

## Effect of water soluble fraction ( WSF ) and the oil –in water dispersions ( OWD ) of crude oil on the survival rate of crab *Sesarma boulengeri* from Hamdan canal a branch of Shatt Al -Arab . Iraq .

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### Abstract

The present study includes toxicity experiments carried out under laboratory conditions for ( 24 , 48 , 72 , 96 and 120 ) hours period by using renewal toxicity test system to determine the comparison of crude oils , dispersant mixtures and the water – soluble fraction to crab *Sesarma boulengeri* male and female net weight (2.655 ±0.5) gm which is found in Hamdan canal , a branch from Shatt Al \_Arab River . The median lethal time (LT<sub>50</sub>) has been recorded for each concentration and median lethal concentration (LC<sub>50</sub>) has also been recorded within (120) hours of exposure to concentrations of ( 2.5 , 5 , 10 and 20 ) ml / l crude oil . The toxicity experiments show that the dispersant mixture water soluble fraction ( WSF ) vary widely in their toxicity and accumulation of petroleum hydrocarbons to the specimen tested and slightly less toxic to oil – in water dispersions ( OWD ) . The mortalities increased with the increase of the concentrations and with the increase of time . The female tend to accumulate petroleum hydrocarbons slightly more than the male , and that the individuals had an ability to dispose large amounts of oil pollutants after their recovery in clean water .

**Key words :** Pollution , Crude Oil , Crab , Shatt Al -Arab , Toxicity .

### Introduction

Oil pollution get great public attention because highly using , hydrocarbons found in aquatic environment which from various sources including decaying , phyto and zooplankton, shipping operation , terrestrial runoff ,atmospheric fallout ,natural seepage ,shipping and offshore well disaster [1]. The direct lethal effect is found in food chain alteration and it reduces resistance to environment stress on funa and flora [2]. [3] have indicated that certain hydrocarbons fractions are stable in the marine environment and that hydrocarbons may determinately affect feeding responses, osmo regulation , behavior ,respiration , growth and reproduction of marine organisms . [4]have found beneficial effect such as an overall increase in productivity , may result from low level oil input into the sea . Oil coming ashore from spillages showed little evidence of harming marine life when free from dispersant [5] .[6]have observed the oil alone is not necessarily a toxic which shows that limpets can ingest the oil and pass it through the gut

. Similar observations have been recorded with respect to mussel [7].Our observation has been respect to crab *S.boulengeri* . In general , the deleterious effect of oil in marine life would appear to be physical rather than chemical , [8]reported that oil contamination of gill filament of fish prevented the exchange of gases and caused a anoxia accordingly . Oil can become associated with an aqueous phase in a variety of different ways such as emulsion, dispersion, accommodation or dissolution [9] .The solubility of oil compounds determines the toxicity oil – water solution [10]. [11] reported that gentle mixing of oil in sea water for 20 hours will generate water-soluble fractions with oil concentrations from about 1 to 10 ppm , while the violent mixing can produce oil concentrations in sea water in the 100 ppm , with much of the oil present at dispersed droplets . The time is important that water and oil mixed are essential in determining the quantity of oil that enters the water phase by mixing , [10] reported the time increase for over 30 hours .

[9]reported that the composition of oil transported into the aqueous phase is also dependent on compound solubility ,mixing energy , mixing duration ,oil viscosity .The solubility of oil is influenced by pH , salinity and temperature [11].Many studies have been done about crustaceans . The sensitivity of shrimp *Caridina babulti* basransis and *Atyaephyra desmaresti* mesopotamica upon oil in water mixture have been studied by [12] , The effect of gas oil upon *S.boulengeri* have been studied by [13] , while the ionic and osmosis

arrangement in *S. boulengeri* have been studied by [14] .

#### **The aim of the study**

1- To determine the comparative toxicities of crud oil , oil in water mixture ( water soluble fractions and oil- in water dispersions) to crab *S . boulengeri* common in Shatt Al \_Arab , such toxicity data are important in monitoring the level of contamination .  
2- Organisms which accumulate petroleum hydrocarbons after exposure are of interest because they enter the food chain , because of their potential for causing toxicity humans and other organisms .

