

研究简报

多种农药对胎儿发育的联合作用分析*

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摘要 分析了应城农村 12 万确定人群中 1988—1989 年 2 年期间出现妊娠结局的妇女的前瞻性流行病学调查资料。共调查了 5674 位妇女。按照孕期家中使用的农药品种数目, 将研究对象分为 0、1、2、3、4、5、 ≥ 6 和总暴露组, 计算了各组发生各种不良妊娠结局的相对危险度, 结果表明。所暴露的农药品种数愈多, 发生自然流产和出生缺陷的危险度愈大。农药品种数与它们对胎儿发育的不良影响之间存在“剂量-效应关系”。由此得出结论: 多种农药的同时使用可能发生交互作用, 而这种对胎儿发育的不良联合效应对较早期的妊娠尤为明显。

关键词 农药, 妊娠结局, 交互作用, 联合影响。

目前农村中使用的农药品种很多, 例如应城市 1988 年销售的 45 种农药中, 常用的约 13 种, 笔者曾分析研究过这 13 种农药单独对妇女妊娠结局的影响^[1], 本文专门分析多种农药同时暴露对胎儿的联合效应。

1 材料和方法

1.1 材料来源

以应城市一个 12 万确定人群中 1988—1989 年期间出现妊娠结局的 2872 位妇女为研究对象, 在初孕时即建立围产期保健卡, 同时开始随访, 出现妊娠结局后填写调查表, 调查表内容见参考文献^[1]。

1.2 方法

用回顾性队列研究方法, 用 SAS 软件包将研究对象分为孕期家中使用过农药和未使用过农药两个队列, 前者又按暴露的农药品种数分为 1、2、3、4、5 和 ≥ 6 种 6 个队列。根据计算各个队列的各类不良妊娠结局发生率, 并以非暴露的组率为 1 求各个暴露队列的相对危险度(RR), 用以分析农药品种数与不良妊娠结局的关系。

2 结果

列于表 1 中的数据表明:

(1) 除死产和晚期新生儿死亡外, 暴露组发生各类不良妊娠结局的总相对危险度均大于 1,

说明孕期农药暴露对胎儿发育有不良影响。

(2) 除低出生体重外, 发生其它不良结局的危险度均与农药品种数呈正相关, 其中, 自流和出生缺陷的相关系数最大; 农药品种数等于或大于 6 时, 所有不良结局的危险度几乎都大于 2。说明农药的交互作用, 对胎儿发育可以协同产生不良影响, 这种协同作用, 在妊娠早期尤为明显。

(3) 在各类不良妊娠结局中, 由于农药的暴露所致的相对危险度, 以出生缺陷最大 ($RR = 2.22$), 也就是说, 出生缺陷与农药的联系最紧密, 而人群归因危险度则以低出生体重最大 ($PAR = 22.07$)。如果将 7 类不良妊娠结局合计, 则归于农药所致的危险度(AR)为 52.8%, 人群归因危险度 PAR 则为 40.07%, 说明目前农药污染状况对胎儿发育的危害是很大的。

3 讨论

(1) 一种环境污染物的生物学效应, 可以由其它污染物的存在而被改变(变大或变小), 这种现象, 在流行病学中称为“效应修饰”(effect modification), 它是由于污染物之间的“交互作用”(interaction)引起的。在环境流行病学研究中, 化学污染物之间的“效应修饰”或“交互作用”的存在

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表 1 各个农药暴露队列发生各种不良妊娠结局的相对危险度

