Effect of some Organic Pollutants (furfural and toluene) on Biological Aspects of Free- living Ciliate *Oxytricha falax*

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Abstract:

Samples of *Oxytricha falax* were collected from Tigris River by 55µ. mesh net.

Culturing of *O. falax* were cultivated in specific conditions (DO 3-5mg/l.; W.Temp. 24±1ºC; pH: 6.8-7.5).The effect of various furfural concentration 0, 20, 40, 80,100 and 124 ppm and toluene concentration 0, 15, 30, 34.2, 34.5 and 35 ppm after two periods of treatment (24 and 48 hr.) on the physiological parameters of *O. falax* ciliate were observed. This study showed that the lethal concentration of furfural was 124ppm and 80ppm after 24hr. and 48hr. from treatment which killed all the individual community respectively. Furthermore the treatment of *O. falax* individuals with different concentrations of toluene indicated that 34.5 ppm of it caused disappearance of the individuals' population after 48hr., while the 35ppm concentration from toluene caused dead of all individuals after 24 hr. from their treatment.

Key words: Organic Pollutants, Oxytricha falax, Biological treatment.

Introduction:

Furfural and toluene were used in different industrial activities. Furfural is used as selective solvent in the refining of lubricating oils and solvent for phenolic resins [1]. While the toluene is a common solvent, able to dissolve paints, paint thinners, silicon sealant, many chemical reactants, rubber, printing ink, adhesive (glues), lacquers, leather tanners and disinfectants [2].

Free living ciliates are unicellular eukaryotic, mainly phagotrophic protests that play important metabolic roles in fresh water ecosystems [3,4]. Protozoa are at the base of the heterotrophic eukaryotic food web and an essential component in marine, fresh water because they consume a significant portion of the bacterial productivity, enhancing nutrient cycles and energy flow to the benefit of microorganisms, plants and animals [5]. Protozoa are not only important bioindicator of environmental conditions and changes in natural and human influenced ecosystems [6], but they also play a pivotal role as regulators of key ecosystem processes [7]. Also, protozoa are single celled-animals that feed on bacteria but also eat other protozoa, soluble organic matter and sometimes fungi [8,9].

In this context, the present study is an attempt to evaluate the sensitivity of *O. fallax* to two organic compounds (furfural and toluene) and to obtain a predictive tool for hazard and risk assessment in the water quality criteria.

Materials and Methods:

Samples collection:

Samples of O. *fallax* were collected from Tigris River by 55µ diameter mesh size net. O. *fallax* tested

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in these toxicity experiments, which collected from several stations and identified according to [10,11]. Organisms were cultivated in controlled condition in the laboratory at W.Temp:24±1ºC; pH: 6.8-7.5; DO: 3-5 mg/l, and cultured in sterilized media containing lettuce extracts. The composition of this media comprise 1.5g dry lettuce in 1L D.W., boiled for 10min, filtered then inoculated with fresh *E.coli* and finally incubated (12). Stock solution and experimental concentrations of furfural were prepared as described by:

Stock solution of 1000ppm of furfural was prepared using D.W. and serial dilutions were made from stock solution. Also, stock solution of 1000ppm of toluene was prepared using methanol as solvent and then serial dilutions were made from stock solution. Stock solution contains 20% of culture media.

Generation number and generation time were calculated according to the following equation:

$$N = \frac{\text{Log } Y/X}{\text{Log } 2}$$

Y: final number X: initial number

N:generation number. G= t/ N

t= treatment period

G= generation time

Results and Discussion:

Effect on the population growth of *O. fallax*:

The results in table (1) showed that the noticeable toxic effects on the community of *O. fallax* were observed with 124 ppm concentration of furfural after 24hr. from exposure. While, the toxic effects of furfural on communities of ciliates were noticed with 80ppm concentration after 48hr. from exposure which indicated that this pollutant affect on the growth of organisms with No. of generation at the 80 and 100ppm were measured as 1.585and 1.379 as compared with control (1.678) within 24hr. While the No. of generation at the same concentration of furfural was disappear after 48hr. from exposure due to the death of organisms. The time of each generation of *O. fallax* exposed to 80 and 100 ppm of furfural was recorded 15.142 and 17.404 after 24hr. from exposure to while after 48hr. the generation time was disappear in the same concentration which due to the death of organisms.

Many recent studies have shown that ciliates play a very important trophic role in periphytic communities and as the indication of pollution degree in river and lakes [13,14]. Also, *O. fallax* is significant consumers of bacteria and algae, which participate in transformation of the organic matter and nutrients that constitute the components of diet of rotifers and crustaceans [15].

