

Potential effect of endosulfan on enzymatic activity of the freshwater shrimp *Caridina babaulti basrensis* (Al-Adhub and Hamzah, 1987)

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Abstract

Endosulfan, polycyclic organochlorine pesticide contaminating aquatic ecosystem as a potential toxic pollutants. Enzymatic tests in shrimp *Caridina babaulti basrensis* that were exposed sublethal concentration (0.1 µg/l) of endosulfan were carried out. Reductions in Superoxide Dismutase (SOD) activity was noticed and there was no alterations in the activity of Glutamate oxalate transaminase (GOT) and glutamate pyruvate transaminase (GPT). This kind of tests represents a rapid and inexpensive method for pesticide pollution detection.

Keywords: Endosulfan; *Caridina babaulti basrensis*; SOD; GOT and GPT

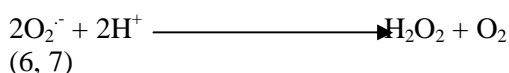
Introduction

Endosulfan is an organochlorine and a member of the cyclodiene class of insecticides. It is made up of a mixture of two isomers, α and β , both of which have similar insecticidal properties (1). Endosulfan is widely used by fishermen illegally to capture fish especially in the Southern Iraqi Marshes and that causes a great destruction to the marshes environment (2).

Benthic communities are functionally important in transferring environmental contaminants to higher trophic levels (fish, waterfowl and humans), and play a key role in sediment energy, nutrient, and contaminant fluxes (3, 4).

Effect of toxicants on enzymatic activity is one of the most important biochemical parameters which is affected under stress. When an organ is diseased due to the effect of a toxicant, enzyme activity appears to be increased or it may be inhibited due to the active site being either denatured or distorted. Since some enzymes catalyse some steps in the metabolism of carbohydrates and protein, this suggests their presence in most tissues. The increase or decrease in their level may be sufficient to provide information of diagnostic value (5).

Superoxide dismutases(SOD) are antioxidant enzymes that catalyze the dismutation of superoxide into hydrogen peroxide and oxygen.



Superoxide radicals are produced in every living cell that is capable of reducing oxygen during aerobic metabolism (8). It is capable of initiating free-radical chain reactions, this radical causes a severe oxidative stress with lipid peroxidation, protein oxidation and DNA damage leads to cell death (9). Therefore, SOD presence is essential for the aerobic survival of all forms of life by scavenging O_2^- (8).

Glutamate oxalate transaminase (GOT) and glutamate pyruvate transaminase (GPT) are enzymes involved in the transfer of amino groups from one specific amino acid to another. GOT and GPT activities are usually used as general indicators of the functioning of vertebrate liver. High GOT and GPT generally, but not definitively, indicate the weakening or damage of normal liver function. The crustacean hepatopancreas is assumed to be homologous to the mammalian liver and pancreas (10).

Caridina babaulti basrensis was selected in the present study being a widely distributed benthic shrimp in Iraq.

In the present work the results of rapid and inexpensive laboratory experiments show some biochemical alterations in shrimp exposed to sublethal concentration of endosulfan. The activity of SOD, glutamate-oxalate transaminase (GOT) and glutamate-pyruvate transaminase (GPT) were investigated.

Materials and methods

Caridina babaulti basrensis is a dominant freshwater macroinvertebrate and is widespread in Iraq. It is an important member of the aquatic community, as it serves to be a primary food source for higher organisms. *C. babaulti basrensis* were collected from Garmat Ali-River during the period from May to June 2008 (Fig.1). The shrimps were brought to the laboratory and acclimatized to laboratory conditions for 7 days, under 12:12 hour

light : dark regime with continuous aeration. The temperature was adjusted to $27 \pm 1^\circ\text{C}$. Before starting the test, all experimental beakers (1 L) were cleaned and filled with dechlorinated tap water. The experimental water was kept in the tank for 48 h before endosulfan was added. The mean pH and salinity during the experimental period in all bioassays were 8 ± 0.3 and $1.2 \pm 2\text{ppt}$, respectively.

