

新疆孔雀河表层沉积物中有机氯农药的分布及风险评价*

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摘要 分析了新疆孔雀河 9 个表层沉积物样品中 22 种有机氯农药 (OCPs) 含量, 其主要 OCPs 含量的顺序为: 六六六 > 异狄氏剂醛 > 滴滴涕 > 艾氏剂 > 硫丹 > 异狄氏剂 > 氯丹. 研究表明, 近期有 HCH 输入到孔雀河, 其最可能的来源是博斯腾湖的补给或孔雀河附近的农业回流水. 滴滴涕的组成特征分析表明, DDTs 主要源于施用的农药在好氧环境土壤中的分解, 产生 DDE 等主要产物. 风险评价表明, 污染物的风险较低, 所有被评估的 OCPs 的风险值均小于风险评价高限 (ERM).

关键词 有机氯农药, 沉积物, 风险评价, 孔雀河.

滴滴涕 (DDTs) 和六六六 (HCHs) 等有机氯农药由于其具有持久性、累积性和生物毒性等特点, 仍在环境中大量残留, 对生态环境系统形成了潜在的危害.

本文通过野外系统采样, 实验室测试分析, 对新疆孔雀河流域表层沉积物中的有机氯农药进行研究.

1 样品的采集和分析

于 2006 年 7 月至 8 月沿孔雀河 (博斯腾湖至尉犁段) 对不同地点的表层沉积物进行实地采样. 共设 9 个沉积物采样点: 1. 旧水渠; 2 和 3. 新水渠; 4. 博斯腾湖; 5. 铁门关; 6 和 7. 普惠; 8 和 9. 尉犁. 样品采集后尽快运回实验室, 在 -20℃ 条件下密封避光保存.

准确称量 15g 经冷冻、干燥的沉积物样品, 均匀混合无水硫酸钠, 在索氏提取器中用 DCM 抽提 24h, 抽提液加入细碎铜片脱硫. 将所有样品的有机分离液通过旋转蒸发器浓缩至 5ml 然后过氧化铝/硅胶 (体积比为 1/2) 的层析柱, 进行净化分离, 用纯正己烷冲洗出烷烃, 再用 DCM/正己烷 (体积比为 2/3) 的混合液淋洗. 淋洗液再次旋转蒸发, 溶剂置换浓缩至 0.5ml, 转移至 2ml 细胞瓶, 用柔和的高纯氮气将浓缩液吹至 0.2ml, 加入 4μl 五氯硝基苯 (PCNB), 进行分析.

根据美国 EPA 检测有机氯农药的标准方法, 标样 (2000μg · ml⁻¹) 配成浓度分别为 200, 150, 100, 50, 20 和 10μg · kg⁻¹, 内标法 (五氯硝基苯) 定量.

GC-ECD 气相色谱仪 (Agilent 公司, HP-6890 型配 ⁶³Ni-ECD 检测器). 色谱柱为 HP-5 毛细管柱 (30.0m × 0.32mm × 0.25μm). 进样口温度 290℃, 无分流进样. 载气为高纯氮气, 流速为 2.1 ml · min⁻¹. 升温程序: 初始温度 100℃, 保持 1min, 以 4℃ · min⁻¹ 升温至 200℃ · min⁻¹, 2℃ · min⁻¹ 升温至 230℃, 再以 8℃ · min⁻¹ 升温至 280℃, 保持 15min. 检样器温度 300℃. 进样量为 2μl.

样品分析测试均实行三级质量保证和质量控制, 用回收率指标化合物 (2, 4, 5, 6-四氯间二甲苯 + 十氯联苯) 和空白样品控制样品预处理过程中的质量, 回收率为 74%—101%.