Table 1: Effect of the organic pollutant (furfural) on the growth of *O. fallax.*

Concentration (ppm)	No. of individual	No. of individual	No. of generation		Time of generation	
	24hr.	48hr.	24hr.	48hr.	24hr.	48hr
O	16	64	1.678	3.678	14.303	13.050
20	8	64	0.678	3.678	35.398	13.051
40	8	64	0.678	3.678	35.398	13.051
80	15	*	1.585	*	15.142	*
100	13	*	1.379	*	17.404	*
124	*	*	*	*	*	*

No. of initial of individuals for each concentration= 5

*: dead

Effect on the growth of *O. fallax*:

Table (2) summarises the data on the effects of different concentration of toluene on the diversity of *O. fallax* , the generation numbers of ciliates received 30 ppm were recorded 1.678 and 2.263 after 24 and 48 hr. respectively .While the generation time was measured (14.303 and 21.210) after 24 and 48hr. respectively. This concentration of

toluene doesn't cause cell death due to the ability of this organisms to survive in water containing high concentration of organic matter and dissolved oxygen (Curds, 1965). The number of species of ciliate present in the effluent indicates qualitatively the efficiency of removal of pollution from the wastewater during treatment in the rotating biological reactor (Luna-Pabello, 1996; Selivanovskaya, 2007). The concentration of 34.2 ppm from toluene was immediate toxic dose to *O. fallax* and cell death was exhibited after 24 and 48hr. due to the high concentration of toluene that it's limited in the industrial water 0.01-20ppm (WHO, 1985).

Table 2: Effect of the organic pollutant (toluene) on the growth of *O. fallax*.

Concentration (ppm)	No. of individual	No. of individual	No. of generation		Time of generation	
	24hr.	48hr.	24hr.	48hr.	24hr.	48hr
O	32	64	2.678	3.678	8.962	13.051
15	16	32	1.678	2.678	14.303	17.924
30	16	24	1.678	2.263	14.303	21.210
34.2	2	1	1.322	18.154	*	*
34.5	2	*		*		*
35	*	*	*	*	*	*

No. of initial individuals for each concentration= 5
*: dead

The result of this study was agreed with result of Adl and Gupta (2006) showed that 32 species of ciliates were found in forest soil containing high organic matter which may be used as the potential bioindicator of soil fertility. Generally, the rapid changes of the water content as well as the discharged wastes appeared to be the main responsible factor for all variations occurred in the water quality as well as the zooplankton community in lake (Abdel Aziz and Aboul Ezz, 2004).

Effect of Experimental toxics on the No. and Time of generation on *O. fallax*:

Number and time of generation of *O. fallax* was disturbed by the culturing in the high concentrations of both toxic materials (toluene and furfural).

According to Sabtie (2005) who studied the effect of reducing dissolved oxygen by the organic matters in the wastewater on some zooplankton species, this study of population individuals *O. fallax* confirmed the same results by pollutants concentrations (furfural and toluene) such as biological aspects in addition to time and number of generation

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تأثير بعض المواد العضوية(الفورفورال والتولوين) على بعض الجوانب الحياتية للهدبي حر المعيشة *Oxytricha falax*

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الخلاصة:

جمعت نماذج افراد النوع الهدبي *Oxitricha fallax* بواسطة شبكة جمع الهائمات الحيوانية (55µ) من محطات مختارة على نهر دجلة. أستزرعت افراد النوع الهدبي تحت ظروف مسيطر عليها (الاوكسجين المذاب 3-5ملغم/لترودرجة حرارة الماء 24±1°م والاس الهيدروجيني 6.8-7.5). ان تاثير تراكيز مختارة من الفورفورال (124،100،80،40،20،0 ملغم/لتر) والتولوين (35، 34.5 ،34.2،30،15،0 ملغم/لتر) خلال فترتي المعاملة (24 و 48 ساعة) على بعض الجوانب الفسيولوجية للهدبي *O. fallax*. بينت هذه الدراسة ان التركيز القاتل للفورفورال لجميع الافراد كان 124 ملغم /لتر بعد 24 ساعة من المعاملة بينما سبب تركيز 80 ملغم/لتر من نفس الملوث موت جميع الافراد الخاضعة للمعاملة ايضاً وخلال 48 ساعة . أشارت معاملة افراد الهدبي *O. fallax* بالتراكيز المختارة من التولوين ان تركيز 34.5 ملغم/لتر منه كان سبب موت جميع افراد الهدبي خلال 48 ساعة من المعاملة في حين كان التركيز 35 ملغم/لتر منه هو التركيز القاتل الذي سبب موت جميع الافراد بعد 24 ساعة من المعاملة.