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The Study of Transfer Rate in the Mixture of Heavy Metals (Cu and Cd) and LAS Detergent in the Food Chain of 1g-White Fry (*Scenedesmus sp*Algae– Daphnia – 1g-White Fry)

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Abstract The results from the investigation of individual and mixed transfer rate of heavy metals (Cu, Cd) and LAS detergent in the food chain of white fry showed that the transfer of Cd was not observed in a significant amount in the food chain in the alga culture to the amount of 0.0127 ppm, respectively in the infected alga, 0.0041 and in the daphnia 0.0015 andin the white fry fed with the infected daphnia. And it was achieved in the white fry fed with the infected 0.002 alga and transfer rate in the chain respectively was 32%, 8% and 16% and Cu transfer was not reported asa significant amount from the limit amount added to the algae culture to the amount of 0.15 pp, 0.07 ppm in the infected alga and 0.02 ppm in Daphnia and in the little with fish fed by Daphnia. In the white fry fed by the infected 0.02 ppm alga and transfer was achieved in the chain respectively 46%, 13% and 13% and rate of mixed transfer (LAS+Cd), of the limit pollutants added to the culture of alga in amount of 0.127 and 2.153 ppm, in the infected alga 0.007 and Daphnia 0.003 and in the white fry fed with the 0.00 Daphnia and in the white fry fed with the 0.003 ppm infected alga and transfer ratein the chain were respectively 58%, 25%, 8% and 25%. Also, the obtained results from the transfer of LAS+ Cu mixture showed that from the limit pollutants added to the culture of alga in amount of 0.15 and 2.153 ppm, in the infected alga 0.09 and 0.05 in the Daphnia and in the white fry fed with the infected Daphnia 0.01 and in white fry fed with the infected alga l.04 ppm and transfer rate in the chain respectively were 60% and 33% m 6 % and 45%. by analyzing the results obtained that Cd in comparison with Cu is more toxic while the mixed state with LAS the percentage of toxicity is multiplied. The results of statistical test showed that there is not any significant difference between two pollutants (Cu and LAS+Cu) and (Cd and LAS+Cd) regarding the transfer rate and uptake within the food chain cycles.

Keywords Heavy metals, Transfer Rate, 1g-white fry

1. Introduction

Recognizing the pollutants and prevention and combating them is one of the necessities in the modern knowledge. therefore, the necessity to control is to recognize the polluted resources and ecological and environmental effects resulted from it and then the prevention methods of these materials and parallel with that the refinement of industrial and household wastewater within the human societies has a great role in the protection of environment and awareness toward the important main role of it.

Some of the factors which causes the acute and chronic effects to be created for organisms, are the elements that we knew them as the toxic and trace elements[1]. Although, Cd is a non-requisite element for living beings, but due to some unclear reasons, phytoplankton photosynthesis is increased during the concentration higher than 100ppm.

It appears that cadmium, along with the phosphate is absorbed by phytoplankton, but except for a few exceptions does not accumulate in the food chain. The standard and threshold limit of cadmium by the Committee of Experts on America Occupational Health is determined c approximately 0.1 milligrams per cubic meter of air, and a maximum of 0.1 milligrams per liter of water and the maximum concentration allowed to aquatic creatures is.5 microgram per liter.

Entering the natural copper to the marine environment caused by erosion of mineral cliffs at about 325,000 tons per year, is estimated. Inputs from human activities, was regional and vary depending on their nature. Copper dissolved in seawater, is mainly in the form CuCo3 or can be seen within the low salinity water, as the form of Cu(OH)2. Nowadays detergents are widely spread and released through urban and industrial effluents in the aquatic environment[2].

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In recent years in America, alkyl benzene sulfonate (LAS) is the important anionic surfactant which was applied in the main line of household cleaning products and detergents are used. These materials through municipal and domestic wastewaters caused a widespread pollution in the dry and aquatic environment. Today, synthetic detergents due to their high consumption are important and exposed the aquatic organisms to the risk of contamination.

These detergents may be separated by certain bacteria, however, in high concentrations of bacteria may be unable to fulfill their role, High concentrations of detergents, act as a barrier to bacteria's activity of enzymes and enzymes to break down or reduce the effects of detergents are required. Biodegradation of detergents in the contaminated waters increases the solutes concentration in the water[4].

Chattopadhyay, 1992 expressed thatthe toxicity of oil material will be increased several times in the presence of detergents. Because of the detergent pollution makes easy entry of oil into the water. Petroleum association with anionic detergents reduced water hardness, dissolved oxygen significantly at all concentrations and increased the released carbon dioxide, alkalinity and phosphate of all aquatic ecosystems significantly.

Many organic materials when are combined with each other in the water produce the sediment that remain in the river bed as sediment or generally remain floating down the river. The mixed effects on organisms should also be evaluated so that the animals of different species which play an important role in the food chain, to be retained.

