

汞和农药安绿宝对四膜虫的毒性*

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摘要 采用梨形四膜虫为实验生物评价了汞离子和安绿宝农药的毒性。结果表明, 随着 Hg^{2+} 和安绿宝浓度的增高, 梨形四膜虫细胞的增长繁殖明显降低。24h 最低影响浓度 Hg^{2+} 为 0.001mg/L , 安绿宝为 0.01mg/L , 48h 最低影响浓度同 24h。在高浓度下, 四膜虫的毒性效应为细胞变形, 缩小和运动异常, 甚至全部致死。用个体计数法和透光度法判断 Hg^{2+} 和安绿宝的毒性结果一致。梨形四膜虫是一种非常好的实验生物。

关键词 梨形四膜虫, 汞离子, 安绿宝, 毒性试验。

梨形四膜虫具备动物细胞的基本构造, 是一个单细胞真核动物, 此细胞能在实验室条件下进行克隆化培养, 用四膜虫来判断毒物的毒性大小具有快速、简便等优点, 并能在短时间内获取具有细胞水平的实验数据。显然梨形四膜虫是一种非常好的实验生物^[1]。本实验用四膜虫做实验生物, 研究了汞离子和农药安绿宝的毒性。

1 材料与方法

实验所用梨形四膜虫 (*Tetrahymena pyriformis*) 是本室长期在无菌条件下培养的纯品系细胞株 80HA^[3], 以四膜虫的增长倍数来判断毒物毒性大小。四膜虫的培养是采用 PPY 培养液在 29°C 培养箱中进行并观察结果^[2], 在显微镜下对各个浓度进行个体计数, 同时用 752-C 型分光光度计进行透光率的测定。实验所用的汞离子是用氯化汞按离子浓度配制的, 安绿宝农药是按有效成分配制的, 均以 10 的倍数连续稀释各个实验浓度**。

2 结果与讨论

2.1 24h 实验结果

实验结果表明, 汞离子与安绿宝农药对梨形四膜虫均有一定的毒性, 毒物浓度越高对四膜虫生长繁殖的影响越大。24h, 汞离子、安绿宝农药无影响浓度为 0.00001mg/L 和 0.001mg/L , 细胞仍有增长繁殖能力, 增长的倍数与

对照组接近。 Hg^{2+} 和安绿宝浓度分别为 0.0001mg/L 和 0.01mg/L 以上时, 细胞的增长倍数随毒物浓度的增高而逐渐下降(见表 1, 2), 出现死亡和变形的细胞增多, 二分体明显减少或没有, 中毒后的细胞会变得不规则, 运动异常, 有的细胞出现自转型。两种毒物浓度在 100mg/L 以上时经 24h 均能使全部细胞致死。

2.2 48h 实验结果

48h 汞离子和安绿宝最低影响浓度为 0.0001mg/L 和 0.01mg/L 。表现为细胞的增长繁殖倍数下降。在高浓度组出现大量的死亡细胞, 与对照组相比有明显差别(见表 1、2)。

2.3 四膜虫在不同浓度汞离子和安绿宝影响下的透光度

与计数法同时采用 752-C 型分光光度计测汞离子和安绿宝农药对梨形四膜虫的毒性, 以四膜虫透光度表示。汞离子和安绿宝分别进行 3 次和 4 次的实验, 24h 结果表明接种四膜虫细胞于不同浓度的汞溶液和安绿宝溶液中, 其透光率不同, 但都是随毒物浓度升高而细胞生长繁殖受影响越大, 其透光率就越低(见表 3.4)。

从表 3.4 中可看出, 汞离子和安绿宝农药

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** ISO, Water quality determination of the mobility of *Daphnia magna* Straus, Ref. No. ISO 1982, 6341-82(E)

