ISSN 1991- 8690 الترقيم الدولي ٨٦٩٠ - ١٩٩١
website: http://jsci.utq.edu.iq Email: utjsci@utq.edu.iq

A Study of acute toxicity to pyrethroid insecticide "KARATE" on fresh water alga *Scenedesmus quadricauda* (Turb.) Bereb.

Jasim Mohammed Salman Mayson Mahdi Saleh
Biology Dep.- Coll. Of Science-Babylon University-Iraq

Abstract

The study was conducted to evaluate the acute toxicity of insecticide (Karate) upon trough use green algae *Scendesmus quadricauda* as test organism in period time(24,72,96) hours under control conditions.The alga was growing in water giving from Al-Hilla river after filtering by Millipore filter paper (0.45)µm.

Triplicates of samples where exposed to insecticides in a different concentrations (0.5,1,3)mg/l. Monitoring was proceeded every 24 hours for four days .

This study include measure the optical density as indicators to density of algae and total count of cell number ,growth average and inhibition ratio was study ,also LT50 is calculated.

Result show increase concentration of insecticide with increase concentration and recorded high inhibition ratio in concentration 3mg/l is (91.4%) after (96)h , and low value of LT50 in concentration (3)mg/l is (17.78).

This study pointed out that insecticide differs in their toxicity according to concentration and tim exposure.

Key words: acute toxicity ; *Scenedesmus quadricauda*; pyrethroid insecticides.

E.mail: jassim_hilla@yahoo.com

Introduction:

Algae considering as being the primary producer in the aquatic environment their importance in providing energy to zooplankton and fish (Vagi *et al.,* 2005).

Algae were used to evaluate the risk of new chemicals via laboratory research and these organisms are used to bioassays to measure the toxicity of waste water stream(Prokhotskaya *et al*., 2003).

A variety of organic toxic gents such as insecticides , herbicides and other organic compounds have detected in fresh water system, and effect both target and non target organisms when discharged into a water body(Li *et al*.,2005).

Toxic compounds may affect on algal photosynthesis, growth, enzyme activity and respiration ; the action of toxic substance on algae is important not only for the organisms themselves, but also for other links in the food chain(Ma and Liang, 2001). Insecticides are diverse` group of widely varying chemical structure from simple inorganic to complex organic molecules, they are released in the environment by volatilization, adsorption, chemical and\ or microbiological transformations(Rand,1995) , their application can cause adverse effects on aquatic ecosystems in areas near by agricultural fields because those substance can be transferred to the aquatic environment leading to contamination of its flora and fauna , these contaminants may occur during rainfalls or eventually by atmospheric deposition(Vagi, *et al.,* 2005) .

In order to evaluate the importance of this aquatic contamination it is necessary to resort to toxicity bioassays (Deneer,2000). A decrease in algae density and species richness affects the aquatic system directly by reducing their biodiversity and primary products (Abdel-Aty, *et al.*,2006) .

Numerous studies have indicated that pesticides inhibits growth and photosynthesis of fresh water algae and algal responses to this compounds vary widely depending upon concentration use ,duration exposure, and algale species tested (Tang *et al.* 1997).

Pyrethroid insecticides are relatively persistent in water, and its concentrations would not be expected to vary greatly over time specially in short-term bioassays(Solomon *et al*., 1996). More recent testing procedures have recognized that, because the wide range of sensitivity

observed, a batter of species is recommended to improve algal toxicity detection in chemical evaluation(Boutin *et al*., 1993).

Algae species used in this bioassays *Scenedesmus quadricauda* was chosen in this study because easy to cultivate and its response is highly reproducible(Huang *et al.* 1994).

The aim of the current study was examine the effect of insecticide" Karate" on growth of green alga *S. quadricauda* and include measure of optical density as indicators to density of algae; % inhibition ; and LT50.

Materials and Methods:

Fresh water algae *S. quadricauda* was obtained from institute of Biotechnology \ Baghdad University-Iraq.