2 沉积物中有机氯农药的浓度特征

在 9 个表层沉积物样品中, 22 种有机氯农药除 *o,p'*-DDT 外均有检出. 主要有有机氯农药的浓度范围及检出率见表 1. 沉积物中主要 OCPs 含量大小的顺序为: 六六六 > 异狄氏剂醛 > 滴滴涕 > 艾氏剂 > 硫丹 > 异狄氏剂 > 氯丹. 总有机氯农药 (OCPs) 的浓度变化范围为 1.36ng · g⁻¹—24.60 ng · g⁻¹. 在九个采样点中, 6 号采样点 OCPs 的浓度最高, 其次是 3 号采样点和 8 号采样点, 其它采样点 OCPs 的浓度较低, 均小于 3ng · g⁻¹.

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Distribution and risk assessment of organochlorine pesticides in surf

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Abstract: The content of 22 organic chlorine pesticides (OCPs) in 9 surface sediment samples in the Peacock River in Xinjiang were analyzed. The main OCPs content was: 666> isodilrin aldehyde > DDT> Aldinidine> endian sulfide > isodinidine> chlorodine. Studies have shown that recently 2HCH has been imported into the Peacock River, and its most likely source is Bosten Lake Recharge or agricultural return water near the Peacock River. Analysis of composition characteristics of DDT shows that DDTs mainly originate from the decomposition of applied pesticides in aerobic environment soil, producing major products such as DDE. Risk evaluation shows that the risk of pollutants is low. The risk values of all assessed OCPs are less than the risk assessment limit (ERM).
Keywords: Organochlorine pesticides, sediments, risk assessment, Peacock River.

Organochlorine pesticides such as DDTs and hexa-hexa-hexa (HCHs) are still in large quantities in the environment due to their durability, accumulation and biotoxicity, which poses potential harm to the ecological environment system.

This paper studies the organic chlorine pesticides in the surface sediments of the Peacock River Basin in Xinjiang

1 Samples collection and analysis

From July to August 2006, the surface sediments at different locations were sampled on the site along the Peacock River (Bosten Lake to Yuli section). A total of 9 sediment sampling points were set up: 1. Old canals; 2 and 3. New canals; 4. Bosten Lake; 5. Tiemenguan; 6 and 7. Puhui; 8 and 9. Yuli. Samples are collected and transported back to the laboratory as soon as possible, and sealed and kept at -20 °C without light.

Accurately weigh 15g frozen and dried sediment sample, mix anhydrous sodium sulfate evenly, extract it with DCM in Soxhlet extractor for 24 hours, add finely divided copper sheets to desulfurize the extract. The organic separation solution of all samples is rotated. Concentrate the evaporator to 5mL. Then, a chromatography column of alumina/silica gel (volume ratio is 1/2) was purified and separated, and the alkane was washed out with pure n-hexane, and then DCM/n-hexane (volume ratio is 2/3) The mixture is rinsed. The leachate is rotary evaporated again, the solvent is replaced and concentrated to 0.15 mL, transfer to a 2 mL cell flask, blow the concentrate to 0.12 mL with gentle high-purity nitrogen, and add 4-5 µL Chloronitrobenzene (PCNB), analyzed.

According to the standard method for detecting organic chlorine pesticides by the US EPA, the standard samples (2000 µg·mL⁻¹) were prepared in concentrations of 200, 150, 100, 50, 20 and 10 µg·kg⁻¹, respectively. Quantification by internal standard method (pentachloronitrobenzene).

GC/ECD gas chromatograph (Agilent, HP26890 model with N12ECD detector). The column is an HP25 capillary column (3010m × 0.132mm × 0.125 µm). The inlet temperature is 290 °C, no Split injection. The carrier gas is high-purity nitrogen with a flow rate of 2.11 mL·min⁻¹. Warming procedure: The initial temperature is 100 °C, keep 1 min, and the temperature is increased to 200 °C in 4 min⁻¹, 2 min⁻¹. The temperature is increased to 230 °C, and then the temperature is increased to 280 °C at 8 min⁻¹, and the temperature of the sampler is 300 °C.

