研究简报

大型水蚤生物检测系统对新农药速灭杀丁的毒性评价*

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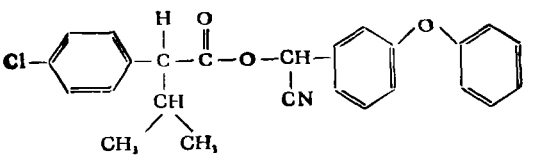
速灭杀丁（Fenvalerate, Sumicidin 20%EC），又叫杀灭菊酯、戎酸氰醚酯、氰戎菊酯、S-5602。商品名叫来福灵。化学名称为a-氰基-3-苯氧基苄基-2-(4-氯苯基)-3-甲基丁酸酯。化学结构式：



速灭杀丁是一种高效、低毒、广谱、耐光热的新杀虫剂。可以防治棉花、柑桔、蔬菜等作物的棉蚜、棉铃虫、菜青虫等。它具有触杀和胃毒作用。击倒快、残效期长，在作物内残留少，有拒产卵、杀卵、杀蛹作用。是我国新引进的拟除虫菊酯类农药。在一些有机氯农药禁用后，速灭杀丁和溴氰菊酯一样是七十年代以来发展最快的新农药。速灭杀丁原液对大鼠经口半数致死剂量 LD_{50} 值为451mg/kg；制剂对大鼠急性口服 LD_{50} 为310—400mg/kg；其急性中毒症状为兴奋乱跳、共济失调，舞蹈与抽搐等。

大型水蚤（*Daphnia magna* Straus）是自然水体中水生食物链的一环，鱼的重要饵料，是一个优秀的实验生物[1,2]。大型水蚤生物测试系统已经被用在环境污染评价上，美国已经将大型水蚤毒性试验纳入国家标准法中[3]。国际标准组织（ISO）制定了大型水蚤运动受抑制试验的标准法[4]，并在各国推广试用(1982)。大型水蚤生物测试系统成了对毒物公认的快速、敏感、廉价的生物测试法[5,6]。为开拓大型水蚤生物测试法在管理农药保护环境方面的应用途径，本室用大型水蚤做为实验生物对新农药速灭杀丁的毒性进行了研究。目前还很少有这方面的报道。

一、材料和方法

实验用大型水蚤是本室自1962年以来分离培养的单克隆纯品系 $62D_a$，按国际标准组织的规定，对此生物株用大型水蚤敏感度测定方法进行了测定试验，其敏感度完全符合ISO要求。实验用出生24h内的幼蚤，水温恒定在20℃(±0.5℃)，实验的pH、溶解氧都在最适范围内。实验用稀释水为ISO标准水。

实验用速灭杀丁购自北京永定门生产资料商店，为20%的乳剂，按有效成分配制成含速灭杀丁1000mg/L的原液，用ISO稀释水以10的倍数连续稀释为各实验浓度。设对照组，并进行重复试验，实验最终按ISO法测定半数运动受抑制浓度 EC_{50}，以实验水蚤的心脏停止跳动做为最终死亡指标，测定半数致死浓度 LC_{50}。

* 本研究为国家自然科学基金资助项目。

二、结果和讨论

1. 速灭杀丁对大型水蚤运动的影响

速灭杀丁能够抑制大型水蚤的运动（表1）.随着速灭杀丁浓度的增加,实验水蚤运动受抑制的百分率在增加. 1mg/L的速灭杀丁在24h内能使全部水蚤失去自由游泳能力而沉底不动.10μg/L 在48h时使全部实验水蚤运动受抑制. 1μg/L 的速灭杀丁在96h时使全部水蚤失去运动能力. 经过统计处理结果表明,使半数实验生物失去运动能力的浓度(EC_{50}值), 24h 为2.5μg/L (1.8—3.2μg/L), 48h 为 0.049μg/L (0.032—1.0μg/L),96h 为 0.0128μg/L (0.01—0.016μg/L). 能够保持实验水蚤正常运动的最高浓度，在 24h 时是 0.01μg/L, 48h 及 96h 时都为 0.0001μg/L.

2. 速灭杀丁对大型水蚤生存的影响

表 1　速灭杀丁对大型水蚤运动的影响*

浓度 (μg/L)	运动受抑制水蚤(%)			实验生物数(个)
	24h	48h	96h	
3200	100	100	100	40
1000	100	100	100	40
320	92.5	100	100	40
100	87.5	100	100	40
32	75.0	100	100	40
10	67.5	100	100	40
3.2	37.5	95	100	40
1.0	27.5	85	100	40
0.32	1.5	77.5	97.5	40
0.1	0	62.5	95	40
0.01	0	32.5	45	40
0.001	0	10.0	37.5	40
0.0001	0	0	0	40
对照	0	0	0	40

* 四次实验平均结果

速灭杀丁中毒的实验幼水蚤，首先是运动兴奋,不停地剧烈窜动,然后沉底原地兴奋性震动，渐渐失去了动的能力. 但是其心脏仍然在跳动,而心率却逐渐减慢,由正常心率(280 次/min) 减为 80 次/min，最后停止跳动而死亡. 死亡的水蚤体膨胀，有的体色变红. 速灭杀丁使实验水蚤运动兴奋的这一现象与哺乳动物中毒后兴奋乱跳,共剂失调,舞蹈抽搐等现象一致.