The test species grow in natural conditions by use water from Hilla river after sterilized and filtration by Millipore filter paper 0.45µm to released other species of algae and microorganisms as bacteria ;pH regulation in lab. By NaoH andH2SO4 ;

Screw- capped glass tubes(150 mm × 22mm diameter) , each containing 30 ml river water and 14.5 ml from algal culture(Li *et al*.2005). Insecticide (Karate) solution(6%) dissolved in water was added to each tube providing nominal concentration of 0.5, 1 , and 3 mg/l.

Samples were withdrawn after 24,72, and 96 hours , each test was replicated three times.(Kent and currie,1995). From day(0) to day(4) algal cells were taken daily and cell numbers were counted with counting chamber under microscope determine the growth rate and % inhibiting optical density was measured at 680 nm from each sample(Kasai *et al.,* 1993) .

The growth rate was calculated according to the equation

(Guillard,1973):

U=LnNi-LnNo\(t-to)

Where(U) is the growth rate, (Ni)the cell number at (t) time, (No) the cell number at o time, t the sample time for counting cell number, and to is the origin time of the treatment.

The percent inhibition(% I) of algal growth for each concentration was calculated according to(U. S. EPA, 1989).

LT50 were calculated using the probate procedure with log transformed values of test insecticide concentrations.(Li,*et al*.,2005). The statistically significant effects of the pesticide on growth of algae species under study was determined using analysis of variance(ANOVA) with SPSS program.

Results and Discussion:

The effects of the pesticide(karate) show in figures (1-4). The inhibitory effects on algal growth by optical density, it is decreased with increase the concentration of pesticide and time exposure.

The growth rate of algae measured after the exposure to pesticide by total count of cell survival reflects of cell responses to increasing concentration and inhibition in low doses and cell death in high doses(Prokhotskaya *et al*., 2003).

The growth of algal cell under study was highly affected by insecticide karate in the number of cells was decreased and the content of pigments and the activity of SOD were highly activity by different types of pesticide (Kong and Sang, 1999).

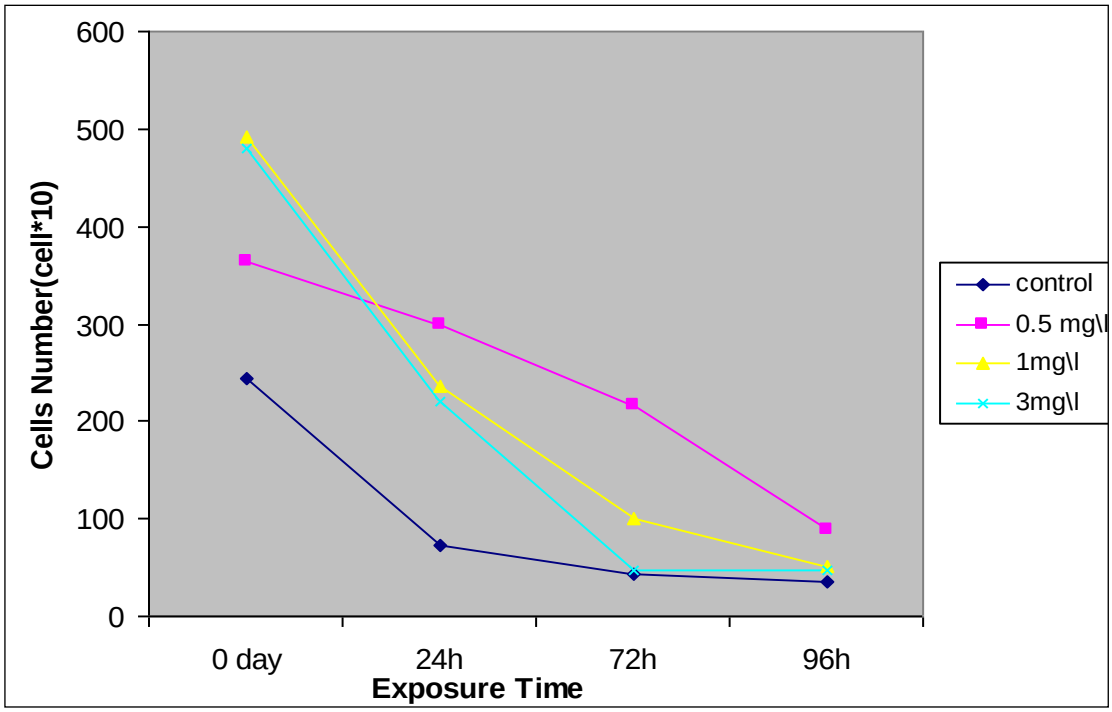
The effective concentrations that caused 50% inhibition compared with the controls were calculated for the algal species under study(figure 4) at (24,72, 96)hours after treatment for optical density.