The sample analysis and testing are subject to three-level quality assurance and quality control, and the quality of the sample pretreatment is controlled by the recovery index compound (2, 4, 5, 6-tetrachloromethylene+ decachlorobiphenyl) and blank samples. The recovery rate is 74% -101%.

Concentration characteristics of organochlorine pesticides in 2 sediments

Among the 9 surface sediment samples, 22 organic chlorine pesticides were detected except o and p'2DDT. The concentration range and detection rate of the main organic chlorine pesticides are shown in Table 1. The main OCPs in the sediment The order of content is: 666>isodilrin aldehyde>DDT>Aelinidine>endianII>isodilrin>chlorodilrin. Total organochlorine pesticide (OCPs) concentration variation range is 1136ng·g⁻¹—24160 ng·g⁻¹. Among the nine sampling points, OCPs in sampling point No. 6 have the highest concentration, followed by sampling point No. 3 and sampling point No. 8, the concentration of OCPs at other sampling points is lower, all of which are less than 3ng·g⁻¹.

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表 1 孔雀河表层沉积物中主要有机氯农药的浓度 (干重, $\text{ng} \cdot \text{g}^{-1}$)Table 1 Concentrations of main OCPs in surface sediments of the Peacock River (DW, $\text{ng} \cdot \text{g}^{-1}$)

	六氯苯	-HCH	-HCH	-HCH	-HCH	$\alpha, p\text{-DDT}$
均值	0.19	0.11	1.00	0.08	0.26	0
范围	ND—0.37	ND—0.48	ND—4.98	ND—0.13	ND—0.99	ND
检出率 / %	88.89	88.89	88.89	88.89	77.78	0.00
	$p, p\text{-DDT}$	$p, p\text{-DDE}$	$p, p\text{-DDD}$	TC	CC	艾氏剂
均值	0.37	0.35	0.08	0.02	0.26	0.54
范围	ND—1.44	0.06—0.79	ND—0.37	ND—0.08	ND—1.54	ND—4.83
检出率 / %	66.67	100.00	55.56	33.33	88.89	11.11
	狄氏剂	异狄氏剂	硫丹	硫丹	异狄氏剂醛	OCPs
均值	0.06	0.29	0.01	0.37	1.42	5.91
范围	ND—0.14	ND—1.55	ND—0.05	ND—1.47	0.07—8.82	1.36—24.60
检出率 / %	77.78	44.44	22.22	66.67	100.00	100.00

注: ND为未检出。

3 沉积物中 HCHs的组成特征

新疆孔雀河沉积物中 HCHs组成浓度的大小为 $\gamma\text{-HCH} > \beta\text{-HCH} > \alpha\text{-HCH} > \delta\text{-HCH}$ 。HCH 浓度变化范围为 $0.13\text{—}6.58\text{ng} \cdot \text{g}^{-1}$, 平均浓度为 $1.44\text{ng} \cdot \text{g}^{-1}$ 。其浓度高峰主要出现在农业区, 如普惠农场和尉犁县等, 其它地点浓度相对较低。这种浓度变化趋势与区内农业活动比较一致。HCHs四种异构体的浓度变化范围见图 1。由图 1可见, $\alpha\text{-HCH}$, $\beta\text{-HCH}$ 和 $\gamma\text{-HCH}$ 的浓度沿采样点的变化趋势基本相同, 而 $\delta\text{-HCH}$ 的变化趋势与其它三种异构体不同。由此可见, 在最近一段时间内 $\delta\text{-HCH}$ 的来源较之其它三种组分曾有一定变化。 $\alpha\text{-HCH}$ 的浓度最高, 与其在环境中具有高持久性一致。