Sometimes a test result in two different locations does not reflect same conclusion and therefore does not reflect the actual impact of toxic substances on aquatic ecosystems and. But from the point of view of the environmental protection, these experiments can provide useful suggestions in order to reduce the adverse effects of pollutants[7].

Since within our country loss or discharge of sewage, urban, industrial and agricultural streams, lakes and other water sources takes place without any limitation and control, todays the pollution of rivers and wetlands to be considered of an important issues, Given the water and water resources shortages in the country, trying to maintain quality and prevent deterioration of aquatic and biological ecosystems is imperative and inevitable.

Caspian Sea white fish, is one of the migratory fishes which according to the time of migration and spawning place has the a migration in the spring and autumn. Habitat for white fish (Rutilus Frisii Kutum) is Caspian Sea where some rivers entering the Caspian Sea, and Anzali lagoon is the spawning place. Due to excessive pollution of, Anzali lagoon and rivers around it, white fish's migration for spawning has declined in them[1].

Therefore the effects of various pollutants on the types of organisms in the food chain levels must be checked so that based on the data relative to the discharge of sewage into the aquatic environments, a normative management to be applied for preserving the environment.

2. Methods and Materials

The experiments took place based on method of The Organization for Economic Cooperation and Development and with the conventional name of OECD Guideline on testing of chemicals method[6].

In these experiments, the effect of copper and cadmium and LAS detergent individually and in mode of a ternary mixture, based on the limit obtained in previous experiments in each segment of the food chain (algae - Daphnia - Fish) was investigated and the absorption rate of any pollutant individually and in a mixed mode, in the transition from one cycle to the next cycle are calculated.

Thus, in each experiment, based on the limit amount, we added 9 flasks of each polluting substance (250 cc) into the environment of algae cultivation according to the methods explained in chapter 2, and after 96 hours three Erlenmeyer sample flask were centrifuged for testing and determining the amount of each pollutant uptake in algae by atomic were studied and three other example flasks after counting the algae, according to the concentration achieved by calculations of algae, the degree of concentration of algae exposed to the contaminated Daphnia's feeding (6 flasks) and each one in volume of 1 liter and 100 Daphnia were placed at each container and after 24 h in an environment free of light, to prevent the proliferation of algae, samples were collected for testing by atomic absorption and three other flasks containing Daphnia added to each aquarium which each one was five-liter size aquarium and five pieces of 1g white fish were added to them and after feeding fishes from Daphnia, to we collected the contaminated fishes.

Three samples of algae flasks polluted with pollutions within each experiment, exposed to feeding of fishes which such as the previous tests, we added 5 fishes within into three five-liter aquariums and then collected contaminated fish over a period of 96 hours.

At each phase of the test, samples were digested by 12 cc of nitric acid and 2 cc of hydrogen peroxide and ultimately transfer rate of heavy metals and detergents individually and in a mixed mode in each loop and transfer from one cycle to the next cycle in the food chain of white child fish, with Atomic absorption was calculated[3]. Finally, the experimental results were analyzed by Probit analysis.

3. Discussion

Results of transfer rate in the mixed mode of cadmium and LAS showed that firstly the amount of 0.0127ppm of cadmium nitrate, and 2.153 ppm of LAS detergent were added to the initial algae medium and in the next phase, the calculated transfer rate of infected *Scenedesmus sp*Algae was 0.007 and in Daphnia 0.003 and in the of 1 gram-white fish children directly fed with infected Daphnia was 0.003 ppm, which were achieved by fed, 003/0 mg calculated based on the amount of cadmium nitrate by atomic absorption method.

Results of transfer rate of copper + LAS Detergent mixture showed that firstly 0.15 ppm of copper sulfate and 2.153 ppm of LAS detergent were added to the initial algae medium andon stage next phase, the transfer rate calculated inthe contaminated algae was 0.09 and Daphnia about 0.05 and in 1 gram-white child fishes fed with contaminated Daphnia, was 0.01 ppm and another fishes fed directly with the infected algae was 0.004 ppm that was achieved based onthe calculation of copper sulfate by atomic absorption (Atomic Absorption).

(Table 1 and 2) the result from investigations showed that, trnsfer rate of heavy metals and Detergents within each cycle of food chains white child fish, based on the increse of LAS limit, (2.153 ppm) and 0.0127 ppm of Cd to the initial algae medium, in *Scenedesmus sp*Algae 0.007, Daphnia 0.003 and 1g-white child fishfed with infected Daphnia about 0.001 an 1g-white child fish fed directly with infected algae about 0.003 ppm according to the calculation of Cadmium nitrate were achieved by Atomic absorption apparatus.