		非暴露组	暴露组	孕期家中使用的农药品种数						P 值	r
				1	2	3	4	5	6		
自然流产	分子	13	57	2	13	14	8	13	7		0.980
	分母	1209	3772	903	1151	703	409	408	198		
	率(‰)	1.08	1.51	0.22	1.13	1.99	1.96	3.19	3.54	<0.001	
	RR		1.4	0.2	1.05	1.84	1.81	2.95	3.28		
	AR		4.3								
	PAR(‰)			3.3							
早 产	分子	34	149	18	52	27	20	18	14		0.854
	分母	1230	3864	919	1190	716	421	413	233		
	率(‰)	2.76	3.86	1.96	4.37	3.77	4.75	4.36	6.00	<0.05	
	RR		1.40	0.72	1.58	1.37	1.71	1.58	2.17		
死 产	分子	11	28	3	10	4	6	1	14		0.612
	分母	1265	4011	956	1238	725	452	434	206		
	率(‰)	0.87	0.70	0.31	0.81	0.55	1.33	0.23	1.94	<0.081	
	RR		0.80	0.39	0.93	0.63	1.52	0.26	2.66		
早期新生儿死亡	分子	10	48	3	22	8	1	12	2		0.423
	分母	1264	4031	956	1250	729	447	445	204		
	率(‰)	0.79	1.19	0.31	1.76	1.10	0.22	2.70	0.98	<0.001	
	RR		1.51	0.39	2.23	1.39	0.28	3.42	1.24		
晚期新生儿死亡	分子	11	31	6	7	10	1	3	4		0.546
	分母	1265	4014	959	1235	731	447	436	206		
	率(‰)	0.87	0.77	0.63	0.57	1.37	0.22	0.69	1.94	<0.001	
	RR		0.88	0.72	0.66	1.57	0.25	1.02	2.23		
出生缺陷	分子	5	35	5	10	4	4	7	5		0.874
	分母	1366	4276	980	1311	779	479	499	230		
	率(‰)	0.37	0.82	0.51	0.76	0.51	0.84	1.40	2.17	<0.05	
	RR		2.22	1.37	2.05	1.38	2.27	3.78	5.86		
	AR(‰)		4.5								
	PAR(‰)		3.41								
低出生体重	分子	46	257	70	99	21	17	34	16		-0.023
	分母	1197	3813	879	1189	679	429	434	203		
	率(‰)	3.84	6.74	7.96	8.33	3.09	3.96	7.83	7.88	<0.001	
	RR		1.76	2.07	2.17	0.80	1.03	2.04	2.05		76.11

r=相关系数 RR=相对危险度 AR=归因危险度 PAR=人群归因危险度

可能是很普遍的,因而对这种情况的研究有着重要的实际意义。

(2)本研究的结果说明,在目前农村中,多种农药的同时使用,对人类生殖功能和胎儿发育有可能协同产生不良的影响,这种影响随着所暴露的农药品种数的增加而加强,特别明显的是自然流产和出生缺陷,农药品种数目明显与这两种结局的发生率呈“剂量-效应关系”,因而提示,在围产期保健工作中,特别是在妊娠早期,应注意孕妇的保护。人群归因危险度由于农药的暴露而增加了 40‰,因而说明,如果搞好这方面的防护

工作,有可能使 1000 个孕产妇减少 40 个不良结局,这是一个值得重视的有社会效益的工作。

(3)交互作用的评定方法,曾经是流行病学文献中有争论的题目^[2]。本文所用的回顾性队列研究的分析方法,适用于环境因素(农药暴露与健康效应(不良妊娠结局发生率)两者均为计数资料的情况。

(4)由于本文系将整个研究人群按其实际暴露情况分为不同程度的暴露队列,不可能控制各组之间在某些易混杂因素方面的可比性。经过 χ^2 检验,暴露组与非暴露组在近(下转第 V 页)

Abstracts

Chinese Journal of Environmental Science

Study on the Model for Leaching Heavy Metals from Industrial Solid Wastes. Wang Haifeng, Xue Jiyou (Institute of Environmental Sciences, Beijing Normal University, Beijing 100875); *Chin. J. Environ. Sci.*, **15**(1), 1994, pp. 79—81

Based on an analysis of many possible factors which affect eluviation of heavy metals from industrial solid wastes during or after stowing, a model for eluviation and release of heavy metals was presented. The model connected the specific surface area of solid waste, the pervious rate of solid waste and pervious rate of burial layer to the eluviation of heavy metals. The trial data were reasonably applied in practice. The model provided a help to predict, evaluate, control and manage the release of heavy metals.

Key words: industrial solid wastes, heavy metals, model of eluviation and release.