在工业源 HCHs中主要由 $\alpha\text{-HCH}$ (占 65%—70%), $\beta\text{-HCH}$ (占 5%—6%), $\gamma\text{-HCH}$ (占 13%)和 $\delta\text{-HCH}$ (占 6%)四种组分组成。 $\alpha\text{-HCH}$ 和 $\beta\text{-HCH}$ 的浓度比值 ($\alpha\text{-HCH} / \beta\text{-HCH}$)可以用来指示 HCHs的来源特征。在工业源的 HCHs中, $\alpha\text{-HCH} / \beta\text{-HCH}$ 比值一般在 3—7之间, 大于或者小于这个范围则说明在近期内 HCHs的沉积环境有变化^[1]。一般来说, $\alpha\text{-HCH}$ 在环境中的分解速度比 $\beta\text{-HCH}$ 要快, 当工业源 HCHs进入环境中之后, 如果没有新的工业源 HCHs的输入, $\alpha\text{-HCH}$ 可以转化为 $\beta\text{-HCH}$ 。因此, 当长时间停止使用工业源 HCHs后, $\alpha\text{-HCH} / \beta\text{-HCH}$ 的比值将大于 7; 如果有 $\alpha\text{-HCH}$ (林丹)的输入, $\alpha\text{-HCH} / \beta\text{-HCH}$ 的比值将小于 3。

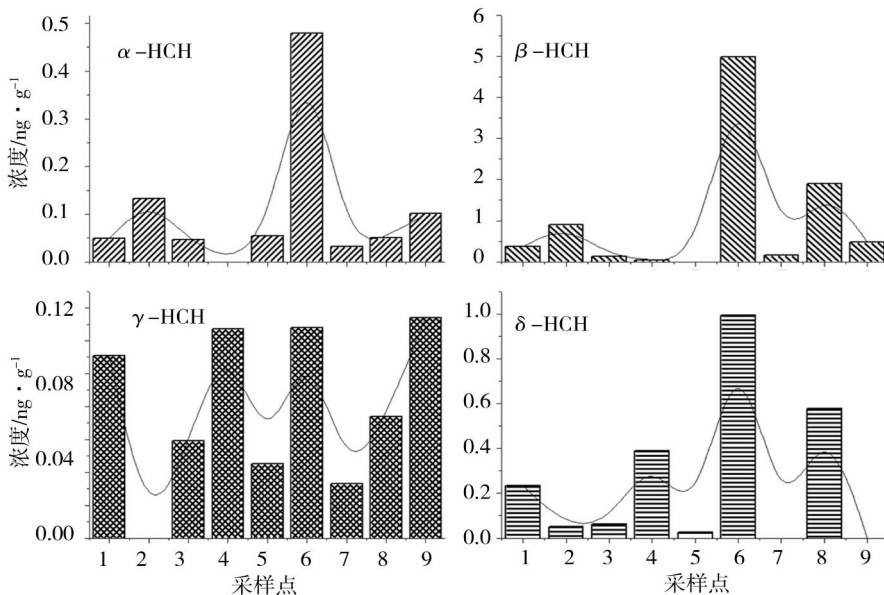


图 1 HCHs四种异构体的含量分布特征 (.....浓度趋势线)

Fig. 1 Distribution of four HCH isomers in sediments

由图 2可知：除了 2号(无法计算)和 6号采样点外，孔雀河表层沉积物中 α -HCH/ γ -HCH的比值均小于 1.5(平均值为 1.33, $R^2 = 0.037$)，说明环境发生了变化，这可能是沉积环境发生了变化或者是有了新的 α -HCH(林丹)的使用。其最有可能的来源是博斯腾湖的补给或者孔雀河附近的农业回流水。

4 沉积物中 DDTs的组成特征

在孔雀河表层沉积物中 p, p' -DDT及其生物分解代谢产物 p, p' -DDE和 p, p' -DDD均有检出，而 α, p' -DDT未检出。 p, p' -DDT, p, p' -DDE和 p, p' -DDD的检出率分别为 66.67%, 100%和 55.56%。DDT浓度的变化范围是 $0.10\text{ng} \cdot \text{g}^{-1}$ — $1.54\text{ng} \cdot \text{g}^{-1}$ 。