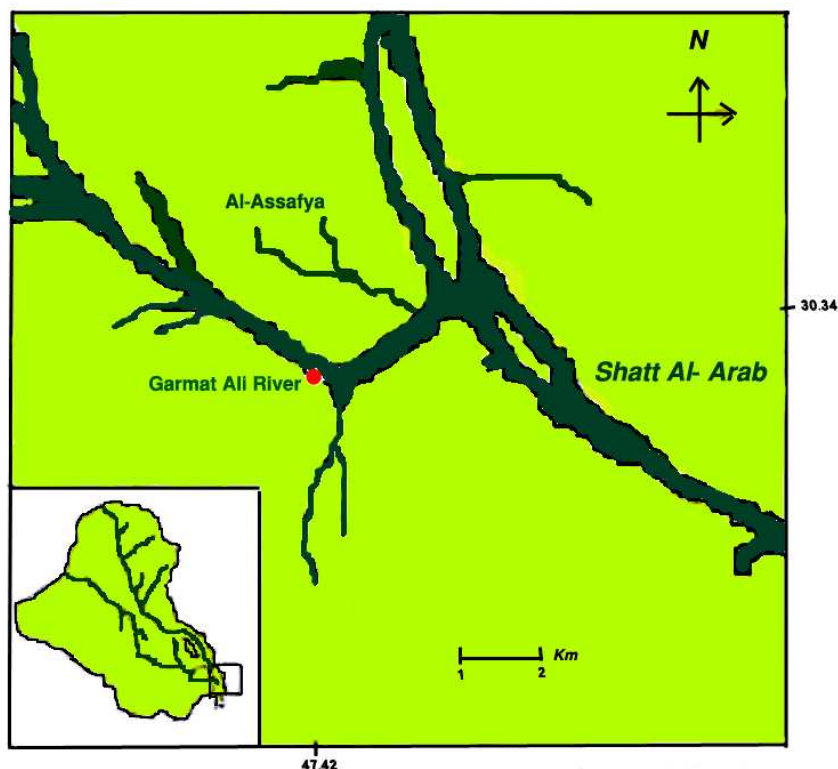


Fig (1). Sampling site map

SOD activity was determined by the use of riboflavin/NBT(nitrobluetetrazolium) method (11), this method is based on the generation of blue formazan dye ($\lambda_{\text{max}}:560\text{nm}$) by a reaction with O_2^- . One unit of SOD is defined as that amount of sample which causes a 50% decrease of the SOD-inhibitable NBT reduction in this assay. Therefore, the SOD activity in the sample can be expressed as RU(riboflavin/NBT assay unit)/ml.

The activities of glutamate-pyruvate transaminase (GPT) and glutamate-oxaloacetate transaminase (GOT) enzymes were evaluated colorimetrically according to the method of Reitman and Frankel (12) utilizing a ready-made kit for this purpose (Biomaghreb, Tunisia).

The commercial grade endosulfan, Thiodan® 35 EC (soluble in water) was used in this study. The

commercial grade endosulfan was diluted with distilled water to prepare a solution of tested concentrations.

In the present study, the sublethal concentration of endosulfan was used, about 1/20 of 96LC_{50} for seven days of exposure. The LC_{50} value was calculated through a probit analysis program according to Finney (13), and it was $2.0 \mu\text{g/l}$. Static renewal tests were conducted. One sublethal concentration of endosulfan ($0.1 \mu\text{g/l}$) and a control with three replicates were used in the test series. Ten shrimps (mean weight $0.15 \pm 0.07 \text{g}$) were transferred into each beaker.

After 7 days exposure to sublethal concentration, a sample of haemolymph was drawn from the cardiac area of animal using a microsyringe. Immediately, GOT, GPT and SOD activities were determined.

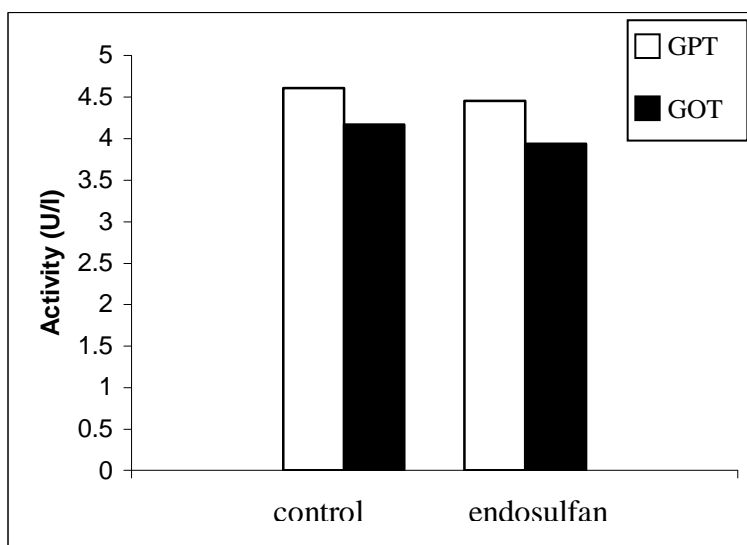
All experiments of enzymatic activities that were carried out were statistically analysed by t-test

($p < 0.05$).