The LT50 values varied significantly among different concentrations, according to this study the 96 h LT50 of karate on *S. quadricauda* was (17.78) mg\l and 72h,24 h LT50 were (22.28) and (38.48)mg\l respectively.

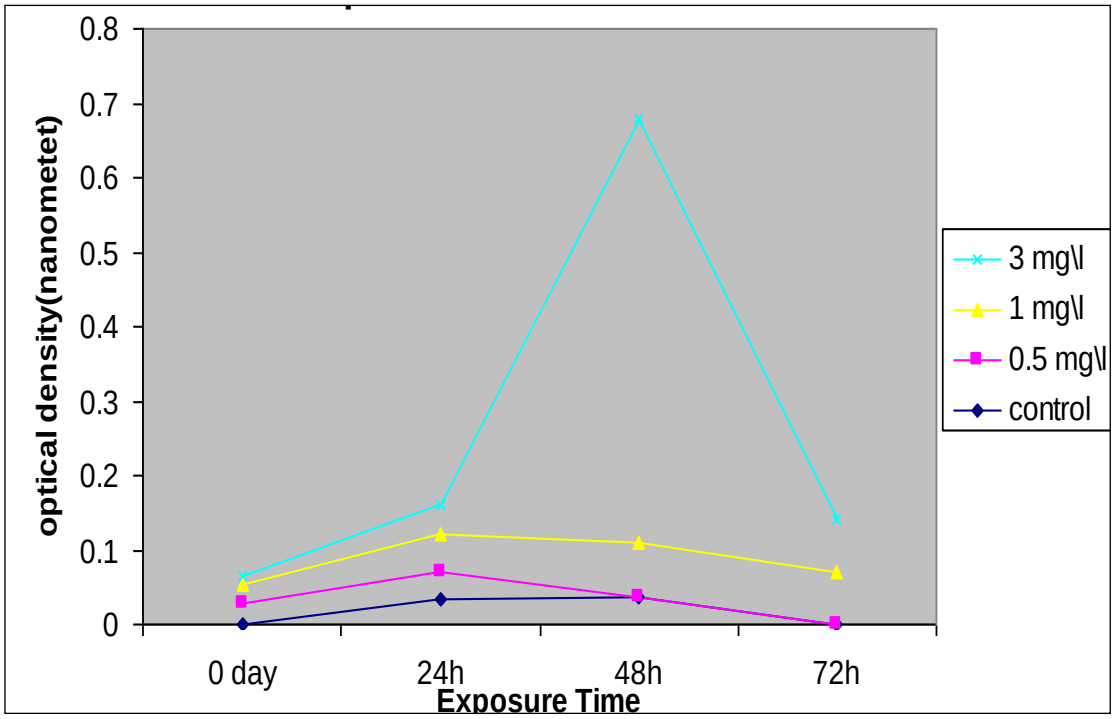
LT50 values are useful to more exactly determine the range of pesticide concentrations that cause growth inhibition in an algal population(Anton *et al* . 1993).

The LT50 values (fig. 5-7)from this study are similar to those reported for other algal species(Solomon *et al*., 1996).