工业源 DDTs主要由 p, p' -DDT(占 80%—85%)和 α, p' -DDT(占 15%—20%)组成。 p, p' -DDT在有氧条件下可转化为 p, p' -DDE, 在无氧条件下可转化为 p, p' -DDD。因此，如果存在着持续的 DDT输入，则 DDT的相对含量会维持在一个较高水平，如果没有新的 DDT输入，则 DDT的含量就会不断降低，而相应的降解产物的含量会不断升高， p, p' -DDT及其生物代谢产物 p, p' -DDE和 p, p' -DDD的相对浓度可用来评估可能的污染来源。由图 3可知，孔雀河沉积物中 DDTs类农药以 p, p' -DDE和 p, p' -DDT为主。由此可知，DDT处于好氧的分解环境。

Wilfred等^[2]指出，利用 DDD/DDE和 $(\text{DDE} + \text{DDD}) / \text{DDT}$ 的比值可指示 DDT的降解程度、输入情况和降解过程中的氧化还原条件。由图 4可知，除了 2号，3号和 7号采样点外， $(\text{DDE} + \text{DDD}) / \text{DDT}$ 的比值均大于 0.5。当沉积物中 $(\text{DDE} + \text{DDD}) / \text{DDT}$ 大于 0.5时，沉积物中 DDTs污染物主要来自农业风化土壤，近期没有新的污染源输入。除了 9号采样点外，各采集点 DDD/DDE均小于 1，进一步验证了研究区的分解环境是好氧环境。

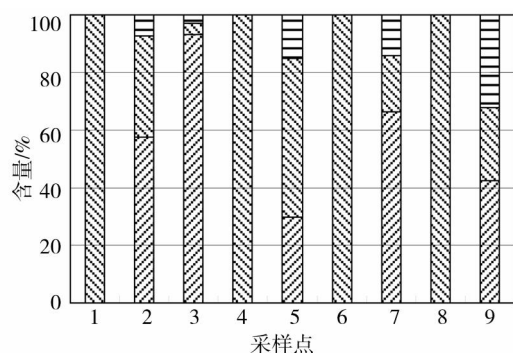


图 3 沉积物中 DDTs各同分异构体的含量

▨ p, p' -DDT ■ α, p' -DDT ▩ p, p' -DDE ▤ p, p' -DDD

Fig. 3 Percentage of DDTs isomers in sediments

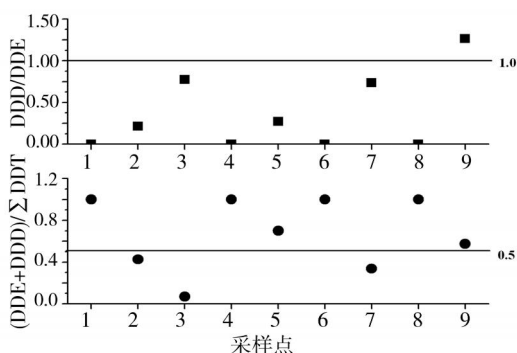


图 4 沉积物中 DDD/DDE和 $(\text{DDE} + \text{DDD}) / \text{DDT}$ 比值

Fig. 4 Ratio of DDD/DDE and $(\text{DDE} + \text{DDD}) / \text{DDT}$ in sediments

5 环境风险与污染现状评估

目前，广泛使用的风险评估标准有两种：Ingersoll风险评估标准和美国佛罗里达海洋和河口沉积物化学样品风险评估标准。Ingersoll风险评估基本原则：一般情况下，当有机污染物的残留程度小于风险评估低限(ERL, 生物效应几率 < 10%)，毒性风险小于 25%，当有一项高于风险评估高限(ERM, 生物效应几率 > 50%)，毒性风险大于 75%^[3]。