表 1 汞离子对梨形四膜虫的毒性

浓度 (mg/L)	24h		48h	
	细胞浓度 (细胞数 $\times 10^4$ /L)	细胞增长倍数	细胞浓度 (细胞数 $\times 10^4$ /L)	细胞增长倍数
接种细胞浓度	31.2			
对照组	1378	44	2691	86.3
100	0	0	0	0
10	72.8	2.3	40.3	1.3
1.0	403	12.9	1274	40.8
0.1	507	16.3	1625	52.1
0.01	676	21.7	1703	54.6
0.001	845	27.1	1781	57.1
0.0001	1066	34.2	2158	69.2
0.00001	1326	42.5	2301	73.8
0.000001	1391	44.6	2691	86.3

表 2 安绿宝农药对梨形四膜虫的毒性

浓度 (mg/L)	24h		48h	
	细胞浓度 (细胞数 $\times 10^4$ /L)	细胞增长倍数	细胞浓度 (细胞数 $\times 10^4$ /L)	细胞增长倍数
接种细胞浓度	46.8			
对照组	1937	41.39	3965	84.72
100	0	0	0	0
10	630.5	13.47	2379	50.83
1.0	1066	22.70	2782	59.44
0.1	1183	25.28	3016	64.44
0.01	1274	27.22	3172	67.78
0.001	1937	41.39	3952	84.44
0.0001	1937	41.39	3952	84.44

表 3 四膜虫在不同浓度 Hg^{2+} 影响下的透光率(%)

浓度 (mg/L)	对照	0.000001	0.00001	0.0001	0.001	0.01	0.1
1	68.4	70.4	69.5	65.2	62.0	61.1	56.6
2	52.8	51.8	49.5	46.0	41.4	40.0	35.4
3	75.0	75.0	73.2	71.4	70.1	68.3	64.2
平均	65.4	65.7	64.1	60.86	57.8	56.4	52.1

表 4 四膜虫在不同浓度安绿宝影响下的透光率(%)

浓度 (mg/L)	对照	0.0001	0.001	0.01	0.1	1.0	10
1	36.7	36.6	32.7	30.8	29.6	29.0	24.7
2	28.7	28.5	26.8	25.4	24.6	22.3	15.9
3	65.8	65.6	60.5	57.4	56.1	53.1	25.8
4	61.4	61.8	60.8	54.6	51.2	50.4	26.4
平均	48.2	48.2	45.2	42.1	40.4	38.7	23.2

分别在 0.0001mg/L 和 0.001mg/L 以上浓度时,细胞的增殖倍数下降,透光率明显低于对照组,与个体计数法相符。因此,可用透光率来判断毒物对四膜虫细胞的抑制作用。

3 小结

采用汞离子和安绿宝农药对梨形四膜虫的生长繁殖进行了抑制试验,用个体计数法和用分光光度计测其透光率方法判断毒物的毒性结

果相一致。两种方法相比,用分光光度计测其透光率既快速又简便,能在短期内获取细胞水平的实验数据。

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• 环境信息 •

人造湿地生态系统转化矿山排放水

据位于加利福尼亚州帕洛阿尔托的电力研究所 EPRI) 出版的 1992 年第 1 期《环境现代化》报道,人造湿地生态系统或许能以“大大低于传统化学处理”的费用,将矿山酸性排放水转化成“依从质量”的排放水。田纳西流域管理局(TVA)最初工作结果不太令人满意。但好象运行得较好的是一个利用需氧氧化反应去除铁和锰的湿地生态系统,这类反应将铁和锰转化成可沉降的非溶性化合物。然后,种植耐这些化合物的

香蒲属植物和灯心草。TVA 遇到的一个问题是:这种需氧反应使水变得更酸。由于一个偶然的发现,用一种缺氧的石灰石排放水将排水的 PH 值从 3.1 提高到 6.3,并将金属去除到依从水平。引入鲤科小鱼和房螭蝠来控制蚊子繁殖。仍不确定的是:痕量元素可能在食物链中的沉积物、植物和鱼体内累积。EPRI 计划与 TVA 一起工作,观察是否出现这种情况,并寻找预防办法。