### **Material and Methods**

#### **study site**

The study was carried out on individuals of *S . boulengeri* from the intertidal zone of Hamdan canal which is located in Abo Al-Khaseeb as a branch from Shatt Al- Arab , during ( September , October and November , 2009) Figure (1) .

#### **Sampling**

The test juveniles individuals were transferred to an aquarium for an acclimation period of seven days prior to the toxicity experiment , under laboratory temperature of  $20 \pm 2^{\circ} c$  with light cycle ( 12 = 12 ). After acclimation period the dead and the week organisms of juveniles male and female of crab were removed . The experiment procedure adopted for toxicity determination was based on the method established by [15] .

#### **Oil – in water mixture .**

Test individuals were exposed to oil – in water mixture of two types , water soluble fractions of oil (WSF ) and oil – in water dispersions (OWD) [16] .

The water soluble fraction was prepared freshly according to the procedure of [17].. Batches of (10) individuals were exposed to each type of oil for period of ( 24 , 48 , 72 , 96 and 120 ) hours in glass aquarium (20 ×20 × 40) cm the test was set up in triplicate together with three control , the individuals divided for male and female net weight ( $2.655 \pm 0.5$ ) gm , the concentration of test solution of each type of oil manually mixing (2.5, 5, 10, and 20) ml / l of oil with each liter of River water , the individuals were left without food during the exposure period ,the recovery rate was recorded by noting the number or individuals which crawled out of the tap water for (5) days. Mortalities in *S . boulengeri* were taken as a number of individuals still immobile and remaining in water after 5- days . The procedure of [18] was used in the extraction of hydrocarbons from *S . boulengeri* (whole body) . The total hydrocarbons were estimated by spectrofourometer system .