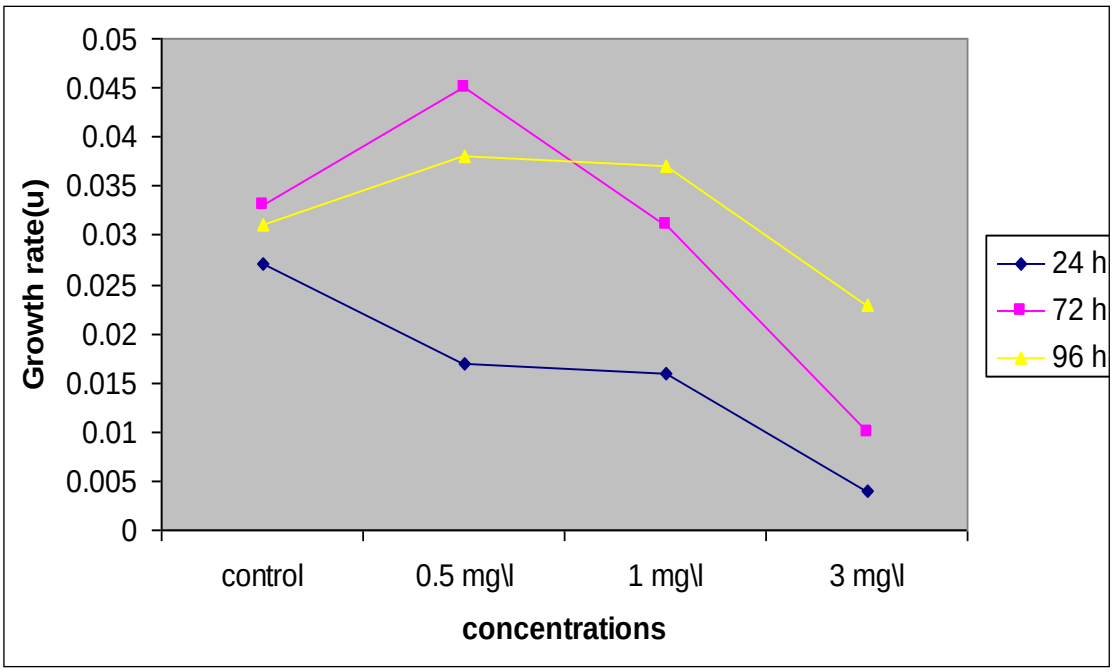
The differential sensitivity to toxins among freshwater algae could have serious impacts on community structure and seasonal successional patterns (Hersh and Crumpton,1987).



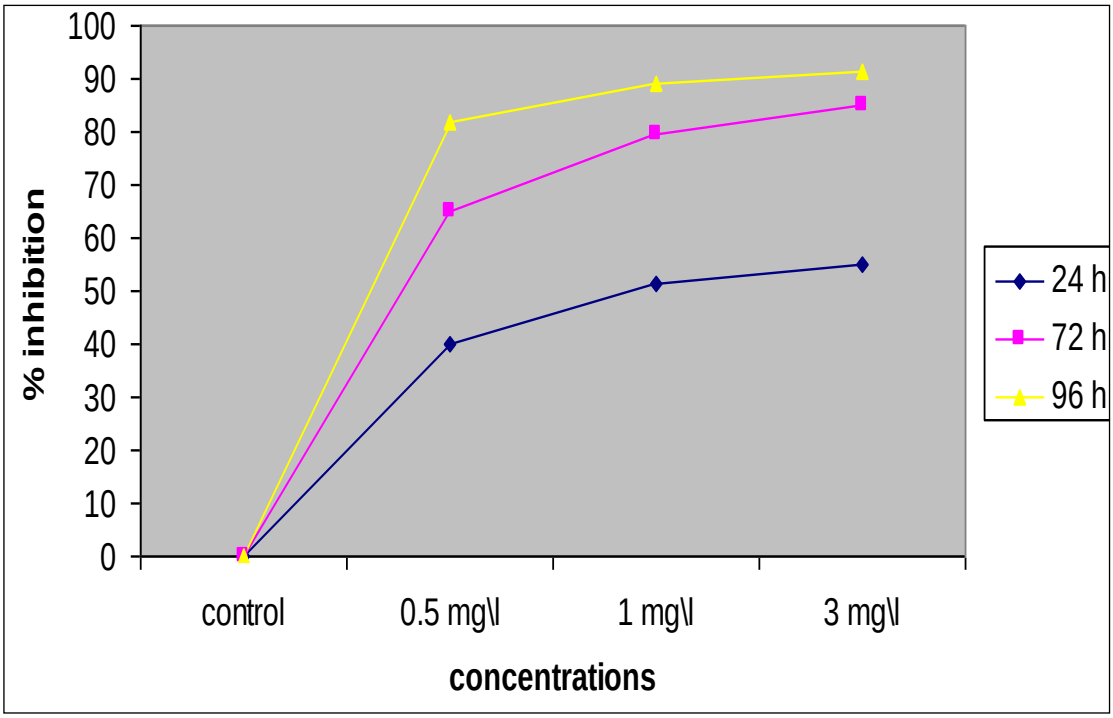
Figuer(1) Total cell number of *S. quadricauda* at exposure to difrente concentrations from insecticide karate