Effect of Acetate on Biological Removal of Phosphorus and Nitrogen. Zhou Yuexi. (Chinese Research Academy of Environmental Sciences, Beijing 100012); *Chin. J. Environ. Sci.*, **15**(1), 1994, pp. 82—84

In this paper, the effects of acetate on biological N and P removal rates and activated sludge settleability were studied. A sequential biological batch reactor (SBR) was used. Experimental results demonstrate that, Acetate has morde effects on PO_4^{3-} -P and NO_3^- -N removal than on NH_4^+ -N removal. The removal rates of PO_4^{3-} and NO_3^- -N became higher with increase in initial acetate concentrations. The least required initial concentration of acetate is 125×10^{-6} . As the initial acetate concentration reached 215×10^{-6} , the bulking of activated sludge ocured.

Key words: wastewater, biological, nitrogen, phosphorus, activated sludge settleability.

Determination of Butyltin Species in Sediments by

Gas Chromatography. Xu fuzheng et al. (Research Center for Eco- Environmental Sciences, Chinese Academy of Sciences, Beijing 100085); *Chin. J. Environ. Sci.*, **15**(1), 1994, pp. 85—87

A method is described for determination of butyltin species in sediments. The butyltin species were extracted from sediments with a mixed benzene-hexane (2 : 1) solvent after a sonication in acetic acid, then converted into volatile butyltin hydrides by using a solution of sodium tetrahydroborate. Butyltin hydrides were measured by gas chromatography with flame photometric detector. The detection limits were 4—10ng tin per gram of sediment sample.

Key words: butyltins, gas chromatography, Sediment.

The Enrichment of Trace Cadmium by Liquid Membrane and It's Determination by Flame Atomic Absorption Spectrometry. Li Longquan et al. (Department of Applied Chemistry, University of Science and Technology of China, Hefei 230026); *Chin. J. Environ. Sci.*, **15**(1), 1994, pp. 88—91

In this paper, the selective preconcentration of trace of cadmium by liquid membrane is studied and the best conditions for enriching trace cadmium reported. The liquid membrane composed of span80P204-kerosene- HCl is found to be more effective. The demulsification of the emulsion phase after extraction is carried out by a heat demulsification technique. The emulsion swelling is examined. Cd^{2+} at $\times 10^{-9}$ level can be enriched and determined by FAAS. A recovery of more than 97% and a enrichment of over 80-fold are obtained for Cd^{2+} . The results was satisfied.

Key words: cadmium, liquid membrane, enrichment, atomic absorption spectrometry.

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亲结婚、孕期服药和孕期饮酒方面是有可比性的,但年龄、孕次和吸烟的分布有显著性差异农药品种数与其效应关系的规律非常明显,因而可以估计,这种误差对结果的影响是有限的。

(5)在暴露于 1 种、2 种或 3 种农药的队列中,有的不良结局的相对危险度小于 1,特别是死产和晚期新生儿死亡更明显、提示存在某种负混杂的影响而用本文的

方法未能加以发现和区别。这也可能提示死产和晚期新生儿死亡这两类结局易于受到医疗技术进步等因素的保护性影响,从而抵消了农药的不良作用。

参考文献

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(上接第 78 页)象不会产生明显影响^[2,3]。本次调查,发现中性白细胞增高和红细胞偏低,并且两组间有显著性差异。这种变化还有待今后进一步验证。

4 小结

本次调查结果表明,居民在 50dB(A)以上的环境下生活、工作和学习,神经系统和听力均会受到不良影响,其损伤情况与居住年限有密切关系。而煤矿的环境噪声污染是严重的,为确保居民的身心健康,每个职防工作者,特别是领导干部应重视环境噪声的治理工作。

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- 3 善慕贞, 北京卫生防疫站编. 全国部分省市噪声普查资料汇编(上册). 北京: 北京出版社, 1981; 263

Abstracts

Chinese Journal of Environmental Science

Sci. 15(1), 1994, pp. 61—64

Four ways for removing inhibitive synthetic organics from an anaerobic system, including anaerobic degradation, sorption onto sludges, volatilization and washout are reviewed in this paper. Based on the relationship of interaction equilibrium between micro-organism communities in the anaerobic system, a reversible mechanism of the anaerobic inhibition by synthetic organics is analysed, and the diagram types of the reversible mechanism of inhibition are also proposed.

