

CHAPTER

1

PALM OIL MILL EFFLUENT

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1.1 INTRODUCTION

Palm oil mill effluent, or simply called POME, has been a persistent environmental concern for palm oil producers, governmental bodies, and environmentalists. It is a particular problem for palm oil-producing countries such as Indonesia, Malaysia, Thailand and others. In general, POME is a brown liquid byproduct generated from oil palm mill which contains high amount of total organic content, total dissolved and suspended solids, and nutrient contents. The discharge of POME into water stream can consequently affect the water quality and cause serious water pollution. Thus, the treatment of POME is necessity to reduce the pollution level below the acceptable standard which is set up by the environmental authorities. Now, with the manufacturing paradigm shift towards sustainability as set out by United Nations and joined by Malaysia, the aim of POME treatment is not limited to reduction of pollution level in the discharge but goes higher towards zero discharge while making the system more economically and environmentally sustainable. As result, the treatment system can generate income through waste-to-wealth transformation. This book is compiling recent works on advanced treatment technologies for POME and exploring the potential of POME products.

This book is constructed into three major parts. The first part of the book focuses on the POME and its current/conventional treatment

systems which are practiced in many palm oil producing countries. The breakdown of the chemical composition of POME and its subsequent treated POME at each treatment level has been summarised in Chapter 2. POME undergoes strenuous treatment to reduce its pollutant content below the acceptable limit set by the government environmental bodies. The current or common treatments of POME are comprised of ponding system: cooling pond, anaerobic ponds to carry out anaerobic biodegradation, followed by aerobic biodegradation and polishing ponds before being discharged. Chapter 3 focuses on the anaerobic and aerobic biodegradation of POME, challenges, and prospects of biological treatment. The application of physiochemical treatments such as sedimentation, centrifugation, flotation, coagulation, and flocculation has also been discussed in Chapter 4. The second part of the book presents the potential application of various membrane technologies, such as ultrafiltration (Chapter 5), membrane distillation (Chapter 6), and microbial fuel cell (Chapter 7) in advanced POME treatment system.

For the last part of the book, attention is given towards the exploration of the potential transformation of POME, or the utilization of POME waste into valuable products. The objective is to shift or upgrade the POME treatment system towards environmental and economic sustainability while minimising waste production. The generation of electricity or power through microbial fuel cell (MFC) has been explored in Chapter 7. The conversion of POME sludge into adsorbent has also been highlighted in Chapter 8. Chapter 9 summarises other current or potential valuable products that can be or have been derived from POME and POME waste.

1.2 POME: COMPOSITION, CHARACTERISTICS, AND IMPACTS ON THE ENVIRONMENT

Palm oil mill effluent (POME) is a by-product of the palm oil milling process. It is a high-strength wastewater generated from the extraction of oil from palm fruit. It is a complex mixture of organic and inorganic

compounds, and its composition can vary depending on factors such as the type of palm oil processing technology used, the quality of the raw material, and the efficiency of waste management practices at the palm oil mill. Understanding the composition and characteristics of POME is crucial for devising effective treatment and management strategies to mitigate its environmental impact. POME has a distinctive composition and characteristics that pose environmental challenges if not managed properly.

1.2.1 Composition of POME

General composition of POME is shown in Figure 1.1 where POME consisted of water, oil and grease, suspended solids and soil particles (Low et al., 2021). POME contains various organic matters including oil and grease, organic acids phenolic compounds e.g. phenol and benzene-1,2-diol, and carbohydrates (Ganapathy et al., 2019). Residual oil and grease from the palm fruit remain after the extraction process, contributing to the high organic content of POME and posing challenges for treatment. The oil and grease content in POME is around 4,000 mg/L (Andrew et al., 2021).

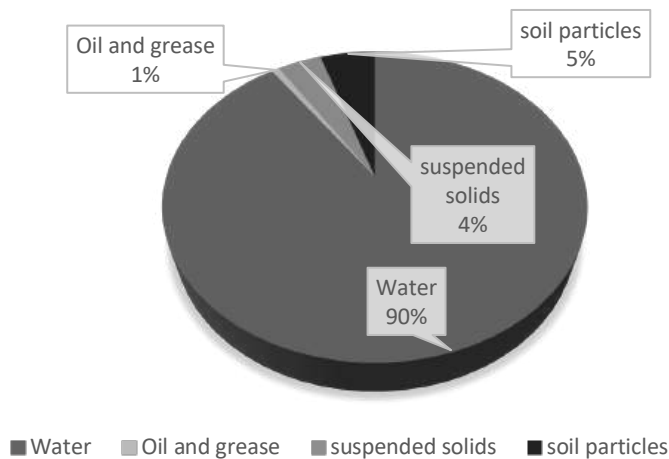


Figure 1.1 General composition of raw palm oil mill effluent
(Source: Ratnasari et al., 2022)