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Recovery Time of Great Sturgeon, *Huso huso* after Acute Exposure to Crude Diesel Oil

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Abstract: In order to examine the efficacy of diesel oil as toxicity on Great sturgeon, *Huso huso*, an experiment was conducted to investigate if diesel oil suppressed the swimming behavior in this species or not. Six different concentrations of diesel oil (0, 10, 40, 100, 500 and 1000 ppm) were assessed. After 48h, immediately upon placement in recovery tank, 1, 6, 12 and 24 h post recovery in order to evaluate behavior responses. Narcosis, inaction and death occurred with different concentrations of diesel oil (100, 500 and 1000 ppm) rapidly occurred in 48 h after exposure to the diesel oil. Death times in recovery tanks was shorter in 1000, 500 and 100 ppm respectively. After 72h all infected fish in these treatments were dead. With regard to toxicity effects of diesel oil, dosages upper than 40 ppm will be dangerous and it is not possible to came back to normal situation after 48h exposure.

Key words: Fish · LC_{50} · Oil · Pollution · Toxicity

INTRODUCTION

Since fish breathe through gills rather than lungs, toxicity agents are greatly inhaled with gills. As a result, toxic additive will be added to the tank water and delivered through an aquatic medium. Therefore, the relationship between the epithelium surface of the gill and the body volume as well as thickness of epithelium affect the efficacy of toxicicants [1, 2]. The other biological factors, including species, the stage of life cycle and age, size and weight, lipid content, body condition and disease status also influence the metabolic rate and therefore the pharmacokinetics of the toxicity compound [3]. Water condition, such as temperature and pH can also affect the efficacy of any toxic solution on species [4]. Great sturgeon is an endangered species [5]. It is spawned artificially in aquaculture facilities with the aim of restocking to improve its population. So some studies were done on effects of toxicological agents on brood stocks and fries [6]. Raising sturgeons for producing broodstocks in order to reduce dependency on natural populations is very promising [7]. During culturing and breeding practices, stressful functions such as handling and transportation might affect its survival and growth, so using toxicological agents could be helpful [8]. In order to examine the efficacy of diesel oil as its toxicity on Great sturgeon, *Huso huso*, this experiment was conducted and also to investigated whether diesel oil anesthesia suppressed the normal behavior and swimming in this species or not.

MATERIALS AND METHOD

Fish and Rearing Condition: The experiments conducted on juvenile Great sturgeon (average weight: 200 g) produced at the Institute of Aquaculture of the Marjani for Sturgeon, Golestan, Iran. Prior to the study, fish were maintained in groups in 400-L aquariums in an indoor facility. For the purpose of the study, fish were housed separately in experimental aquaria and acclimated to it for a minimum of one week. The aquaria shared a common source of water with a steady temperature of 25°C. Throughout the acclimatization period and during the experiment; environmental conditions were monitored and maintained within a narrow range of variable. Fish were kept under natural photoperiodic conditions, fed 2% of body weight on hand with formulate pellet and fasted for 24 h prior to each experiment.

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Toxicity Preparation and Experiment: First part of the experiments was toxicity effect. Before beginning the study, LC_{50} test was conducted and found that these dosages are often lethal for this species. Eight different concentrations of diesel oil were choosen (0, 5, 10, 20, 40, 100, 500 and 1000 ppm) according to our own LC50 test and previously pilot study. For preparation the desired dose of diesel oil, we made up a stock solution and injected directly to the tanks.

Since many Scientists add toxicological agents directly to water baths to achieve the desired dose [9], we applied prepared diesel oil solution into water.

As far as diseased or weakened animals are much more susceptible to toxicity treatment, seven healthy Fish were anesthetized by immersing them in a bath containing clove powder agent (1 ppt), so that it is absorbed through the gills and rapidly enters the blood stream. Aeration provided extra oxygen required during induction which causes increased respiration. To prevent abrading the skin of the fish, the handler wore wet latex gloves and gently transferred the fish into the container.

For the toxicity effect, a video cassette recorder (DSC-W80, Japan) was used to record fish behavior for subsequent analyses [10]. Two observers made decision using the Table 1, according to the Iwana *et al*. [11].

The recovery tank used the same water as toxicity bath (at a similar temperature and chemistry) supplied with flow-through water at a high exchange rate to ensure that fish were always in contact with clean water.

Toxicity and Recovery times before deaths were recorded from the time place the fish in toxicity and recovery tank to the nearest second using an electronic stop-watch [12].

RESULTS AND DISCUSSION

Cumulative mortality of Great sturgeon exposed to different dose of crude diesel oil is presented in Table 1. A summary of the average time to toxicity stages at each of the tested dosages is presented in Table 2. Response time at tested dosages was rapidly occurred in 48h after exposure to the diesel oil. All experimental fish were successfully revived and no mortalities observed before 48h post-treatment (Table 3).

It was shown that the Great sturgeon exposed to the diesel oil tested concentrations in our experiment; get in toxicity phase in 48h. death time for all treatments was less than 6 h. Toxicity induction as well as recovery phase was significantly affected by concentration, toxicity and death times were increased by elevating toxicity agent dosage.

Table 1: Cumulative mortality of Great sturgeon (n=7, each concentration).

	No. of mortality			
Concentration (ppm)	24h	48h	72h	96h
Control	-	-	-	-
5	-	-	-	-
10	-	-	-	-
20	-	-	-	1
40	-	-	4	7
100	-	4	7	7
500	-	7	7	7
1000	-	7	7	7

Table 2: Stages of Toxicity and Recovery

Stages of Toxicity	Description
I	Loss of equilibrium
II	Loss of gross body movements but with continued opercular movements
III	As in stage II with cessation of opercular movements
Stages of Recovery	Description
I	Body immobilized but opercular movements just starting
II	Regular opercular movements and gross body movements beginning
III	Equilibrium regained and pretoxicity appearance

From Iwana *et al*.[40], modified by Ackerman *et al*.[12].

Table 3: Effects of diesel oil on toxicity and recovery of Great sturgeon

Dose (mgL^{-1})	Death time(s)	Recovery times before death
10	-	-
40	-	-
100	72 h	5 h 22 min
500	48 h	5 h 15 min
1000	48 h	3 h 56 min

Longer recovery times before death which was observed in fish with diesel oil could be an additional advantage in activities such as morphological evaluations, biopsy and stripping which are required long handling periods outside the water [3, 13] Since environmental factors affect the efficacy of toxicities in fish, it is not surprising that the relationship between diesel oil dosage and water temperature was also significant ($P<0.05$) regarding toxicity and recovery times before death.

As an ectoderm animal; body temperature of fish closely follows their environments which result in temperature-related physicochemical passage of the drug into the fish. Therefore, at lower water temperatures, higher doses or longer exposure times to toxicity agents required due to the decrease in absorption rate [4]. This suggests that the levels of diesel oil used in our trial may have been very high with rapid effect on fish treated with this toxicity.

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