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Abstract

Introduction: Using advanced technologies such as nanotechnology in the food and fishery industry, as one of the most important industrial sectors of countries, has received too much attention. Traditionally, fishing and hunting have been considered important sources of supplying food.

The subject and methodology: The study aims to investigate nanotechnology for detecting fish hatching time. This is a review article that collects the information from databases such as Sid, civilica, and Google Scholar. In the end, 22 papers were studied for extracting and collecting the required information from the abovementioned scientific database.

Finding: After examining the food, drug, and agricultural-related papers published from 2009 to 2020, it was concluded that small Nano-sensors, controlling & monitoring systems made from nanotechnology can be installed on fishing nets, fishing rods, and other fishing equipment. These devices (Nano-sensors and controlling & monitoring systems) will help fishes so that they don't get caught. In this way, as a fish gets close to the fishing equipment, it will receive sound, smell, or heat-based alarm. Therefore, the fish will stay away from the fishing equipment.

The result: according to the finding of this study, it can be concluded that excessive fishing in the hatching time will be avoided by the application of nanotechnology in the fishing equipment. As a result, the following advantages will be secured:
1- There are lots of opportunists who misuse fish during the hatching time. With the application of nanotechnology, they will be stopped.
2- Opportunists are ambushing in different time points to misuse fish. Also, the guards might be ignorant. With the application of nanotechnology, guards are no longer required.
3- This plant is cost-effective too.

Introduction:
Nowadays, there are clear indications of excessive exploitation of aquatic creatures which threatens the stability of long-term fishing and its share of the food supply demanded by humans. Considering the limitations of water resources on the planet earth, the ever-increasing rate of fishing and its consequences for all seas and oceans, overpopulation, and people's higher tendency to consume aquatic creates have shrunk the fishing and put many aquatic species on the verge of extinction. Obviously, Iran is not an exceptional case.

In this article, it has been tried to investigate the application of biotechnology and nanotechnology in the marine and biological sciences in a general sense. Also, a novel idea will be presented to address the abovementioned biological issues (excessive fishing in the hatching time).

The science of nanotechnology
Nanotechnology is a discipline related to different branches of science. It has entered applied sciences such as chemistry, physics, biology, medicine, and medical engineering. Nanotechnology is defined as a systematic investigation and development to understand, manipulate, and measure materials on the atomic and molecular scale. At least one of the

dimensions of nanoparticles is in the range of 1-100 nanometers. These particles exhibit novel features which are related to their high surface-to-volume ratio. One nanometer is 0.000001 of a meter. Nanotechnology considers the topics related to viruses and pathogenic scales. Therefore, nanotechnology has a great potential in identifying and eliminating pathogenic agents (Azarm 2016).

The phrase "nanotechnology" was defined for the first time in 1947 by Norio Taniguchi from the University of Tokyo. Nanotechnology (nanotech for short) studies the manipulation of materials on the atomic and molecular scale (Peridikala 2009).

Nanotechnology is actually working with structures in the range of one to 100 nanometers and includes the production of the material or machines in this range (Agravaland et al. 2014). In the Nanoscale, materials exhibited altered characteristics which are novel and completely different from observed materials in the macroscopic scale. The alteration of characteristics happens as a result of molecular size reduction as well as the different nature of molecular interactions. Nanotechnology can create many materials and new machines with extensive applications in medicine such as stem cell engineering, the production of implementable machines inside the body, and predesigned antibodies.

Because nanotechnology can be applied in all sciences, we aim to investigate its application in the marine and biological industries.

The industry of seafood is one of the most important sectors in the industry of countries which has a deep connection with the health and food security of individuals in the society. Using novel technologies, nanotechnology, in particular, has been received too much attention. Nanotechnology is very important to the community of food industries because of improving the quality and taste of food, saving during cooking and catering, superiority in following the safety principles, preserving the food for a long time, producing food containing drugs, complementary substances, and required vitamins very cheaply and effectively. Nanotechnology can be used in the production line to create sensors and machines. So, they will secure the production of pollution-free food. Fast distribution of Nano food and creating food containers with authorized additives are some of the applications of nanotechnology in this industry (Ghadi et al. 2014).