由表 2可知，除 DDT、异狄氏剂的浓度值高于 ERL 值而低于 ERM 值外，其余均低于 ERL 值。其中 DDT 的浓度高于 ERL 值而低于 ERM 值所占比例为 11.1%，异狄氏剂的浓度高于 ERL 值而低于 ERM 值所占比例为 44.44%。表明孔雀河表层沉积物中有机氯农药对水体生物及家畜的毒害性风险较小。但由于孔雀河水体处于流动状态，沉积物中的有机氯农药可能会进入水体造成一定的污染和风险。

From Figure 2, we can see that except for sampling points No. 2 (unable to calculate) and No. 6, the ratios of α -HCH/ γ -HCH are less than 115 (average value is 1133, $R^2 = 01037$) indicates that the environment has changed. This may be because the sedimentary environment has changed or the use of new γ -HCH (Lindan). The most likely source is Supplies from Lake Bosten or agricultural return water near the Peacock River.

Constituent characteristics of DDTs in 4 sediments

p, p' -DDT and its biological catabolic products p, p' -2DDE and p, p' -2DDD were detected in the Peacock River surface sediments, while α, p' -DDT was not detected. p, p' -DDT, the detection rates of p, p' -2DDE and p, p' -2DDD are 66167%, 100% and 55156%, respectively. The range of change of DDT concentration is $01110\text{ng}\cdot\text{g}^{-1}$ — $1154\text{ng}\cdot\text{g}^{-1}$

Industrial source DDTs are mainly composed of p, p' -DDT (80% -85%) and α, p' -DDT (15% -20%). p, p' -DDT can be converted to p, p' under aerobic conditions. 2DDE, which can be converted to p, p' -2DDD under anaerobic conditions. Therefore, if there is a continuous DDT input, the relative content of DDT will be maintained at a higher level, and if there is no new DDT input, the content will continue to decrease, and the content of the corresponding degradation products will continue to increase. The relative concentrations of p, p' -DDT and its biological metabolites p, p' -2DDE and p, p' -2DDD can be used to evaluate possible sources of contamination. From Figure 3, it can be seen that the DDTs pesticides in the Peacock River sediments are mainly p, p' -DDT and p, p' -2DDT. From this we can see that DDT is in an aerobic decomposition environment.

Wilfred et al. pointed out that using the ratio of DDD/DDE and $(\text{DDE} + \text{DDD})/\text{DDT}$ can indicate the degree of degradation of DDT, the input situation and the redox conditions during the degradation process. Figure 4 shows that except for sampling points No. 2, No. 3 and No. 7, the ratio of $(\text{DDE} + \text{DDD})/\text{DDT}$ is greater than 015. When $(\text{DDE} + \text{DDD})/\text{DDT}$ in the sediment is greater than 015, the DDTs pollutants in the sediment mainly come from agricultural weathered soil, and there is no new pollution source input recently. Except for the No. 9 sampling point, the DDD/DDE of each collection point is less than 1, which further verifies that the decomposition environment of the study area is Aerobic environment.

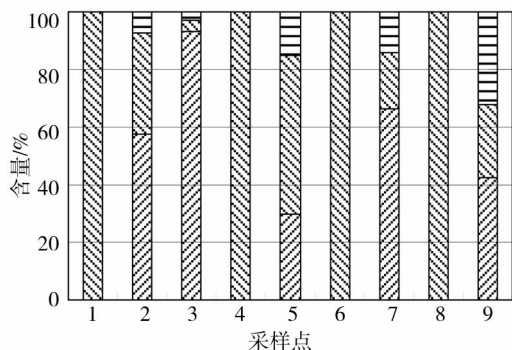


Figure 3 The content of each isomer of DDTs in the sediments Fig13 Percentage of DDTs isomer in sediments