淮海译自 *ES&T*, 1992, 26(8): 1475

从工业废水中清除阴离子的吸附剂

日本国立工业化学实验室建立了一种新的处理含氟化物离子工业废水的有效方法,用铈作吸附剂,使氟化物含量降至 1ppm。该实验室研究用水合金属化合物,主要是稀土化合物,如铈、镧和钇,清除氟化物离子的吸附过程。用加脲均相沉淀法制备水合氧化铈,60℃干燥。在 95ppm 的氟化物溶液中加入 0.25g 干燥的水合氧化铈,使羟离子和氟化物离子向发生离子交换反应。混合液在 20℃振荡 20h 离心得上清液,然

后用离子色谱分析。氟化物离子几乎 100% 被清除,残留的氟化物离子浓度不足 1ppm。碱化合物共沉淀法只能将氟化物离子降至 10—30ppm。该实验室计划研究廉价的吸附剂,如铈改性的氧化铝和氧化钪。

钱玲华译自 *New Technology Japan*, 1992, Vol.20, No.3

Key words: environmental sciences, expert system, environmental information system.

Study on the Planned Environmental Capacities of Water Pollutants and the Control of Total Amount of Discharged Sewage at Lanzou Section of the Yellow River. Cao Lei (Provincial Bureau of Environment Protection of Gansu, Lanzou 730030): *Chin. J. Environ. Sci.*, **14**(1), 1993, pp.54—58

According to the water function, the section of the Yellow River in Gansu is divided into three series sectors, the water resource protection sector, the para-resource protection sector and the comprehensive functional sector. A new conception of planned water environmental capacity of each sector and a scheme for the control of total sewage discharge were proposed. Taking COD, the indicator of organic pollution, as an example, the author calculated the environmental capacities of the sedors based on the U. S. "PDM-PC model", which was simplified for the boundary condition to form an approximate analytic formula. The results thus reckoned from the formula and the planned environmental capacities are both continuous risk values of environmental capacities on the random conditions of different objectives and different probabilities. And these provide more choices for the overall control of sewage discharge and environmental policy-making.

Key words: Yelliw River, environmental capacity, environmental programme.

Preliminary Study on the Biological Negadiversity Country. Zhang Weiping et al. (China Environmental Science Press, Beijing 100062): *Chin. J. Environ. Sci.*, **14**(1), 1993, pp.59—63

The article discusses the concept of biological megadiversity country and illustrates the great strategic importance of these countries in the worldwide conservation of biological diversity. Seven of the megadiversity countries are introduced to readers. Finally, the way of the determination of megadiversity country is discussed. The megadiversity approach is to attract attention of the world on these highly diverse, strategically critical mega-

diversity countries. The approach is a part of the measure of establishing priorities for conserving biological diversity.

Key words: megadiversity country, biological species, level of endemism, biological diversity.

Effects of Fumigation with SO₂, NO₂ and their Mixture on Ascorbic Acid in Chinese Cabbage. Yu Fei, Xu Yigang, Qin Wenjuan (Nanjing Institute of Environmental Sciences, National EPA of China, Nanjing 210042): *Chin. J. Environ. Sci.*, **14**(1), 1993, pp. 64—66

Effects of different doses of SO₂ (0.1—0.25 ppm), NO₂ (0.05—0.25 ppm) and their mixtures on the contents of ascorbic acid in Chinese Cabbage (*Brassica Chinese*) were investigated by using an top-open field chamber device. The results show that the content of ascorbic acid in Chinese Cabbage goes down as the concentrations of SO₂ and NO₂ increase, and SO₂ exerts greater influence on the level of ascorbic acid in the vegetable than NO₂. As ascorbic acid in Chinese Cabbage is reduced, the amount of chlorophyll dropped also. A linear correlation exists between the reduction rate of ascorbic acid and the injury rate of leaves of Chinese Cabbage.

Key words: Chinese Cabage, SO₂, NO₂, fumigation Ascorbic acid.