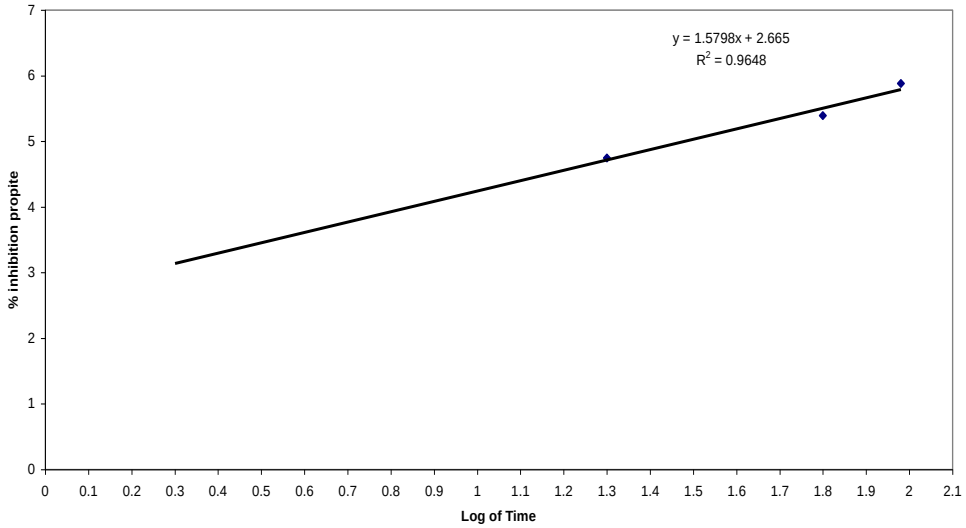
Figure(2):Optical Density of*S.quadricauda* after exposure to insecticide karate



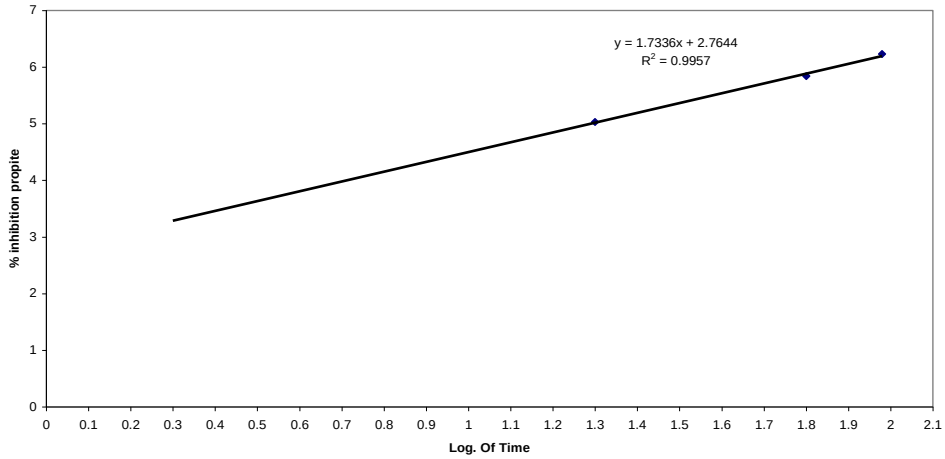
Figure(3):Growth rate of *S.quadricauda* at exposuer to diferent cocentrations from insecticide karate



