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Pharmaceutical Pollution in the Environment and Health Hazards

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Today Pharmaceutical products are very important and essential in modern life and are used to treat human and animal diseases. Furthermore, presence of pharmaceutical products in the environment is one of the most important and concerned problems [1]. The main resources of Pharmaceutical pollution in the environment are including raw and treated effluent from the pharmaceutical factories, hospital waste, excretion by livestock treated with antibiotics, runoff from agricultural fields, and municipal wastewater treatment plants [2]. Pharmaceutical products with a long half-life are environmentally sustainable [3] and remain at the wastewater treatment stages and will enter to the environment [4]. Recently, pharmaceutical products have been found to be abundant in sewage treatment plants, surface water, ground water, and in particular drinking water [2, 5]. Antibiotics as a large group of Pharmaceutical or drugs, are widely used in the treatment of infections, in which accounts for about 15% of total drug use in this group [6]. This material disrupts the sewage treatment process and the microbial ecology of surface water [4]. Due to the presence of antibiotics in the treatment systems, the activity of sewage bacteria is inhibited and can seriously affect the organic matter decomposition [7]. The presence of an antibiotics group is considered to be toxic to nitrifying bacteria in the wastewater treatment process. In the study on the sewage treatment system that received various antibiotics in human wastewater, there was also a decrease in the number of bacteria along with a change in the microbial population. Therefore, the effects of antibacterial agents should be given special attention [8]. Anti-microbial resistance of isolated bacteria from urban and hospital wastewater showed that the rate of drug resistance in hospital wastewater is higher than urban wastewater. Increasing the concentration and diversity of antibiotics in hospitals, in comparison with urban sewage, leads to an increase in the resistant bacteria transmission as well as multiplier resistance [9].

Compared to the other countries, the criteria of drug per capita in Iran is low, in which 23- 27% of healthcare grants are allocated to the medicine [10].The average of the drug items in the world is about 2 medicine per prescription in each cell, and this rate in Iran is 3 to 4 medicine per prescription.

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In Iran, 10 - 15% of drugs are consumed without a physician consultation. Meanwhile, analgesics and antibiotics contain the highest levels of arbitrary intake. The average growth rate of drug use in Iran is 11.5%, which is 9% higher than the global average [10, 11]. The most important reason for investigating and controlling the environment pollution is the entry of these pollutants into the food cycle and drug resistance. These pollutants lead to many environmental and medical hazards due to the different chemical structure and various physical and chemical properties. One of the main concerns of pharmaceutical contaminants is the presence of antibiotics in urban water resources, which results in microbial and increased drug resistance in humans as well as the population of pathogens in the environment (Water, soil, and air) [12]. Continuous exposure to antibiotics can increase the bacterial resistant strains in the environment. The spread of antibiotic-resistant bacteria can disturb the environmental balance and causing unpredictable effects on humans and animals. The relationship between antibiotics in the environment and the development of resistance in bacteria has been investigated by the researchers [13]. A study in Tehran has shown that *acinetobacter* have a high resistance to the most commonly used antibiotics. Therefore, given the ineffectiveness of existing antibiotics, the increasing risk of releasing antibiotics in the environment can be identified. Due to the volume of drugs sold and by investigating urban sewage, to identify the drug compounds, the priority was to determine these pollutants [14].

Indirect drug use (by water or food contaminated with drugs) by the community helps the body to neutralize the drugs and the next high-impact effects [15]. Any mutation in the microorganisms in response to the presence of drug compounds in their growth medium and in the structure of microorganisms is not logical at least in the early years when they are unknown and uncontrollable, [16]. Medicines enter the environment directly or after metabolism and through human and animal excrements. People directly (drinking water) or indirectly (plants containing these compounds that are absorbed and stored by the environment or animal products such as milk, meat, etc.) receive some of these compounds as well as their side effects. Therefore, the human body that directly received these compounds will be resistant to the drug while controlling the disease. On the other hand, the pathogenic microbes living in the environment are lethal by receiving low and constant amounts of these compounds [17].They are resistant to this drug compounds and a new medicine must be prescribed to control the disease [15]. Unfortunately, some studies have shown that at the beginning of the disease the patients try to control it by increasing the volume and repeating drug use. Although, drug addiction in the short term improves the disease, most their side effects increase the risks for human. The microorganisms that are exposed to the pollutants are forced to change their body systems to adapt to the environment, which this change in their structure may cause unknown and dangerous illnesses that are uncontrollable at least in the early years [18, 19]. Therefore, the efforts towards an effective and rational drug system should be part of the important goals of all health centers in the world and improving drug use based on the WHO actions and recommendations [20].

In recent years, research on pharmaceutical pollution removal has received a lot of attention. Different methods (physical, chemical, and biological) have been investigated to remove antibiotics from water and wastewater. The appropriate methods for pharmaceutical products removal from water and wastewater are including adsorption such as carbon nanotubes, graphene oxide, activated carbon [21], biological degradation processes, chemical advanced oxidation processes such as fenton, photophenton, photocatalytic oxidation, ozonation, and ionizing irradiation [22- 25]. The combination of advanced oxidation processes and biological treatment methods has shown suitable removal efficiency for pharmaceutical products [22].

Pharmaceutical products are necessary and inevitable for human health; however it should be

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produced in such a way cause the least harm to the environment. It is better to control the high consumption of drugs and consider pollutants spread prevention. People in the community must be familiar with the consequences of drug contaminants and the medicine use culture has to be created.

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