximation method of general reaction rate forms (See pp. 6—9)

Effect of Mercury on the Growth and Physiological Function of Wheat Seedlings

Zhang Zhijie, Lu Qiufen and Fang Fang (Xi'an Institute of Metallurgy and Construction Engineering, Xi'an, Shaangxi Province)

It has been observed that mercury depressed the germinant rate of wheat and its seedling growth, decreased its transpiration and chlorophyll content. Degrees of the influence was directly related with the mercury concentrations in wastewater and the content of it in the seedlings. In low concentration of mercury, the respiratory rate of seedlings increased, but it decreased or increased considerably in accordance with its high concentrations. Moreover, the respiratory rate in the growth and stages of the seedlings. The result showed that mercury caused a change of peroxidase isozyme pattern. The effects of mercury on wheat seedlings were a physiological reaction due to injury of mercury. (See pp. 10—13)

An Automatic and Continuous Analyzer of COD

Zhu Wansen et al. (Department of Chemistry, Fudan University, Shanghai)

An automatic COD analyzer has been designed. A pump is used as a driving force to control operation of the eletromagnatic valves in the pipeline, by which volume control of wastewater samples and reagents, digestion, photometric measurement and cleaning in the process are carried out orderly. These procedures can be automatically repeated for continuous monitoring. This instrument is convenient for rapid determination of COD, 5—8 samples per hour can be analyzed. The results match with the ones abtained by the standard methods, relative standard deviation is 1.9% for 10 samples determined. (See pp. 13—16)

Reclamation of L-Proline and Other Amino-Acids from Chrome Leather Scraps

Jiang Tingda and Zhang Chunping (Research Center for Eco-Environmental Sciences, Academia Sinica, Beijing)

The scraps of chrome leather is a tanning waste. The process of reclaiming six amino-acids was operated as follows: de-chroming of the scraps was adopted by basic hydrolysis with calcium oxide, and the protein extracted; the protein was hydrolyzed with 6 mol HCl; the hydrolysate was declorized with activated carbon; then separated by 732 cation exchange resin (H form) and 717 anion exchange resin (OH form) respectively. L-Arg, L-Pro, L-Asp, L-Ala and Gly were obtained. (See pp. 17—20)

Distribution and Migration of Redioactive Nuclides in Paddy Food Chains

Wang Liang et al. (Shaanxi Provincial Research Institute of Preventive Medicine, Xi'an)

On the basis of what radioactive levels existing in soil and rice around Hanzhong region of Shaanxi Province were studied as the references (1) and (2), the following problems have been discussed in this paper: the transmitted coefficient of radioactive nuclides from soil to rice, U-Ra equilibrium coefficient in soil and rice, the relationship between nuclide content in rice and the paddy species, the ratio of nuclide contents in rice and in rice bran, rice polluted by radioactive nuclides in the course of harvesting and husking, and viriations of nuclide content in rice after washing. (See pp. 21—24)

Regional Contaminant Features of Suspended Particulates in Beijing-Tianjin Area

Chen Zhongliang et al. (Research Center for Eco-Environmental Sciences, Academia Sinica, Beijing)

Total suspended particulates (TSP) and their chemical composition in Beijing-Tianjin Area have been analyzed. There were 12 elements (Cd, Cu, K, Mn, Pb, Zn, Fe, Na, Ni, Cr, Sr, Ba), 5 kinds of ions (F, Cl, NO, SO, NH) and 26 kinds of organic pollutants in the regional distribution. The sources of TSP were estimated by means of orgenic odd/even carbon number rates. Atmospheric pollution affected mutually among Beijing, Tianjin, Lanfang anf Gixian County were studied with identification analysis of inorganic elements. (See pp. 24—27)

Economie Optimization in Noise Reduction by Sonnd-Absorbing Treatment

Kang Jian (Architecture Department, Tsinghua University, Beijing)

In the design of noise reduction by sound-absorbing treatment, there may be several schemes that can attain the goal of anticipated noise reduction under approximate decorative level. However, the costs are very different. So it is necessary to choose an optional one. This paper presents a maths model to solve the optimization problem. The corresponding computer program and a case study are also given. (See pp. 30—33)

Removal of Cd^{2+} and Cu^{2+} Ions in Water Solution by the Modified CARIX Ion-Exchange Technology

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This paper reports a new technology of ion exchanges in removing Cd^{2+} and Cu^{2+} from the dilute solutions of cadmium sulfate and copper sulfate. Its advantages are derived from the use of carbon dioxide and magnesium compounds as regenerats. As carbon dioxide is a non-polluting chemical, it could diminish saline loads in water bodies. The experimental results show that a partial conversion of the resin to magnesium is achieved and the effect of desalination is satisfied. In addition, the concentration of magnesium ions in the regenerant is higher than that of carbonic acid and calcium ions during regeneration. It increases effective cation exchange capacity of the weakly acid cation exchange resins. (See pp. 36—40)

Petroleum-Sulfoxide Extract-Leach Resin: A New Resin for Treatment of Wastewater Containing Methylmercury

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This paper presents the study on possibilities of treating low-concentrated methylmercury in wastewater by petroleum solfoxide (PSO) extract-leach resin, in which PSO as a cheap extractant, can be obtained from raw oil containing high sulfur content. The experimental results were as follows: (1) the resin was avaiable to sorb more than 99% methylmercury (concentrations 10-20ppb) in pH range 5—8; (2) current velocity of effuent affected sorption capacity. As the velocity increased from 0.5 ml/min to 5.0 ml/min, the sorption capacity decreased from 99.66% to 98.90% in bed column (diameter 0.8 cm, length 10.3 cm, resin weight 3.0 g); (3) the resin could be regenerated easily by means of eluting it with the regenerant (4mol HCl); (4) Mg(II), Fe(II), Fe(III), Ag(I), Cu(II), Hg(II), FA(fulvicacid) and Cl^- ions had no influence on sorption capacity of the resin except Hg(II) and Ag(I). (See pp. 40—44)

Determination of Trace Selenium Using Hydride Generation-Silver Selenide Sol Method

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A new method for determination of trace selenium has been presented. Se(IV) was converted into H_2Se by reaction with KBH_4 pellet in 0.2 mol H_2SO_4-2% tartaric acid solution and the escaped hydride was absorbed and colored by silver nitrate solution in the presence of gum arabic. Beer's law was obeyed in the range of 0—3 μg Se(IV)/3ml, the colored solution gave an absorption maximum at 246 mm with detection limit 0.04ppm, most of the foreign ions did not interfere with the determination of selenium. The method has high sensitivity and selectivity and has been applied to analyse urine selenium yeast and other samples. (See pp. 45—48)

Determination of Trace Lead in Animal Organs Using Direct Sampling Flameless Atomic Absorption Spectrophotometry

Xu Tonming et al. (Department of Chemistry, East China Normal University, Shanghai)

The animal organs were ground to be very fine particles, with which suspended solution was prepared and then it was analyzed in graphite atomizer by direct sampling. Because the whole procedure would be completed without sample dissolution, separation and concentration, and no reagents were used during sample preparation, the samples so were avoided from contamination. In the experiment, several parameters were investigated, for example, the effects of particle sizes of the samples and of temperature program of atomizer. The results showed that the precision of this method for analyzing different animal organs covered a range of 3.5—8.6% and recovery ratio a range of 90—108% with spiked 20—60 ng/ml of lead. (See pp. 49—51)

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