Nano-scale materials and tools serving the agricultural sciences
Nanotechnology has penetrated all branches of sciences, including agricultural sciences. So far, several applications of nanotechnology in agriculture, the food industry, and animal sciences have been considered. The relationship between nanotechnology and agricultural sciences can be studied in the following areas:
1- A need for the safety of agricultural and food systems
2- Creating smart systems for preventing and treating plant diseases
3- Making new tools for the improvement in biological and cellular studies
4- Recycling agricultural waste from agricultural products

Among all strategies in the management of agricultural pests, using pesticides and biocides is the fastest and cheapest way for reacting to an emergency. Biocontrol methods are currently very expensive. In biological control methods, one of the natural enemies of a specific pest is

used for managing it. Nowadays, excessive use of pesticides has caused lots of problems. These problems include a negative impact on people's health (creating chronic poisonings or chronic diseases), impacting pollinator insects and domestic animals, polluting water & soil, and direct & indirect effects in these biological systems. Excessive use of pesticides will turn agricultural products into reservoirs of toxins (Hiati et al. 2019).

The applications of nanotechnology

Precision agriculture: To be general, precision agriculture is a novel attitude in the management of farms. Currently, it can be determined by nanosensors what nutritional elements or pesticides a small part of the farm might need. In this way, polluting the environment will be minimized, and securing the safety of products and increasing economic efficiency will be secured. nanosensors can assist the data processing center in preserving the products by precise monitoring and reporting (Khadem 2015).

Constructing low-budget small greenhouses on a massive scale can be followed to save energy and more stability against nanostructures' moisture. Such greenhouses can feed the world's population but occupy only 10% of entire agricultural fields. In this way, millions of hectares of agricultural lands will become natural landscapes for animals across the globe (P.Holister J 2013).

The applications of nanotechnology in the production of pesticides and effective & safe fertilizers

Agricultural pesticides' particles find their way to humans' respiratory system by agents such as wind and put humans in danger of catching Inhalation diseases. The improvements of nanotechnology can resolve issues associated with pesticides thanks to increasing the profit and decreasing side effects of agricultural pesticides. Therefore, pesticides will be completely advantageous products (Nanotechnology association, 2014).

some of the applications of Nano in the production of safe pesticides and fertilizers are as follows:
The production of chemical pesticides and fertilizers using nanoparticles and nanocapsules: this generation of pesticides and fertilizers can be released according to a specified plan. Also, they can have better effectiveness and compatibility with the environment. The production of nanocrystals will increase the efficiency of pesticides with lower dosages. This means that that the release of pesticides into nature will be minimized (Nematolahi et al. 2016).

The application of nanotechnology in water treatment and irrigation equipment

Water desalination and water treatment for supplying drinking water and agricultural needs will be more efficient. The united nations organization has predicted that 48 countries (the equivalent of 32% of the world population) will suffer from water shortages for drinking and agricultural uses. The purification and desalination of water by nanotechnology are among the most remarkable areas which lead to a preventive defense of environmental security. The designed nanosystems can desalinate seawater 10 and 100 times more efficiently than reverse osmosis and desalination machines, respectively. Faster and more precise water treatment will be achieved by the application of nanoparticles and Nanos. Also, the use of Nanos has extensive application in bioremediation.

Detoxifying water and soil pollutants and the possibility of recycling them:

Making water super-absorbents from polymers and composite materials: these materials have been designed to save and preserve the humidity of water. Using these materials will be very beneficial in arid areas with a lack of water.

Making new and efficient coating materials for covering the internal parts of metal pipes: this coating material will be used to avoid corrosion which might happen due to fluids and the reduction of pipes' wall roughness.

Using polymers and composite materials for producing different types of droppers: droppers made from these materials can adjust water pressure precisely. Also, due to the nature of these materials, these droppers are resistant to the infiltration of plant roots (Nanotechnology association 2004).

