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Antibiotics in Iranian Aquaculture Industry

Lida Rafati [*]

[*] *Environmental Science and Technology Research Center, Department of Environmental Health Engineering, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.*

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Corresponding Author:
Lida Rafati

Email:
l.rafati@yahoo.com

Tel:
+983538209100

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Antibiotics destroy bacteria, viruses, fungi, algae, and other microbes. The cells of bacteria, such as salmonella differ from those of higher-level organisms such as fish. Antibiotics are chemicals designed to either kill or inhibit the growth of pathogenic bacteria while exploiting the differences between prokaryotes and eukaryotes make them relatively harmless in higher-level organisms. Antibiotics are constructed to act in one of these three ways: by disrupting cell membranes of bacteria (rendering them unable to regulate themselves), by impeding deoxyribonucleic acid (DNA) or protein synthesis, and by hampering the activity of certain enzymes unique to bacteria [1].

Antibiotics are used in aquaculture to treat diseases caused by bacteria[1]. Sometimes, antibiotics are used to treat diseases; nonetheless, most of the time, they are applied to prevent diseases by treating the water or fish before occurence of disease [2]. This prophylactic method of disease prevention is profitable since it prevents loss and allows fish to grow more quickly, but it still has several downsides [3].

Overuse of antibiotics can create antibiotic-resistant bacteria. Antibiotic-resistant bacteria can spontaneously increase when the selective pressure to survive results in changes to the DNA sequence of a bacterium and allow it to survive against antibiotic treatments. Because some of the antibiotics used to treat fish are the same as those used to treat human disease, pathogenic bacteria causing human disease can also become resistant to antibiotics as a result of treatment of fish with antibiotics [4]. For this reason, overuse of antibiotics in treatment of fish aquaculture (among other agricultural uses) can create public health issues. The food and drug administration (FDA) has been testing chemicals in aquaculture products for over two decades. In November 2005, the testing program for aquaculture drugs was revised to include antibiotics such as chloramphenicol, fluoroquinolones, nitrofurans, and quinolones, as well as antimicrobial compounds like malachite green that are not approved to be used in aquaculture fish [5]. From October 1, 2006 to May 31, 2007, FDA tested samples of catfish, basa, shrimp, dace, and eel from China and found that 25% of the samples contain drug residues [6]. Five different drugs were approved to be used in aquaculture by FDA because seafood contains less than a mandated maximum residue

limit: florfenicol, sulfamerazine, chorionic gonadotropin, oxytetracyclinedihydrate, oxytetracycline hydrochloride, as well as a drug combination of sulfadimethoxine and ormetoprim. FDA has approved two drugs, formalin and hydrogen peroxide for which no tolerance limit has been set [7].

Currently, FDA enforces regulations in the US on testing the certain imported products for antimicrobial agents under Import Alert 16-131. The Import Alert expresses that the use of antimicrobials during the various stages of aquaculture, including malachite green, nitrofurans, fluoroquinolones, and gentian violet may contribute to an increase of antimicrobial resistance in human pathogens. It further states that prolonged exposure to nitrofurans, malachite green, and gentian violet has been shown to have a carcinogenic effect [8].

One of the frequently consumed antibiotics in Iranian aquaculture industry is oxytetracycline [9]. Oxytetracycline is a broad-spectrum antibiotic that is active against a wide variety of bacteria. This antibiotic is from a group of antibiotics widely used in aquaculture industry due to its wide range of application and low price [10]. The Iranian Veterinary Organization General Department states the standard dose of oxytetracycline as 200 ppb in the fillet and 600 ppb in the liver of fish based on codex alimentarius commission [11]. Unfortunately, these drugs are consumed without any supervision and monitoring in the aquaculture industry. Despite antibiotic overdosing, accurate health care supervision and control are required in terms of relevant regulation about antibiotics in most countries. Due to some reasons like legal gap, ambiguous behavior with law-breakers, treatment of polluted products, absence of professional officials, lack of a national maximum residue limit (MRL), lack of diagnostic laboratories for veterinary drug residues, and absence of relevant experts, this trend may seriously endanger users' health. In the end, legislating, giving procedural and executive instructions for veterinary drug residues, convincing officials in aquaculture ponds to record date and type of drug(s) prescribed by veterinarians, establishing laboratories for diagnosing veterinarian drug residues at province centers, establishing a national reference laboratory, as well as making the used synthesis standards and techniques uniform are suggested [12].

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