The afore mentioned results suggest that by adding LAS to Cd, the uptake rate by white child fish was increased. The results from transferring the Cu+ LAS mixture showed that from the amount of copper sulfate to the amount of 0.15 and 2.153 ppm (LAS) to the initial algae medium, in the infected algae, to the amount of 0.09 and in Daphnia 0.05 and in 1g-white child fishes which fed with the contaminated Daphnia, 0.01 and in the white chil fishes which fed with contaminated algae, was about 0.004 ppm according to the calculation of copper sulfate rate by the Atomic Absorption method apparatus.

Kardavani, 1993, represented that an increase in the concentration of anionic detergents reduces the surface tension of the water and through the impact upon gills, toxicity creationand the incidence of infant mortality in some fishes, threatens the life of aquatic creatures. Based on the international standard of allowed values of concentrations of Surfactants in the surface waters based on LAS with average molecular mass of 316, must be expressed less than (milligrams per liter). Small amounts of Surfactants in water can increase some contaminants' permeability of the water in fish body and can act as carriers of toxins.

Konr, Mullich, 1993 realized that most of the pollutants when are combined together, produce sediments which either precipitate in the river bed or generally stay afloat river's downstream. Therefore, this effect of pollutants upon the living organisms must be evaluated to obtain the organisms that play an important role within the fishes' food chain.

Solon, 1996 did in experiments on BIGHEAD Carp, the lethal concentration of over parathion lonely was 1.41 ppm and if LAS was added to it, the lethal concentration will be reduced to 0.720.

The average of survival percentage of fish in 0.8 ppm concentration of parathion beside the 1, 0.5 and 0.25 ppm of LAS respectively was 5, 38.5 and 97.5% and average of survival percentage of fish in 0.8 ppm of parathion lonely was 95%.

Simple analysis of aforementioned experiment showed that the main effect in the survival of fish beside the 0.8 ppm of parathion in presence of 1 and 0.5 ppm of LAS can be shown in which we can see a main statistical effect about P=0.5. Some similar results between Dt and LAS shows that toxicity of DDT beside the LAS will be increased significantly.

4. Conclusions

The comparison of the achieved results within this research showed that, transfer rate of Cu and Cd pollutants individually within each cycle of food chain, is more less than the transfer rate of above pollutants in the mixed mode with LAS.

Table 1. The transfer rate of heavy metals mixture (Cd,Cu) and LAS in the cycles of food chain of 1g-white child fish

Pollutants	The initial concentration added to Algae / ppm	Absorption in Algae / ppm	Absorption in Daphnia / ppm	absorption in thewhite fish fed with Daphnia /ppm	Daily intake of white fish fed with algae /ppm
Mixture of LAS+Cd	0.0127 and 2.153	Cd 0.007	0.003 Cd	0.001 Cd	0.003
Mixture of LAS+Cu	0.15 and 2.153	0.09 Cu	0.05 Cu	0.01 Cu	0.04

Table 2. Transfer rate of heavy metals mixture (Cd, Cu) and LAS in percent, in the food chain of 1g-white child fish

Pollutants	The initial concentration added to Algae / ppm	Absorption in Algae / percent	Absorption in Daphnia / percent	absorption in the white fish fed with Daphnia /percent	Daily intake of white fish fed with algae /percent
Mixture of LAS+Cd	0.0127 and 2.153	58%	25 %	8 %	25 %
Mixture of LAS+Cu	0.15 and 2.153	60 %	33 %	6 %	45 %

Such that the toxicity rate was achieved about 25% of transfer of the LAS + Cd mixturein the contaminated algae and about 17% in the contaminated Daphnia and 8 & in the child fished fed by the contaminated algae, in comparison with the heavy metal transfer (Cd) in the foos chain cycles of white fishes.

Then is similar to the results achived from the previous researches based on the intensification of mixed pollutants toxicity and their transfer in the food chain of living creatures.

Also, the comparison of achieved results from transferring the detergent mixture of LAS and Cu in the food chain of 1g-white child fish shows the increase of pollutants mixture toxicity and transfer of them within the food chain.

Such that the toxicity ratewas achieved about 14% in the contaminated algae and 20% in Daphnia and 6% in the child fishes fed with Daphnia and 22% in th white child fishes fed with the contaminated algae, in comparison with the Cu transfer in the food chain cycle of white child fish.

The results from the experiments related to the transfer rate of heavy metals mixture (Cu and Cd) and LAS suggesting the increase of pollutants mixture toxicity and transferring to the food chain cycles of 1g-white child fish that equals with the previous studies and investigation of the increase in the pollutants mixture toxicity in the different organisms' food chain, based on the direct impact of the ani catalyst essence onic detergents on the phospholipid membrane of cell and of anionic surfactants and increase of the permeability of the membrane to the heavy metals.

Statistically, there is not a significant difference between two pollutants Cd and Cd+LAS regarding to the transfer rate and absorption level in the cycles of food chain. ($p>0.01$)

Also, the results of the test showed that we cannot see a significant difference between two pollutants Cu and Cu+LAS regarding to the transfer rateand absorption level in the cycles of food chain. ($p>0.01$)

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