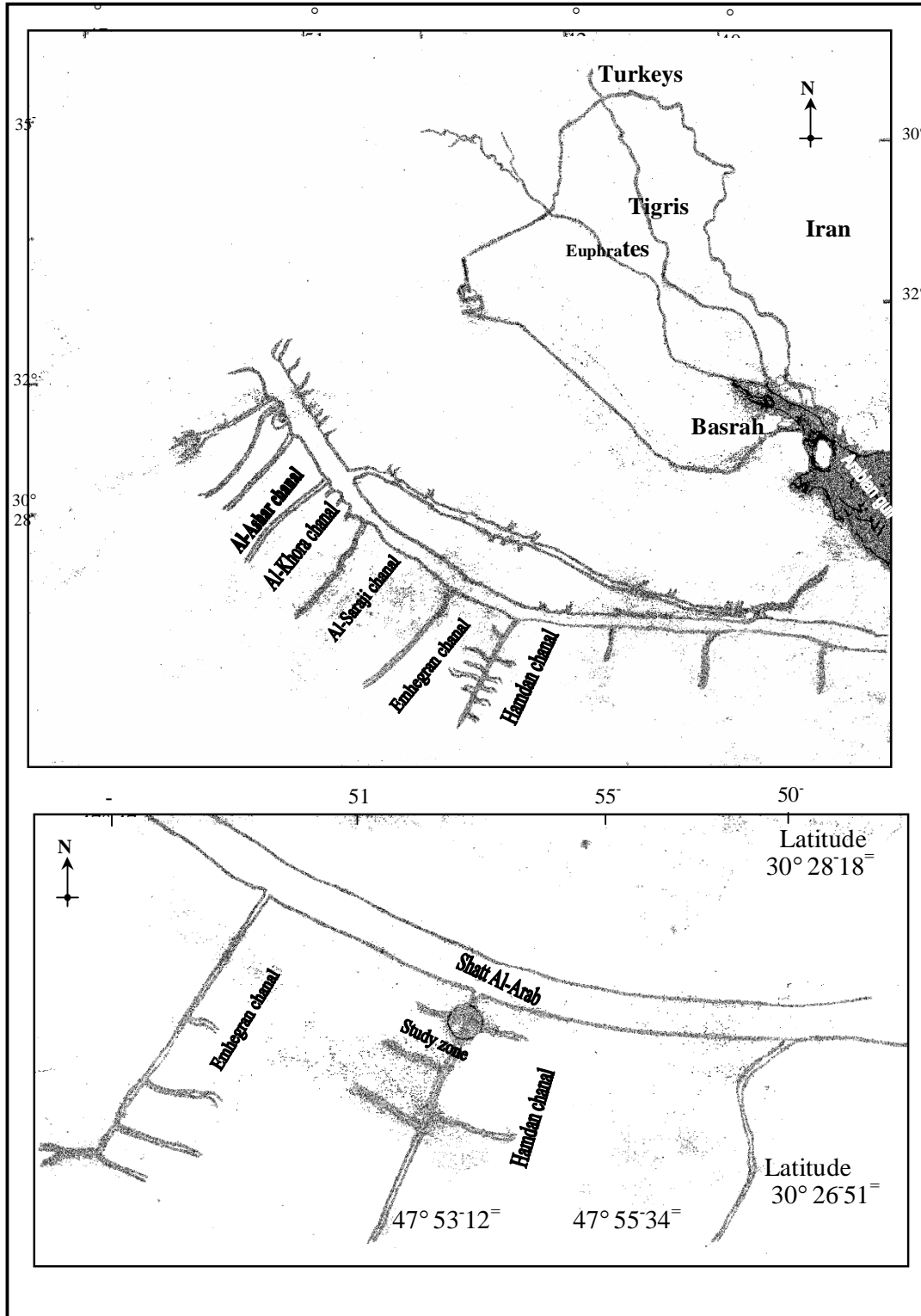


Figure ( 1 ) : Shatt Al-Arab map and study area .

### **Results and discussions**

Figures (2 and 3) represent the percentage survival of the tested juveniles individuals after exposure to different type of water- soluble fractions of oil and oil – in water dispersions . Different  $LT_{50}$  values were obtained with different concentrations of (WSF) and (OWD) and also with different sex . The highest values of  $LT_{50}$  were recorded for male in (OWD) . The laboratory results show an increase slowly in a linear fashion the survival rate with the concentrations . The mortalities were due to the physical influence like the contamination of gills filament [8] , especially the (OWD) which cause a layer decreased the oxygen rate besides decreased the activity of organisms . The results indicated that the values of  $LT_{50}$  ( 156 , 124 , 97 and 84 ) hours for male , ( 130 , 120 , 89 and 78 ) hours for female in (WSF) , ( 190 , 160 , 112 and 108 ) hours for male , ( 154 , 112 , 92 and 72 ) hours for female in (OWD) for concentrations ( 2.5 , 5 , 10 and 20 ) ml respectively . This could be explain on the basis of the reaction of the organisms which is in accordance with the findings of the crustaceans *Gammarus duebeni* [19] . Figure (4 and 5) showed the (120) hours  $LC_{50}$  values ( 6 ) ml / l for male and ( 2.7 ) m / l for female in (WSF) , ( 10.1 ) ml / l for male and ( 2.5 ) ml / l for female in (OWD) . In the present experiment , the (WSF) of crude oil are generally slightly more toxic to *S. bouleengeri* than their (OWD) . It is indicated that the crab avoid themselves from the oil and the mortalities happened may be due to the decrease of oxygen because of the oil layer and for that reason the organisms became unable to do their physiological operation and this increases by increasing the concentration , while in (WSF) the organisms were obliged to uptake the soluble petroleum hydrocarbons by respiration and