Toxicity of Mercury Ion and Cypermethrin Pesticide to *Tetrahymena Pyriformis*. Xu Yongxiang, Xiu Ruiqin et al. (Institute of Environmental Health and Engineering, Chinese Academy of Preventive Medicine, Beijing 100050): *Chin. J. Environ. Sci.*, **14**(1), 1993, pp.67—69

The toxicity of mercury ion and pesticide cypermethrin to *tetrahymena pyriformis* was observed in this study according to the method of aquatic toxicology. Results show that the rate of cell division multiplication of *tetrahymena pyriformis* decreases obviously with the increase of concentrations of mercury ion and the pesticide. The lowest effective concentrations for an observation period of 24h were 0.0001mg/L for mercury ion and 0.01 mg/L for cypermethrin, respectively. The lowest effective concentrations for a 48 h observation

were identical to those for the 24 h observation. High concentrations of the chemicals caused deformation, shrinkage, abnormal movement and even death of the cell. The results of individual counting method was tantamount to these of transmissivity method for judging toxicity of mercury ion and cypermethrin.

Key words: *tetrahymena pyriformis*, mercury ion, cypermethrin, toxicity.

Development of Devices for Collecting Samples near the Lacustrine Sediments-Water Body Boundary. Yuan Ziqiang et al. (State Key Laboratory of Environmental Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550002): *Chin. J. Environ. Sci.*, 14(1), 1993, pp. 70—73

In order to investigate the lacustrine environment, and treat the environmental problem, it is necessary to get undisturbed samples. A whole set of devices for collecting undisturbed samples near the sediments-water interface was developed. This includes a sediment sampler, a sedimentary pore water sampler, and a electro-osmotic guillotine system for core-cutting, and so on. These devices can be used for sampling in lakes as deep as 75 meters, collecting columns of sediment sample of 30—90cm high, and columns of upling water of 10—30 cm high. The minimum separation thickness of the sediment sample is 0.1 cm. The set of the devices is rather light, easily disassembled, convenient to transport, and easy to operate.

Key words: lacustrine environment, sampling, sampler.

Determination of Anion-Surfactants in Dying Wastewater with Doubled Standard Addition Method. He Yamin et al. (Beijing Institute of Light Industry, Beijing 100037): *Chin. J. Environ. Sci.*, 14(1), 1993, pp. 74—78

A pretreatment process with sodium hypochlorite-sodium nitrite-ammonium amino sulfonate was adopted to eliminate the interference from dye in the measurement of anion-surfactants in dye-containing wastewater. Doubled standard addition method and sample repeated operation were used

to determine anion-surfactant content in the examined solution. The upper and lower limit of the determination is 6.0 mg/L and 0.75 mg/L, respectively. Through a collaborative test and verification among fire laboratories on an actual dying wastewater containing LAS of 0.78 mg/L and 6.7 mg/L, it was determined that the repeatability standard deviation was 5.0 and 4.5 percent, and the reproducibility standard deviation was 5.2 and 9.7 percent, respectively.

Key words: anion-surfactant, dying wastewater, doubled standard addition method.

Removal of Interfering Elements in Neutron Activation Analysis of Environmental Samples. Wang Jingshu (Chinese Academy for Radiation Protection, Taiyuan 030006): *Chin. J. Environ. Sci.*, 14(1), 1993, pp. 79—81

Gamma-ray measurement is usually interfered during the analysis of environmental samples with neutron activation analysis (NAA) method. The interfering elements could be removed through a Co-precipitation process which took place addition of Cu carrier, radioactive tracers and CH_3CSNH_2 to the decomposed pine leaves. The removal rates (R), which were tested by radiotracer technique, are affected by pH values. Recoveries of Ag, Cd and Cu increase when pH value rises and on the contrary, recovery of Sb decrease. However, recovery of Hg is not the function of pH values.

Key words: neutron activation analysis, interference, Co-precipitation, determination of Ag, Cd, Cu, Sb, Hg.

Determination of Arsenic, Antimony, Bismuth and Mercury in the Environmental Water with Hydride Generation ICP-AES. Jia Li (Water environment Monitoring Centre of Huaihe-River): *Chin. J. Environ. Sci.*, 14(1), 1993, pp. 82—86

A method of potassium borohydride reduction combined with ICP-AES was tested and used for the detection of arsenic, antimony, bismuth and mercury in the environmental water. The detection limit are 0.01 mg/ml for As, Sb, Bi and 0.001mg/ml for Hg respectively. The method proved to be simple and rapid.