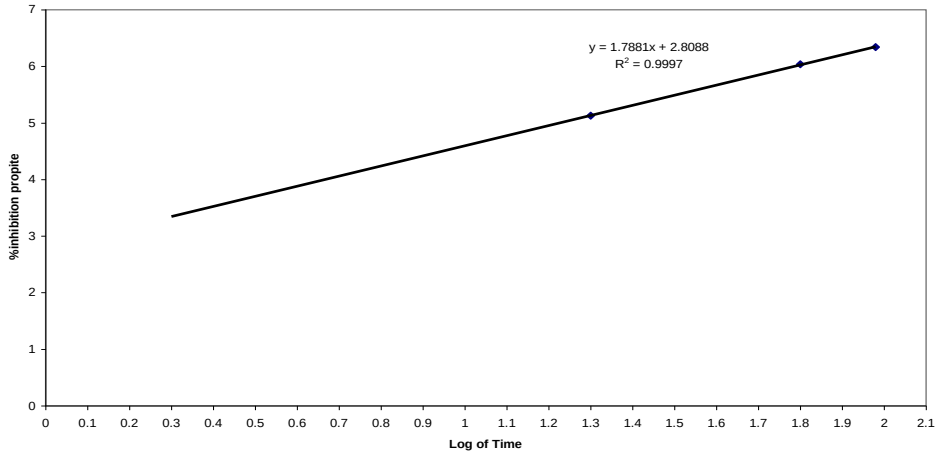
Figure(4):Inhibition rate(%) of *S. quadricauda* at exposuer todifrent concentrations from insecticide karate



Figure(5) Line of toxicity on exposure *S.quadricauda* to isecticide karate in concentration (0.5) mg/l and LT50 value



Figure(6)Line of toxicity on exposure S.qaudricauda to insecticide karatein concentration (1) mg/l and LT50 value



Figure(7): line of toxicity on exposure S.quadricauda to insecticide karate in concentration (3)mg/l and LT50 value

References:

- **Abdel-Aty,A,M. ;El-Dib,M.A. and Badawy,M.I**. (2006).Toxicity of pesticide industrial waste water to the green algae *Scenedesmus obliquas* : A case study. *Pakistan J.of Bio. Sci.*, 9(3) : 563- 567.

- **Anton ,F.A.; Laborda ,E. and Laborda ,P**.(1993). Acut toxicity of technical captan to algae and fish. *Bull. Environ. Ccontamin. Toxicol.* , 50:392-399.

- **Boutin , C.; Freemark, K.E. and Keddy ,C.J.** (1993). Proposed guidline for registration of chemical pesticides: Non target plant testing and evaluation. Technical report series 145.Environment Canada, Ottawa , Ontario.

- **Deneer,J.W**.(2000).Toxicity of mixtures of pesticides in aquatic systems. *Pestic. Manag. Sci.* , 56: 516-520.

- **Guillard,R.L**. (1973). Culture methods and growth measurements. Hand book of phycology methods. Cambridge university press, Cambridge, pp.289-311.

- **Hersh,C.M. and Crumpton , W.G**.(1987). Determination of growth rate depression of some green algae by atrazine. *Bull. Environ. Contamin. Toxicol.* , 39: 1041-1048.

- **Huang G.; Dai, S.G. and Sun, H.W**.(1994). Determination of the toxicity of organic pollutants to algae. *Environ. Chem*., 13(3) :259-262.

- **Kasai, F.; Takamura, N. and Hatakeyama,A.** (1993). Effects of smetryne on growth of various fresh water algal taxa. *Environ.Pollut*., 79:77-83.

- **Kent,R.A. and Currie,D**.(1995).Predicting algal sensitivity to a pesticide stress. *Environ. Toxicol. Chem*., 14:983-991.

- **Kong ,F.X. and Sang,W.L**. (1999). Physiological and biochemical response of *Scenedesmus obliquas* to combined effect of Al ,Ca, and low pH . *Bull. Environ. Contamin. Toxicol*. 62: 179-186.

- **Li, X.; Ping, X.; Xiemei ;Zhenbin, W. and Liqiang, X**. (2005). Toxicity of Cypermethrin on growth ,pigments, and superoxide dismutase of *Scenedesmuse obliquas*. *Ecotoxcol.and Environ.Safety*, 60: 188-192.

