

Chapter 6

Antibiotics in the Ghanaian Environment: Occurrence, Uptake, Risk Assessment, and Removal

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ABSTRACT

The use of antibiotics is widespread throughout the world, and Ghana is not an exception. They are one of the most frequently prescribed medications. Antibiotic residue concentrations are rising in the environment and are found in practically all water bodies, including lakes and rivers, because of inadequate management of residential and medical wastes. Contrarily, there is a substantial chance of medication toxicity and resistance. Therefore, removal of these pollutants from water bodies is essential, yet conventional wastewater or water treatment methods frequently fall short of efficiently removing these chemicals. Antibiotics will be used as a case study in this chapter to discuss the concentration of pharmaceutical pollutants in the environment, specifically in Ghanaian waterbodies, and risk evaluations of these pollutants. Additionally, this chapter will look into the possible removal technologies report and establish the present investigation on removing these pollutants with microplastics.

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1. INTRODUCTION

Pharmaceuticals are chemicals whose utility is based on specific biological activity with the aim of promoting health and high living standard (Kümmerer, 2010). According to the Organization for Economic Cooperation and Development (2018), the word pharmaceutical which is used interchangeably with medicine or drug can be defined as any substance used for medicinal purposes like delaying the onset of and curing diseases, relieving symptoms, and preventing complications. Other uses or functions of pharmaceuticals specified in Encyclopedia Britannica are diagnosis, treatment, and prevention of diseases; as well as regenerating, correcting, and modifying organic functions. The effect of pharmaceuticals depends on their rightful use.

Bacterial infections have long been a significant cause of morbidity and mortality worldwide. The development of antibiotics has played a huge success in improving the outcomes of bacterial infections as well as improvements in nutrition, sanitation and vaccination (Azanu et al., 2018). Between 2000 and 2018, consumption of antibiotic saw a 46% increase from 9.8 defined daily doses per 1000 population per day in the year 2000 to 14.3 defined daily doses per 1000 population per day in 2018 (Jia et al., 2022). The widespread, improper use and easy accessibility of antibiotics often lead to the resistant microorganism strains emerging as well as the potential for drug toxicity and increased morbidity and mortality. The positive impacts of various antibiotics on health are threatened by resistance against these drugs.

In Ghana, antibiotics have been extensively used for treatment in both humans and animals. Afriyie et al. (2015) reported a high use of antibiotics with penicillin having the highest frequency of prescription in Ghana. The availability of these drugs over the counter without prescription or the appropriate indication has contributed widely to their use and misuse. In veterinary practice, antibiotics reserved for human infections are used as prophylaxis, growth promoters, and treatment of livestock, which further adds to their increased presence in the environment (Azanu et al., 2018).

Field and laboratory studies by Schoenfuss et al. (2016) revealed that pharmaceutical mixtures can reduce the population of fishes through varied effect of such mixtures on sexes. Thus, pharmaceutical mixtures have different impacts on males and females, which may not be coherent.

Removal of pharmaceuticals from water and the environment is a critical environmental concern due to the potential presence of various contaminants, including active pharmaceutical ingredients (APIs) and their metabolites. The conventional wastewater treatment processes are often insufficient to remove these compounds effectively. Therefore, advanced treatment technologies have been developed to address this issue. Several methods have been investigated and applied

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