

Chapter 1

Introduction to Water and Wastewater Treatment

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ABSTRACT

This chapter elaborates the importance of water and wastewater treatment to human, environment, and world. It further discusses the water-borne diseases and other effects without implementation of water and wastewater treatment system. The principles of treatments are elaborated in detail as well. The standard parameters and value needed to be checked and compiled by the water and wastewater treatment system are not forgotten. This chapter explains the sources of water pollution such as from geography, ecology, and industry site. It also includes thoughtful discussion on causative factors behind water pollution, either human or other activity. The chapter views the importance of clean water in a variety of economic aspects. Without clean water what will happen to the world economy?

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INTRODUCTION TO WATER AND WASTEWATER TREATMENT

There are about 332.5 million cubic miles of water on earth, but only less than one percent is easily accessible for domestic and industrial application as fresh water (Proverbs et al., 2016). The freshwater resource is often regarded as infinite supply because water purifies and replenishes itself through the hydrologic cycle. However, it is not necessarily true if the water resources keep being polluted or drained faster than it can be restored. Moreover, only two-thirds of the accessible water is suitable for consumption, while the remnants are not consumable due to pollution and other factors. Diminishing water resource is indeed a growing concern all over the world, and thus it is necessary to have clean and safe water accessibility to secure healthy population. The public awareness combined with prevention and treatment action will avert environmental problems and water-related human diseases. Water and wastewater treatment are the mitigation available when dealing with inaccessible water caused by pollution. The treatment technology imitates the 'hydrologic cycle' which purposes are to clean, purify and restore water for drinking or in accordance with the regulated water quality standards.

Water and Disease

Disease is a particular abnormal condition that affects part or all of an organism and consists of a disorder of a structure or function. Disease is not solely a direct outcome of physical injury as it may be caused by external factors such as pathogens (bacteria, virus or vectors) or by internal dysfunctions, particularly the immune system such as immunodeficiency or hypersensitivity. The polluted water can cause a wide range of diseases across the globes which include several life-threatening diseases. In fact, the World Health Organization (WHO) has reported that waterborne disease is the deadliest killer in the world. The target group is the low immunity people namely young children, elders and sick individuals. Number of case reported is higher in developing countries, in which 80% of illnesses are due to water-borne diseases with diarrhea causing dehydration as the top killer among children (Fonyuy, 2014). Water although regarded as renewable resource, safe and protected fresh water, is indeed finite and should not be taken for granted.

Contaminated water which contributes to diseases is often associated with biological factor or presence of pathogenic microorganisms, and thus known as water-borne diseases. Nevertheless, chemicals such as organic substances, inorganic substances, and radionuclides are also noteworthy factors. These chemicals may be introduced into the water from improper waste management, uncontrolled mining and poor agricultural practice. Many of these substances are not harmful to humans or present in low concentrations which hardly cause health effects. However, some of the substances are known to cause serious health effects at low concentrations, and treatment is needed to remove them or to reduce their concentration in drinking water.

Infection may occur through direct or indirect exposures involving these two groups of contaminants. Direct infection which involves biological factor arises through consumption of water which is infested with pathogenic microorganisms such as *Salmonella typhi*, *Shigella* spp., *Campylobacter* spp., *Vibrio cholera*, and many more (Guillot & Lore, 2009). On the other hand, the indirect route is through vectors lurking in the contaminated water. These vectors may live in the water or part of their life cycles requires water as a breeding ground. For example, vectors which carry water-borne diseases are mosquitoes, snails, flies, fleas and tick. For chemical inducing diseases, the direct route is through consumption of toxic water which comprises harmful chemicals such as heavy metals, nitrates, pesticides and disinfectants.

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