The application of nanotechnology and nanosensors
Precision agriculture which has always been an enduring dream leads to obtaining the highest product performance while using the lowest amount of inputs such as fertilizers, pesticides, and herbicides. This can be achieved by studying environmental parameters and smart functions. nanosensors are used for investigating and identifying pollutants, pests, the value of nutrients in the soil, and drought, temperature, and/or pressure-related stresses. Also, these sensors will increase the efficiency of agricultural lands and their productions by proper use of agricultural inputs. It is possible to make the right decisions about the quality of agricultural products' growth, precise identification of the area's nature and their problems by the use of computers, global positioning systems, and remote sensor machines. In fact, the costs and agricultural wastes will be reduced and environmental pollution will be minimized. Small sensors and controlling and monitoring systems that have been made by nanotechnology have an important impact on modern agriculture (Nanotechnology 2015).

The application of nanotechnology in identifying soil fertility
The interaction between soil solution and Nano products, which can assess the number of nutrients precisely, can be provided. The nutritional, humidity, and physiological states of plants can be determined by nanosensors which facilitate taking on time and appropriate corrective actions. Nanoparticles are small labs that can control and adjust temporal and seasonal changes in the plant-soil system very precisely. One of the most important aims of precision agriculture is the correct management of nutrients and water required by the plant. By the application of nanosensors, determining the number of available waters and nutrients for plants can be done very precisely.

The application of nanotechnology in eliminating weeds
Herbicidal molecules can be covered by nanoparticles. These molecules can reach their active agents to a specific recipient molecule in the root parts of the weed. The penetration of herbicidal molecules into the weeds' internal system leads to the movement of these molecules to parts that stop the food's glycolysis in the root. This process leads to weed starvation and eventually its death due to a shortage of nutrients needed for growth. The application of herbicide may be useless in dryland farming due to the shortage of humidity in the soil. Since experts cannot still predict the rainfall in dryland farming precisely, it will not

be possible to apply herbicides before the expected time for the rainfall. It is expected that the controlled releasing of capsulated herbicides can lead to better management of the competition between weeds and agricultural plants in dryland farming.

The application of nanotechnology in the detection of plant diseases
Plant diseases are among the most determinative factors in agricultural plants' performance. The main problem in managing plant diseases is related to detecting the precise time for doing required preventive activities. In most cases, applying pesticides is one of the common preventive measures. As a result, the residue of pesticides will pollute the environment. On the other hand, using pesticides before the emergence of diseases symptoms also reduces the performance of the product to a large extent. Among different types of plant diseases, viral diseases are much harder to manage because the farmer has to control viral vectors so that the distribution of diseases is controlled. Using diagnostic Nano kits for determining the strain of the virus and detecting the appropriate time for application of pesticides are becoming common very quickly. identifying and application of biomarkers (that identify the growth stage of pathogenic viruses by producing discriminative proteins during the time that plants are healthy and sick) can determine the type of different produced proteins during the lifecycle of viral diseases. By using the Nano-based diagnostic kits, the speed of detecting plant diseases not only can be increased but also it can be possible to improve the quality of detection.

The application of nanotechnology in the fishing industry
Nanoparticles can be used in the science of aquaculture, fishing and hunting, and processing fishing products. Nanoparticles can be used for eliminating pollutants in the water by refining sewages. Carbon nanoparticles with zeolite and iron additives can help preserve the aero condition and eliminate pollutants such as nitrite, nitrate, and ammonia. Scholars consider using silver nanoparticles as an appropriate method for sterilizing water in hatcheries against bacteria (Raissy 2011).

To overcome these challenges, a combined approach of understanding, integrating, and deploying new strategies in science and technology in maintaining desirable aquaculture is indispensable. At this point, the aquaculture sector undergoes new scientific and technological innovations to produce more qualified end products. Among the recent advancements in science, nanotechnology is fast emerging as the new science and technology platform for the next generation of development and transformation of agri-food systems (Rodrigues et al., 2017)

Nowadays, some companies have produced products that are based on nanotechnology for water infiltration. For example, the company Argonide in the US has been able to produce water filters that can eliminate many or aquatic microorganisms and bacteria from the water body. Scholars from the Russian Academy of Science have reported that the growth of some fish species such as carp and sturgeon has increased by 30 and 24%, respectively. This happens when these species of fish are fed by iron nanoparticles (Anonymous 2010).