drinking water . The toxicity of an oil is due to the soluble compounds contained in that oil ,and not due to the compounds in dispersed droplets , the chemical composition of droplets is probably very similar to that of the parent oil [20].Tables (1 and 2 ) represent the accumulation of petroleum hydrocarbons by *S . bouleengeri* exposed to (WSF) and (OWD) which show an increase slowly in linear fashion . The highest concentration of petroleum hydrocarbons in female than male in WSF and (OWD) in all concentrations of crude oil. [9] has noted that in general , crustaceans accumulated the hydrocarbons rapidly than estuarine mollusca . The accumulation of petroleum hydrocarbons in the whole body of *S . bouleengeri* which indicated that the organisms tend to accumulate the petroleum hydrocarbons when exposed to WSF higher than they exposed to OWD , the reason may be due to the uptake of hydrocarbons by respiration and drinking contaminated water , while in OWD the organisms avoid themselves from the layer of crude oil by settling down in the bottom of glass aquarium , the female tend to accumulate the petroleum hydrocarbons more than male because of the fat content [21] . Recovery studies with fortified samples have indicated that recovery efficiency exceeded 84% in (WSF) and 80% in (OWD) by comparison between the amount of petroleum hydrocarbons accumulated in organisms before and after recovery , the reason may be the extent of organism's ability to excrete the pollutants out of body by gills or intestine or cuticle , or probably the reason is the organism's ability to metabolize the petroleum hydrocarbon compounds by (MFO) enzyme [21]. The toxicity of WSF depends on part on the way the oil is associated with water .

### **Conclusion**

The findings of this study showed that this species of crustaceans has potential to accumulate the petroleum hydrocarbons when they were exposed to (WSF) of crude oil than when they were exposed to (OWD) of crude oil

and they were used as a bio indicator for the contamination , of petroleum hydrocarbons. It showed that the accumulation of the petroleum hydrocarbons depends on the species , sex and amount of exposure time .