由表 2 看出，速灭杀丁在 24h 时使全部实验水蚤死亡的最低浓度为 100mg/L，48h 为 0.32mg/L,96h 为 0.0032mg/L. 在 24h 时不引起实验水蚤死亡的最高浓度为 0.32mg/L，48h 为 0.001μg/L，96h 为0.0001μg/L. 经过统计处理后所得到的半数致死浓度 LC_{50} 值：24h 为 25.86mg/L (范围为 18—32mg/L), 48h 为 0.133μg/L (0.1—0.18μg/L),96h 为 0.017μg/L (0.01—0.022μg/L).本结果明显看出速灭杀丁 48h 的 LC_{50} 与 24h LC_{50} 间浓度距离很大. 24h LC_{50} 浓度是 48h LC_{50} 浓度的万倍以上，这表明速灭杀丁对大型水蚤的毒性大小与作用时间的长短关系很大，说明毒物的后作用很大.

表 2　速灭杀丁对大型水蚤生存的影响*

浓度 (mg/L)	死亡蚤的百分数(%)			实验水蚤数目(个)
	24h	48h	96h	
100000	100	100	100	40
32000	55	100	100	40
10000	27.5	100	100	40
3200	17.5	100	100	40
1000	7.5	100	100	40
320	0	100	100	40
100	0	97.5	100	40
32	0	92.5	100	40
10	0	87.5	100	40
3.2	0	77.5	100	40
1.0	0	67.5	97.5	40
0.32	0	62.5	92.5	40
0.1	0	45	77.5	40
0.01	0	27.5	52.5	40
0.001	0	0	27.5	40
0.0001	0	0	0	40
对照	0	0	0	40

* 四次实验平均结果

据报道，速灭杀丁对虹鳟鱼的半数忍受限 48h TL_m 为 7.3μg/L，也有人报道 48h TL_m 为 4.6ppm (鳟鱼). 本实验结果表明速灭杀丁对大型水蚤的 48h LC_{50} 为 0.133μg/

L，说明大型水蚤对农药速灭杀丁的敏感性比鱼大．由此可见，大型水蚤生物测试系统是检验农药毒性的有效方法．

综上所述，速灭杀丁对水生生物的毒性很大，在应用中应当严格控制，加强管理，防止环境污染，确保人体健康．

三、小结

新拟菊酯类农药速灭杀丁对水生生物有较强的毒性，通过大型水蚤生物检测系统测定结果其半数水蚤运动受抑制浓度 EC_{50} 值，24h 为 2.5μg/L(范围 1.8—3.2μg/L)，48h 为 0.049μgh(0.032—0.1μg/L)，96h 为 0.0128μg/L (0.01—0.016μg/L)．速灭杀丁对大型水蚤的半数致死浓度 LC_{50} 值，24h 为 25.88mg/L (18—32mg/L)，48h 为 0.133μg/L(0.1—0.18μg/L)，96h 为 0.017μg/L (0.01—0.022μg/L)．96h 内使全部实验水蚤死亡的最低浓度是 3.2μg/L，使全部水蚤存活的最高浓度是 0.0001μg/L．

大型水蚤生物测试系统是评价农药环境污染的快速、敏感的方法，应当给以推广．

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(收稿日期：1987 年 3月10日)

昆明船房河水-底泥系统硝化作用模拟研究

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船房河位于昆明市西南，是排放市区污水的主要河流之一．为了获得一些硝化作用规律，并对研究方法进行探讨，我们选定了对硝化作用有影响的四个因素，通氧、温度、pH 和铵离子浓度，以船房河为样点，实验室模拟研究了水-土系统的硝化作用．样点水质情况见表 1．

一、材料和方法

1. 样品预处理　在实验室中将 100ml 稀泥和 200ml 水装入 500ml 三角瓶中．置 35℃ 温度下振荡(通氧)，直到样品中测不出氨态氮为止．接着将装样三角瓶用高纯氮冲洗后密封，于35℃温度下静置，直到测不出水中的硝态氮为止．此时已分别消除本底氨态氮和硝态氮对实验可能产生的影响．把所有三角瓶中的样品混合，用电动搅拌器搅动 6 小时，使样品均匀，然后用离心机处理 (3000 转/分) 5 分钟，分离上层水和底泥，备用．

表 1　样点水质情况(1985 年 4月20日)

项　目	溶解氧	水深	NH_4^+-N	NO_2^--N	NO_3^--N	pH	温度
值	O(ppm)	1.3m	24.8mg/l	0.01mg/l	0.19mg/l	7.2(水) 6.7(底泥)	20℃(水) 22℃(底泥)

maxium distance and height of hotsmoke cloud is envolved. This model has been veried with photograph measurement. (See pp. 26—30)