Results and discussion

The T-test indicated no significant differences in enzyme activity for GOT and GPT between controls and treated *Caridina babaulti basrensis* ($p > 0.05$); (Fig. 2). From these results can be conclude that the endosulfan assayed do not inhibit activities of GOT and GPT in shrimp haemolymph. These results agree with results of Galindo-Reyes (14), who showed that the GPT and

GOT activities in hemolymph are not effected in white shrimp *Litopenaeus uannamei* exposed to endosulfan. Activities of these enzymes may not be as great in crustacea haemolymph as in fish and other marine animals where the blood is the adequate tissue for enzymatic determinations of GOT and GPT (15).



Fig(2): GPT and GOT activity in haemolymph of *C. babaulti basrensis* exposed to (0.1 µg/l) endosulfan for 7 days.

The present study revealed a significant reduction in SOD activity of treated *Caridina babaulti basrensis* as compared with the control group ($p < 0.05$). The differences in values of activity ranging from 5 to 6 RU/mL between control and treated groups (Fig. 3). Previous studies showed that low doses of

endosulfan modify antioxidants in tissues of rats, erythrocyte SOD decreased by 21% and Liver SOD was 12%-20% lower after endosulfan exposure (16). However, only few studies of SOD in crustaceans are related to oxidative status (17), immunity (18, 19), and disease indication (20).

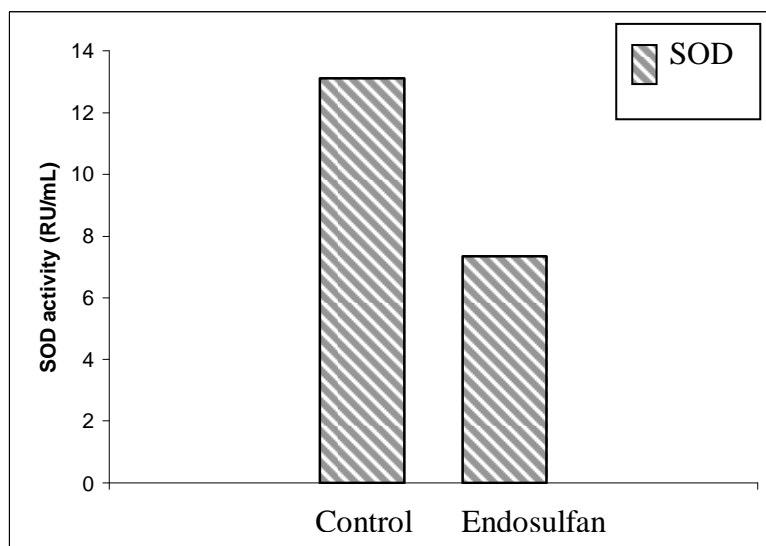


Fig (3): SOD activity in haemolymph of *C. babaulti basrensis* exposed to (0.1 µg/l) endosulfan for 7 days.

Conclusions

From the present study we can conclude that 0.1µg/l of endosulfan pesticide has no effect on hemolymph GOT and GPT activity in shrimp

Caridina babaulti basrensis , but it causes reduction in SOD activity.

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**التأثير الكامن للأندوسلفان على النشاط الأنزيمي لربيان المياه العذبة
Caridina babaulti basrensis (Al-Adhub and Hamzah, 1987)**

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الخلاصة

مبيد الأندوسلفان هو من المبيدات الكلورينية العديدة الحلقة والذي يلوث النظام البيئي كملوثات سمية خطيرة، اختبر تأثيره على النشاط الأنزيمي لربيان *Caridina babaulti basrensis* المعرض للتركيز تحت المميت (0.1µg/l). تم الكشف عن اختزال بالنشاط الأنزيمي لل (SOD) Superoxide dismutases وعدم وجود أي تغيرات انزيمية ل glutamate pyruvate transaminase (GPT) و (GOT) Glutamate oxalate transaminase . هذه الأنواع من الاختبارات تمثل طرق سريعة وغير مكلفة للكشف عن الملوثات.