Also, it has been shown that selenium nanoparticles (NANO-SE) available in the food chain can increase the weight of fish species, anti-oxidant level, and selenium level in muscles (Zhou 2009).

Currently, the topic of using special hooks that are covered to special Nano colors can attract fish species. This is because these colors reflect the light in different directions. This method is very important for the fishing industry. These hooks that are covered with Nano polyimide are responsible for increasing the efficiency of fishing three times more than regular hooks (Rather 2011).

In recent years, excessive fishing of aquatic creatures by different means such as Trawl fishing in south seas or other methods in different seas has jeopardized the diversity of species and their quantity. That's why supportive plans for preserving marine life and fish species have been provided by authorities and people. One of these plans is conducting aquaculture plans, setting dates, fishing time, monitoring the quantity of fishing by smart systems and satellite-related systems.

The application of nanotechnology in the food industry
Nanotechnology in the food industry has many different applications. These applications include the use of nanotechnology in the food production processes and the food itself. According to the definition provided by the Nano forum (an institution established by the European Commission and active in the field of nanotechnology), nanofood is tools or technological methods which are used during cultivation, production, processing, or catering of food. Although the definition of the Nano forum is limited it is a good idea for assessing how much of our future food is Nano-based and how many people are going to be influenced by such food. Currently, the phrase nanofood isn't designated to food that has been produced directly from the nanotechnological methods. However, lots of things will happen in the future. For example, it is possible that somedays some kinds of nanomachines will be produced that can produce food molecule-to-molecule. Scientifica (a consulting firm that is claimed to provide very useful information in the context of guidance and consultation for activists in the field of nanotechnology) believes that molecular production and designing materials atom-to-atom will be possible after 2012. Briefly, different applications of nanotechnology in the food and food industry can be categorized as follows:

A- Food preservation: sterilizing the surface, protecting their anti-oxidants, manipulation, and controlling enzymatic activity.
B- Processing food: different flavors and colors, purifying frying oil (by nanoceramic materials) to prevent heat-derived polymerization and reduce unpleasant odors.
C- Nutrients transportation: water-soluble fats, nanoparticle-based production of some elements such as carotenoids, Phytosterols, and anti-oxidants to distribute them better in juices for their better adsorption, using nanocapsules as careers of essential oils, flavors, antioxidants, 10Q coenzymes, vitamins, mineral nutrients, and phytochemicals for their better and faster adsorption, encapsulating active parts such as polyphenols, mineral nutrients, and nutrients in the micro-scale by nanoparticles for protecting them from oxidants and the recipients of flavor and taste, the application of liposomal nanosacs for encapsulating and transporting nutrients and causal compounds such as proteins, enzymes, flavors, and anti-microbial materials, protein and nano-based butter, curd and whey (400 nanometers) which release their nutrients inside cells.

D- Detecting disadvantageous agents: putting nanosensors in the production line of pollution-free food, production of very small silicone nanosensors for rapid detection of viruses,

bacteria, and other pathogens, targeted development of DNA synthesis using coded colorful probes as barcodes which make detection of food pathogens possible, simultaneous detection of toxins, pathogens, and chemicals in food by a bio-micro-detector which can transport materials in the micro-scale by different nanowires, specific pathogenic antibodies, and fluorescent antibodies, using silver nanoparticles in different products (from bandages to refrigerators) for eliminating bacteria and other microbes, analyzing and detecting pests, different versions of antibiotics in agricultural products by chipsets or Nanosensors (Edu.nano.ir).

Biological control is currently very expensive. In these methods, controlling pests is possible by their natural enemies.

The application of nanotechnology in the catering industry
- Shelf time will increase from 3-4 days to 2-3 weeks out of the fridge in the products that have Nano catering.
- Nano catering protects the products from physical damages and other sources of pollution.
- Nano catering can increase the shelf time and long-term perseverance of products due to their extensive and effective application against living microstructures.
- The production of food and drinking containers that can cool themselves by nanotechnology (Taghizadeh et al. 2015).