- **Ma,J. and L iang,W**.(2001). Acute toxicity of 12 herbicides to the green algae *Scenedesmus obliquas* and *Chlorella pyrenoidosa* to30 herbicides. *Bull. Environ. Cotamin. Toxicol*., 68:275-281.

- **Prokhotskaya, V.Yu. ;Vesolova ,T.V.; Veselovskii, V.A. ;Dmitrieva,A.G. A. and Artyukhova, V.I.** (2003). The dimensional –age structure of a laboratory population of *Scenedesmus quadricauda* (Turp.) Bereb. in the presence of imazalyl sulfate. *Intern. J. Algae*. ,5,82.

- **Rand ,G.M**.(1995) .Fundamentals of aquatic toxicity : effects, environmental fate and risk assessment. 2nd ed., Taylor and francis , Philadelphia.

- **Solomon ,K.R. ;Baker, D.B. ;Richards, R.P. ; Klaine ,S.L.; Lapoint, T.W. ;Kendell, R.J.; Weisskopf ,C.P.; Giddings,J.M.; Giesy, J.P. ;Hall,L.w. and Williams ,W.M**.(1996) .Ecological risk assessment of atrazin in north America surface waters. *Enivron. Toxicol. Chem*. , 15:31-76.

- **Tang,J.X.; Hoagland, K.D. and Siegfried, B.D**.(1997). Differential toxicity of atrazine to selected fresh water algae. *Bull. Environ. Contamin. Toxicol*. , 59:631-637.

- **U.S. EPA** (1989). Sort –term methods for estimating the chronic toxicity of effluents and receiving water to fresh water organisms. 2nd ed. EPA 1.23\5:600\4-89\001.

- **Vag, M.C.; Kostopoulou, M.N.; Petsas, A.S.; Lalousi, M. E. ;Rasouli,Ch. And Lakkas,T.D**.(2005) .Toxicity of organophosphorous pesticides to the marine algae *Tetraselmis suecica. Global NEST Journal*, 7(2): 222-227.

دراسة السمية الحادة للمبيد البايرثرويدي كراتي على طحلب المياه العذبة *Scenedesmus quadricauda* (Turb.) Bersb

جاسم محمد سلمان ميسون مهدي صالح
قسم علوم الحياة- كلية العلوم- جامعة بابل

الخلاصة:

تناول البحث الحالي دراسة السمية قصيرة الأمد للمبيد الحشري كراتي من خلال استخدام الطحلب الأخضر *Scenedesmuse quadricauda*

ككائن اختبار من خلال فترات تعرض (٢٤, ٧٢, ٩٦) ساعة في ظروف مختبريه مسيطر عليها.تم تنمية الطحلب مباشرة على ماء نهر جلبت من نهر الحلة بعد إمرارها خلال ورق ترشيح(٠,٤٥) مايكروميتر لغرض التخلص من الطحالب والأحياء المجهرية التي يحتمل وجودها فيها. استخدمت ثلاث تراكيز من المبيد هي(٠,٥) (١) و(٣) ملغم /لتر وبثلاث مكررات لكل تركيز وسجلت النتائج لكل ٢٤ ساعة من بداية التجربة. تضمنت الدراسة قياس الامتصاصية كمؤشر لكثافة الطحلب وحسبت عدد الخلايا ومعدل النمو ونسبة التثبيط وقيمة الزمن نصف القاتل.

تبين إن التأثير يزداد بزيادة تركيز المبيد المستخدم وظهر إن عدد الخلايا ومعدل النمو يقل بزيادة فترة التعرض وزيادة التركيز المستخدم بينما كانت نسبة التثبيط تزداد بزيادة فترة التعرض والتركيز, وكانت أعلى نسبة تثبيط هي(٩١,٤%)في التركيز ٣ ملغم/لتر بعد فترة تعرض(٩٦) ساعة وأقل قيمة للزمن نصف القاتل كانت (١٧,٧٨) ساعة في التركيز (٣) ملغم/لتر ايضا. بينت نتائج الدراسة إن تأثير المبيد على معايير النمو والكثافة في الطحلب تحت الدراسة يختلف تبعا للتراكيز التي يتعرض لها وفترة التعرض.