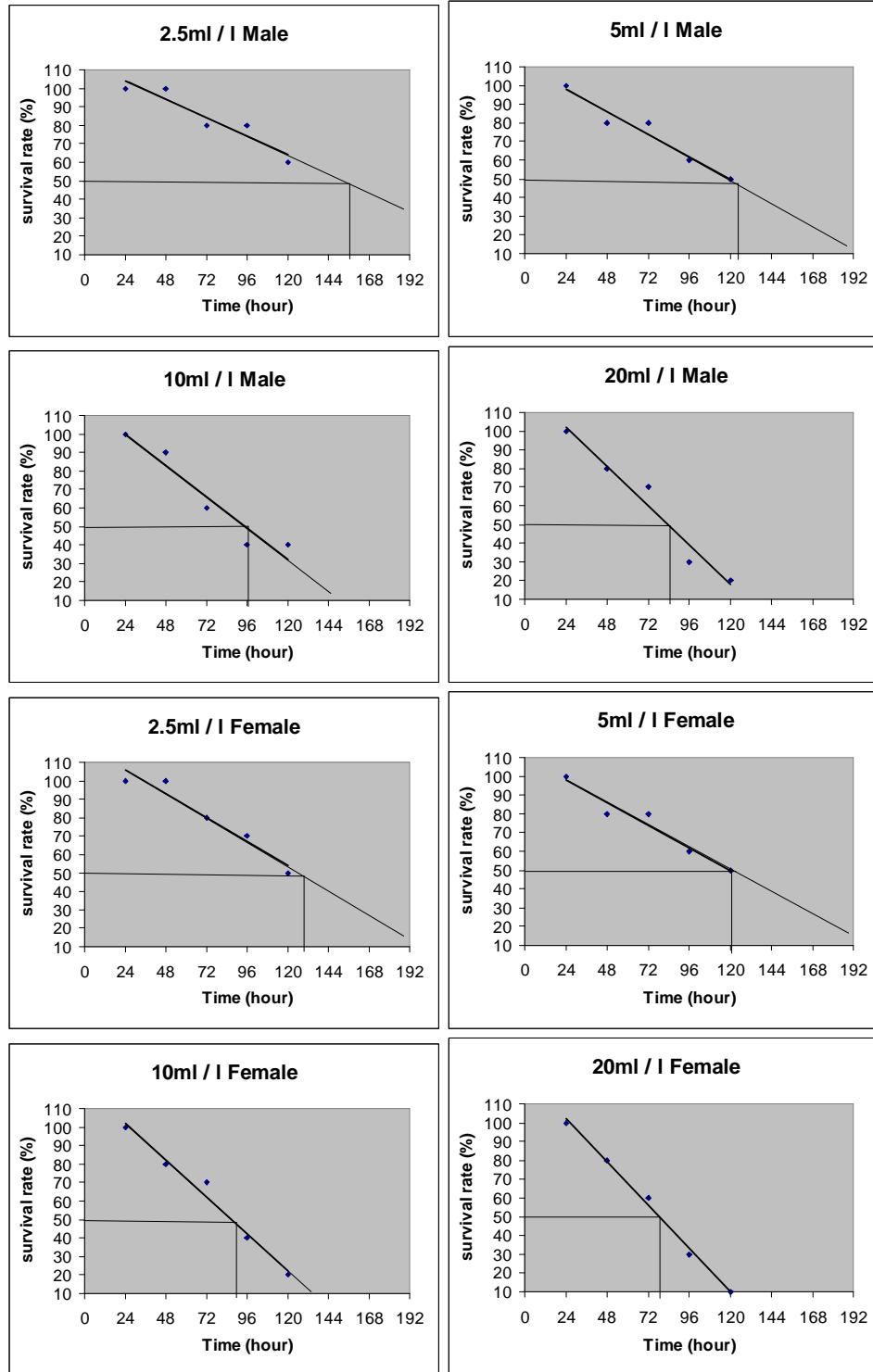


Figure 2 : Relationship between the percentage survival of *S. boulengeri* in each concentration of (WSF) with the time to conclude the value of  $LT_{50}$ .