Concerns about the application of nanotechnology
Nanoparticles can have potential dangers regardless of all their advantages. Therefore, safety issues and potential dangers must be considered when using these methods. Nanoparticles can increase the speed of mutations in bacteria which will become a potential threat to the environment and human health. Although nanotechnology produces more efficient and effective products, the size of these particles, which is an important feature, can threaten the health and environment. These particles are smaller than natural allergens such as pollens and can cause an allergic reaction in humans. Also, it has been reported that Dioxide titanium and black carbon nanoparticles which are very practical in the industry can accelerate air pollution and skin inflammation and stay in the lungs. Zinc oxide and titanium dioxide can also cause free radicals in the living skin cells and hurt DNA and mutation and eventually some types of cancers.

There are also some concerns about the method of nanoparticles production in the agricultural and food sectors. In fact, it is possible that they might enter the food chain. Although food normally contains many nanoparticles such as proteins in the milk, fatty globules in maionese, carbohydrates, DNA, etc., using some engineered nanoparticles in agriculture, water, and food can cause dangers for humans and the environment including accumulation in plant tissues and toxifying plants (Mari Maja 2012).

Method:

This was a literature review that collected information using databases such as sid, civilica, and Google Scholar. Finally, 21 articles were collected and extracted from scientific databases and then investigated.

Findings:

Nanotechnology is a fast-moving field and it has great potential in the fields of food, drugs, agriculture, and the food industry. This notion made scholars look for some ways to help fishermen so that they don't hunt fish species during the hatching time. Scholars do this by very small Nanosensors, monitoring and controlling systems which are made by nanotechnology, implementing these sensors in fishing nets, fishing rods, and other fishing equipment. In this technology, fish species receive an alarm when they get close to the fishing equipment. So, they will stay away from the equipment. This alarm can be a sound, smell, or heat so that it has the lowest risk for the environment and fish species.

Table. Literature review

Number	Authors	Year	Title	Conclusion
1	Nematolahi et al.	2016	The application of nanotechnology in detection	Production of nanocrystals for increasing the efficiency of pesticides
2	Nanotechnology association	2014	A report on the application of nanotechnology in agriculture, and the food industry	Eliminating the risk of pollutants, using nanopolymers for the production of different types of droppers for a precise adjusting of water pressure
3	Nanotechnology association	2015	Nanotechnological products in the field of agriculture and food industry	Determining the type of different proteins during the lifecycle of pathogenic viruses
4	Hayati et al.	2019	Studying different aspects of nanotechnology	

Conclusion

According to the literature review in credential scientific websites in the field of nano and fishing, the current article is in line with another article with the topic of development in nanotechnology for stable aquaculture and fishing in 2019. It is also in the line with another article in the field of agriculture in 1394 which explained nanosensors. Also, in this article, issues about protecting and preserving fish species during the hatching time in seas and lakes have been mentioned. According to the findings of this study, it can be concluded that the application of nanotechnology in fishing equipment can decrease the risk of excessive fishing and hunting during the hatching time which has the following advantages:

1- There are lots of opportunists who misuse fish during the hatching time. With the application of nanotechnology, they will be stopped.

2- Opportunists are ambushing in different time points to misuse fish. Also, the guards might be ignorant. With the application of nanotechnology, guards are no longer required.
3- This plant is cost-effective too.

Suggestions
According to the study in the field of nanotechnology in the marine and fishing industry, we felt that this is necessary to mention some of the problems and issues about this study as follows:

1- Identifying the issues and problems in nanotechnology in the field of food, drug, and agriculture
2- Collecting suggestions and increasing the applicability of nanotechnology in the field of food, drug, and agriculture
3- Embracing this plan and similar plans for aquatic creatures and preserving their habitat by the fishing industry.

Those scholars who like to contribute to nanotechnology in the field of food, drug, and agriculture can study in the following areas:

1- Studying small Nanotechnological sensors and monitoring and controlling systems on fish species during the hatching time
2- Studying small Nanotechnological sensors and monitoring and controlling systems on fishing nets and fishing rods for identifying fish during the hatching time

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It is a review report for detecting fishes hatching time. The authors provide detailed and rich literature and makes some suggestions. However, no actual experimental work was present.