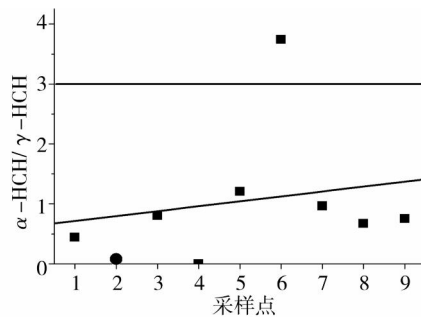


Figure 2 The ratio of α -HCH/ γ -HCH in sediments Fig12 Ratio of α -HCH/ γ -HCH in sediments

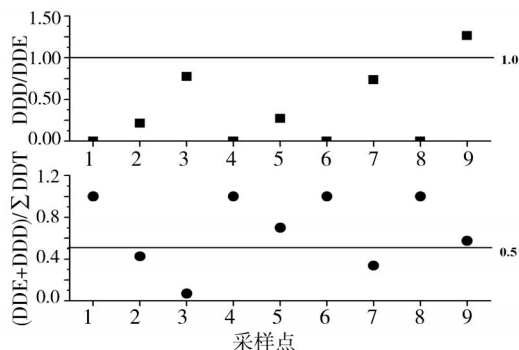


Figure 4 DDD/DDE and (DDE +DDD)/DDT ratios in sediments Fig14 Ratio of DDD/DDE and (DDE +DDD)/DDT in sediments

5 Assessment of the Current Situation of Environmental Risks and Pollution

At present, there are two widely used risk assessment standards: Ingersoll risk assessment standards and the risk assessment standards for chemical sediments in Florida marine and estuary sediments in the United States. Basic principles of Ingersoll risk assessment standards: Generally speaking, when the residual degree of organic pollutants is less than the risk The evaluation limit is lower than 25% (ERL, biological effect probability < 10%), and the toxicity risk is less than 25%. When there is a higher than the risk assessment limit (ERM, biological effect probability > 10%), the concentration values of DDT and isodilin that are higher than the ERL value and lower than the ERM value, the rest are lower than the ERL value. Among them, the proportion of the concentrations of DDT is higher than the ERL value and lower than the ERM value is 1111%, the proportion of the concentration of isodilin is higher than the ERL value and lower than the ERM value is 44144%. This indicates that the organic chlorine pesticide in the surface sediments of the Peacock River has a low toxicity risk to water organisms and livestock. However, due to peacock The river water is in a flowing state, and the organic chlorine pesticides in the sediments may enter the water body and cause certain pollution and risks.

表 2 孔雀河沉积物中有机氯农药的生态风险评价

Table 2 Risk assessment of sediment from the Peacock River

化合物	ERL 值 ($\text{ng} \cdot \text{g}^{-1}$)	ERM 值 ($\text{ng} \cdot \text{g}^{-1}$)	本研究区浓度范围 ($\text{ng} \cdot \text{g}^{-1}$)	比例 /%		
				< ERL	ERL—ERM	> ERM
DDT	1.0	7.0	未检出—1.44	88.89	11.11	0
DDD	2.0	15.0	未检出—0.37	100	0	0
DDE	2.0	20.0	0.06—0.79	100	0	0
DDT	1.58	46.1	0.10—1.54	100	0	0
异狄氏剂	0.02	45	未检出—1.55	55.56	44.44	0

综上所述, 在新疆孔雀河表层沉积物中所有被检测的 22 种有机氯农药, 除了 *o, p'*-DDT 以外全有检出. 其主要 OCPs 浓度的大小为: 六六六 > 异狄氏剂 > 滴滴涕 > 艾氏剂 > 硫丹 > 异狄氏剂 > 氯丹. OCPs 的主要来源是农业和人类活动的共同结果. HCHs 的组成表明, 最近一段时间内孔雀河有 γ -HCH 的输入, 其主要来源可能是农业灌溉的回流水或者博斯腾湖湖水的补给. DDTs 的组成表明, DDT 的主要来源是农业风化土壤, 主要分解产物是 DDE. 另外, 除 DDT 和异狄氏剂的含量高于 ERL 值而低于 ERM 值外, 其余均低于 ERL 值. 说明孔雀河流域残留有机氯农药对生物的毒害风险不大.