Toxicological Assessment of the Pesticide *Fenvalerate* by Bioassay System of *Daphnia magna* Straus

Xiu Ruiqin, Gao Shirong and Xu Yongxiang (Institute of Environmental Health and Engineering, Chinese Academy of Preventive Medicine, Beijing)

In this paper, the experimental result shows that 24h EC_{50} (median effective concentration) value is 2.5ppb (range 1.8—3.2ppb), 48h EC_{50} 0.049ppb (range 0.032—0.1ppb) and 96h EC_{50} 0.0128ppb (range 0.01—0.016 ppb). The LC_{50} (lethal concentration fifty) values are 25.88ppm (18—32ppm) at 24h, 0.133ppb (0.1—0.18ppb) at 48h and 0.017ppb (0.01—0.022ppb) at 96 h for *Fenvalerate* by using *Daphnia magna*. The result of nonlethal concentration is 0.0001ppb at 96h and 100% lethal concentration 0.0032ppb at 96h. That means *Fenvalerate* is highly toxic to aquatic organism.

The bioassay system of *Daphnia magna* is a method of rapid, sensitive and inexpensive screening procedures for new pesticides, according to the authors. (See pp. 31—33)

Imitation of Nitrification of Sediments Sampled from the Chuanfung River, Kunming, (Yunnan Province)

Kon Yunhong (Kunming Industrial College) *and Sheng Lingling* (Yunnan Institute of Microbiology, Kunming)

In this paper, the effects of aeration, temperature, pH and ammonium ions on nitrification of the sediment sampled from the Chuanfung River have been studied in the laboratory. Orthogonal design was applied to the experiment. The results show that each of the four factors has significant influence on nitrification, and the best conditions for the nitrification of sediment samples are areation day and night, temperature 34°C, NH_4—N 35 mg/L and pH 8.5. (See pp. 33—37)

Influence of Technological Conditions on the Content of Halogenated-hydrocarbons in Potable Water

Wang Xinmin, Ding Zaifu and Yao Shouren (Anhui Provincial Institute of Environmental Protection)

The paper deals with the relationship between contents of the volatile halogenated hydrocarbons in potable water and technological conditions under which floccuation and quantity of chlorine are different, and some of the methods to reduce halogenated hydrocarbons in potable water are suggested. The results show that halogenated hydrocarbons in liquid chlorine are one of the main sources besides the halogenated hydrocarbons which have been originated from chlorine and organic compounds in water source. (See pp. 37—41)

A Study on the Persistence of Zineb in Eggplants, Tomatoes and Soil

Mo Hanhong, An Fengchun and Zhang Lianzhong (Research Center for Eco-Environmental Sciences, Academia Sinica)

This paper deals with residues of the pesticide *Zineb*. Eggplant and tomato plants grown in plastic buckets were treated with ethylenethiourea-free *Zineb* for 1—3 times at a rate of 0.1g per plant. Plant leaves, fruits and soil samples were collected periodically. Colorimetric method was used for quantitative determination. The results show that half-life of *Zineb* on both eggplant and tomato leaves was determined to be about 14 days. Higher amounts of *Zineb* residues in the plants were observed when multiply applied. *Zineb* residues in the test soils disappeared much more rapidly with half-life of 3.9—4.6 days. Lower amounts of *Zineb* were found to be physically absorbed on eggplant and tomato fruit skin. (See pp. 41—45)

Treatment of Wastewater Discharged from the Factory Producing Phthalic Acid

Wang Jusi, Xu Kun and Xu Liangcai (Research Center for Eco-Environmental Sciences, Academia Sinica)

A process of "flocculation—clarification—filtration—neutralization by lime" was developed for treatment of high concentration wastewater discharged from a phthalic acid production factory. The pollutants can be removed from wastewater very effectively, i.e. phthalic acid can be removed from the original 2000—3000 mg/L to less than 50 mg/L, COD from thousands mg/L to the level about 500/ mg/L. Furthermore, pH values of wastewater after treatment can be controlled in the range of 6—7 constantly no matter how high (higher than 13) or how low (lower than 4) in the raw wastewater, After treatment, the water will become degradable by biological process. (See pp. 46—52)

Determination of a Small Amount of Crude Oil in Soli Using Tetrahadrofuran-Turbidimetric Method

Zhang Jiaxiang, Zhang Shuxiang, Zhou Sheng and Jing Yunpeng (Shandong Institute of Building Materials)

In this report, the authors intended to find out a method for determining a small amount of crude oil in soil. First oil is extracted from soil by tetrahydrofuran, then subjected to centrifugal settling. And the supernatant is pipetted for determining the content of crude oil by turbidimetry.

The method is limited to an amount of oil 0.025 mg in a 10 g sample. It gives extraction yield about 98%. Compared with the gravimetric analysis, the method is simple and speedy with high yield. The determination of a sample shows that standard deviation of the method is 0.036 and coefficient variation 0.035. Therefore it can be satisfactory to determine a small amount of crude oil containing in soil. (See pp. 57—58)