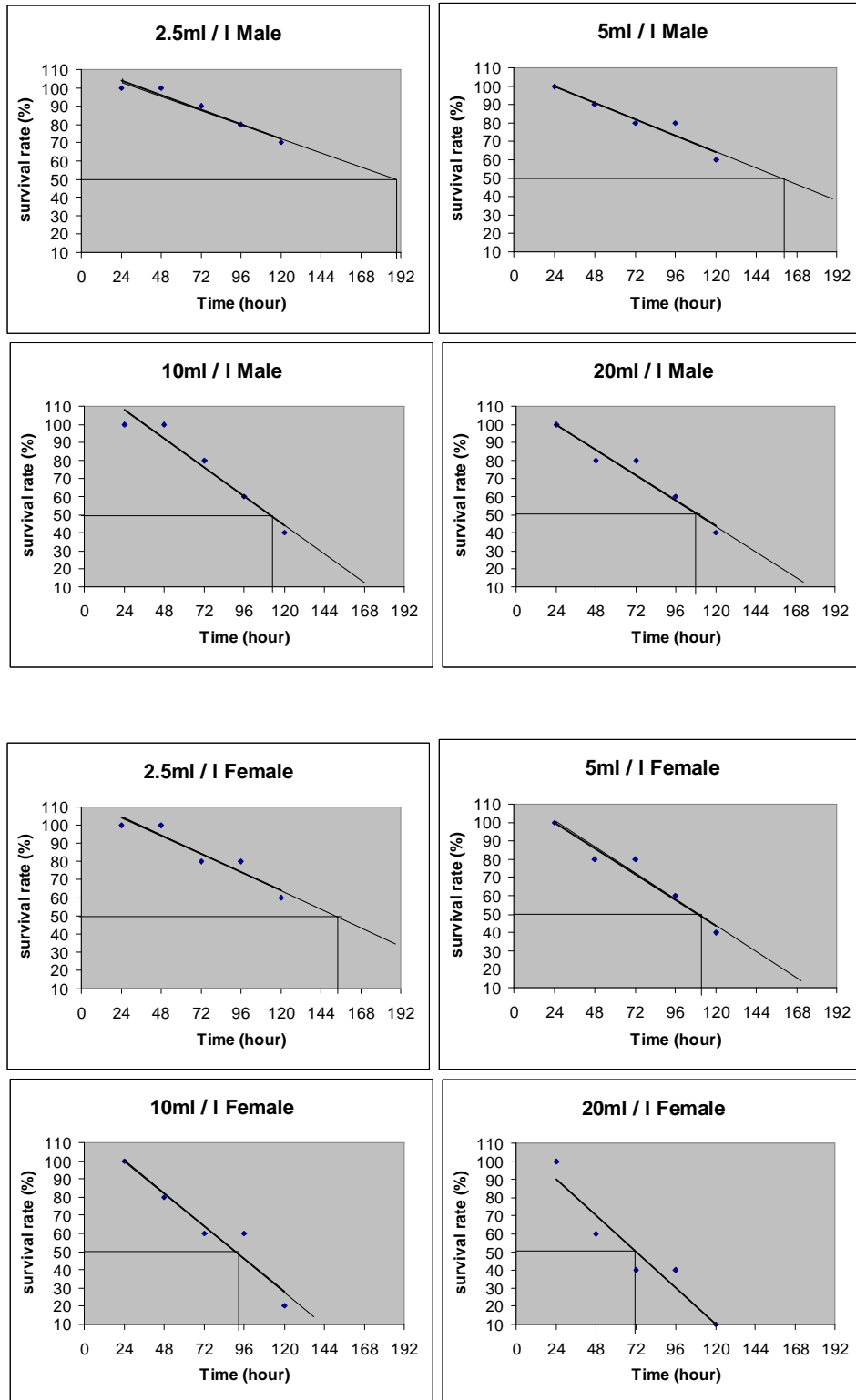


Figure 3 : Relationship between the percentage survival of *S. Boulengeri* in each concentration of (OWD) with the time to conclude the value of  $LT_{50}$ .

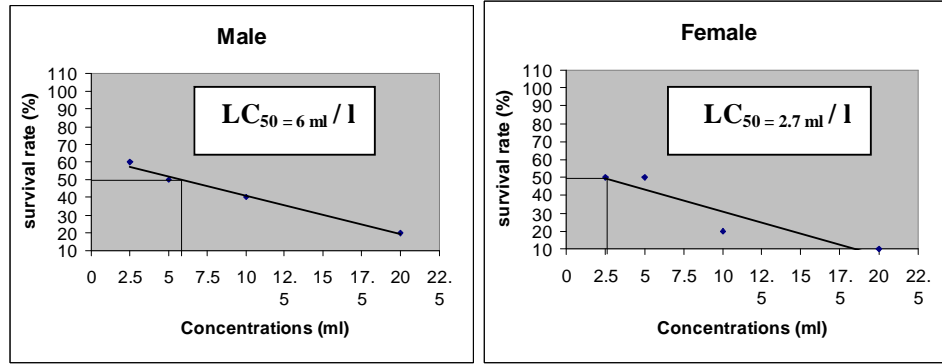


Figure 4 : Relationship between the percentage survival and concentrations of *S. Boulengeri* after exposure 120 hours of (WSF) to conclude the value of LC<sub>50</sub>.

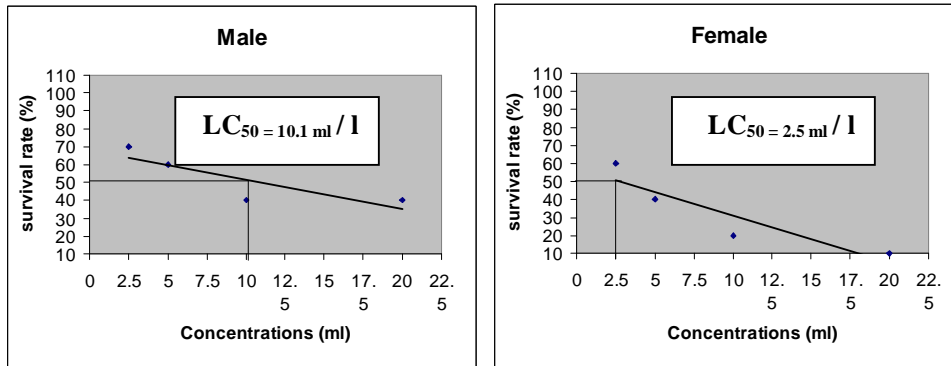


Figure 5 : Relationship between the percentage survival and concentrations of *S. Boulengeri* after exposure 120 hours of (OWD) to conclude the value of LC<sub>50</sub>.