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D I S T R I B U T I O N A N D R I S K A S S E S S M E N T O F O R G A N O C H L O R I N E P E S T I C I D E S I N S U R F A C E S E D I M E N T F R O M T H E P E A C O C K R I V E R I N X I N J I A N G , C H I N A

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A B S T R A C T

Nine sediment samples collected from the Peacock River in Xinjiang, were analyzed for twenty-two pesticides. The mean concentration order of the major OCPs was HCH > Endrin aldehyde > DDT > Aldrin > Endosulfan > Endrin > chlordane (TC + CC). The ratio of γ -HCH / α -HCH showed new input of γ -HCH (lindane) to the Peacock River. The most possible source was the water flowing from Bosten Lake and/or the agricultural tailing water that was returned directly into the Peacock River. The compositive characteristics of DDTs indicated that the DDT compounds in sediments might be derived from DDT-treated aged and weathered agricultural soils. The degradation condition for DDT was aerobic, and the main byproduct was DDE. The risk assessment for some OCPs by effects range-low and effects range-median showed that the risk was very low. All the concentrations of evaluated OCPs were below the ERM guideline values.

Keywords: organochlorine pesticides, sediment, risk assessment, Peacock River

Table 2 Ecological risk assessment of organic chlorine pesticides in peacock river sediments
Table 2 Risk assessment of sediment from the Peacock River

	ERL	ERM	u i S (ng g ⁻¹)	1 /%		
	(ng g ⁻¹)	(ng g ⁻¹)		<ERL	ERL	>ERM
DDT	1.0	7.0	1.44	88.89	11.11	0
DDD	2.0	15.0	0.37	100	0	0
DDE	2.0	20.0	0.79	100	0	0
DDT	1.58	46.1	1.54	100	0	0
s f 4	0.02	45	1.55	55.56	44.44	0

To sum up, all 22 kinds of organic chlorine pesticides detected in the surface sediments of the Peacock River in Xinjiang were detected except *o,p'*-DDT. The main OCPs concentration was: DDT > Aldrin > Endosulfan > isodrinol > chlorodane. The main source of OCPs is the common result of agricultural and human activities. The composition of HCHs It shows that in recent period, the Peacock River has input of γ -HCH, and its main source may be the reflow water of agricultural irrigation or the replenishment of Bosten Lake water. The composition of DDTs shows that the main source of DDT is agricultural weathered soil, and the main decomposition products are DDE. In addition, except for the content of DDT and isodrinol in that is higher than the ERL value and lower than the ERM value, the rest are lower than the ERL value. This shows that the residual organic chlorine pesticides in the Peacock River Basin have little risk of toxicity to organisms.

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DISTRIBUTION AND RISK ASSESSMENT OF ORGANIC CHLORINE PESTICIDES IN SURFACE SEDIMENT FROM THE PEACOCK RIVER IN XINJIANG, CHINA

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ABSTRACT

Nine sediment samples collected from the Peacock River in Xinjiang, were analyzed for twenty-two pesticides. The mean concentration order of the major OCPs was HCH > Endrin aldehyde > DDT > Aldrin > Endosulfan > Endrin > chlordane (TC + CC). The ratio of γ -HCH / α -HCH showed new input of γ -HCH (lindane) to the Peacock River. The most possible source was the water flowing from Bosten Lake and/or the agricultural tailing water that was returned directly into the Peacock River. The composite characteristics of DDTs indicated that the DDT compounds in sediments might be derived from DDT-treated aged and weathered agricultural soils. The degradation condition for DDT was aerobic, and the main by-product was DDE. The risk assessment for some OCPs by effects range-low and effects range-median showed that the risk was very low. All the concentrations of evaluated OCPs were below the ERM guideline values.

Keywords: organochlorine pesticides, sediment, risk assessment, Peacock River.