Key words: anaerobic digestion, synthetic organics, reversible mechanism of inhibition.

Relationship between *Fusarium* Toxins and Some Diseases. Zhang Hong, Li Jilun (College of Biological Sciences, Beijing Agricultural University, Beijing 100094); *Chin. J. Environ. Sci.*, 15(1), 1994, pp. 65—68

In this article reviewed were the acute, subacute and chronic poisonings of some *Fusarium* Toxins to animal and human beings. Acute *Fusarium* toxins poisoning can cause Leukoencephalomalacia (LEM), Alimentary Toxic Aleukia (ATA), Fusariotoxicosis, etc; subacute poisoning causes Kashin-Beck's disease and Keshan disease; and chronic poisoning may cause cancers. It is emphasized that *Fusarium* Toxins in nature are very dangerous to the health of both animal and human beings.

Key words: Leukoencephalomalacia (LEM), Kashin-Beck's disease, Keshan disease.

Progress and Research Needs in Flocculation Science.

Chang Qing (Department of Environmental Engineering, Lanzhou Railway College, Lanzhou 730070); *Chin. J. Environ. Sci.* 15(1), 1994, pp. 69—72

In this article reviewed are some important progresses in flocculation area, including those in design and operation diagram, physical model for rapid mixing, determination of optimum coagulant dosages, inorganic polymeric coagulants, selection of optimum treatment configuration. Some research needs were presented, including model research, descriptive work, optimal process design, and development of new coagulants.

Key words: coagulation, flocculation.

Analysis of The Combined Effects of Exposure to Multiple Pesticides on Fetal Development. Pan Xiaoqin (Dept. of Environmental Health, Tongji Medical University, Wuhan 430030); *Chin. J. Environ. Sci.*, 15(1), 1994, pp. 73—74

In this paper analysed are the data from a prospective epidemiological investigation on women

whose pregnancy outcomes occurred during the period 1988—1989 in a defined rural population (about 120000 in total) in Yingchen county. There were 5674 women studied. According to the numbers of the pesticides which had ever been used by their families during their gestation period, the subjects were classified into eight cohorts and the relative risks for occurring various adverse pregnancy outcomes of each cohort were calculated. The results showed that the more the numbers of pesticides exposed, the more the risk for occurring spontaneous abortion and birth defect. There might be existed dose-response relationship between the numbers of pesticide categories and the adverse effects on fetal development. It is concluded that multiple pesticides used simultaneously could have interacted with each other. Such combined effects were more significant during the earlier stage of pregnancy.

Key words: pesticide, pregnancy outcome, interaction, combined effect.

Investigation into the Effects of Environmental Noise on the Health of Population Living Around Coal Mines. Fu Changying, Wu Zhengyi (Shanxi Provincial Institute for Labor Health and Occupational Disease, Taiyuan 030012); *Chin. J. Environ. Sci.*, 15(1), 1994, pp. 75—78

To refer to PRC's standard for environmental noise, two groups of population which exposed to the noise above 50 dB(A) and below 50 dB(A) were selected from Guandi coal mine in western mountain region, Taiyuan, and 256 men above 16 years old were taken as the investigative subjects in this study. The results of measurement were that the greatest values of environmental noise measured outdoor and indoor were 75 dB(A) and 63 dB(A), respectively. All of these values have exceeded the PRC's standard for environmental noise. Therefore, the results shown that living, working and studying under this condition have injured effects on population's nerve system and hearing to a certain extent and the injury extent was associated closely with living-years. The positive rate of neurasthenia in population living for above 10 years and exposed to above 50 dB(A) was 34.28%, while that exposed to below 50 dB(A) was 13.35%, the hearing injury of voice frequency in population living for above 10 years and exposed to 50 dB(A) was 34.7% while that living for below 10 years was 29.59% and there were statistically significant differences between both above at $P < 0.05$.

Key words: population, noise intensity, environmental noise in coal mine, health damage.