Table (1): Accumulation of petroleum hydrocarbons by *S. Boulengeri* exposed to different concentration of oil in water dispersions (WSF) and concentration after recovery period for 120 hours .

Concentration ml/l	Male		Female	
	concentration µg/g	After recovery	concentration µg/g	After recovery
Control	39.86 ± 1.01	-	70.87 ± 1.91	-
2.5	234.15 ± 3.51	60.15 ± 1.83	336.27 ± 2.07	74.99 ± 1.80
5	425.65 ± 2.31	119.92 ± 3.79	597.24 ± 2.09	122.99 ± 2.80
10	743.47 ± 2.11	128.88 ± 2.37	1033.84 ± 6.91	321.40 ± 3.02
20	811.39 ± 3.59	131.10 ± 1.00	1574.41 ± 5.20	382.49 ± 2.99

Table (2): Accumulation of petroleum hydrocarbons by *S. Boulengeri* exposed to different concentration of water soluble fraction (OWD) and concentration after recovery period for 120 hours.

Concentration ml/l	Male		Female	
	concentration µg/g	After recovery	concentration µg/g	After recovery
Control	39.86 ± 1.01	-	70.87 ± 1.91	-
2.5	55.53 ± 1.11	25.40 ± 0.89	119.18 ± 2.40	66.08 ± 0.90
5	89.07 ± 1.21	31.35 ± 1.87	126.56 ± 1.59	71.11 ± 0.99
10	122.02 ± 2.52	65.59 ± 1.42	144.72 ± 1.09	73.20 ± 1.23
20	141.08 ± 1.35	69.71 ± 1.19	148.98 ± 1.31	79.33 ± 1.65

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## تأثير الجزء الذائب (WSF) والمستحلب (OWD) للنفط الخام على معدل بقاء السرطان النهري *Sesarma boulegeri* في قناة حمدان كفرع من شط العرب . العراق .

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### الخلاصة

تشمل الدراسة الحالية التجارب السمية المختبرية للفترة الزمنية ( 24 , 48 , 72 , 96 , 120 ) ساعة لاختبارات نظام السمية المتجددة لحساب المقارنة بين أجزاء النفط الخام الذائب والمستحلب في السرطان النهري *Sesarma boulegeri* للذكور والإناث لمعدل الوزن ( 2.655 ± 0.5 ) غم والمستجمع من قناة حمدان أحد فروع شط العرب. حسب متوسط الزمن المميت ( $LT_{50}$ ) لكل تركيز من النفط الخام ومتوسط التركيز المميت ( $LC_{50}$ ) خلال ( 120 ) ساعة من التعرض إلى التراكيز ( 2.5 ، 5 ، 10 ، 20 ) مل / لتر . أشارت الدراسة بان الجزء الذائب (WSF) أكثر سمية وتراكماً للمركبات الهيدروكربونية النفطية تجاه الأفراد المختبرة عن تأثير الجزء المستحلب (OWD) ، كما أظهرت النتائج زيادة الوفيات بزيادة التركيز والزمن وأنهما يكونان أكثر سمية وتراكماً تجاه الإناث عنه في الذكور وأن للأفراد المختبرة قابلية على التخلص من كميات كبيرة من الملوثات النفطية بعد استردادها في مياه نظيفة .

**كلمات مفتاحيه :** تلوث ، نفط خام ، السرطان النهري ، شط العرب ، سمية .