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ASSESSING ENVIRONMENTAL-SUSTAINABILITY OF PRODUCT LIFE CYCLE: A CASE STUDY OF HOLLOW FIBER MEMBRANE

Salwa Mahmood[a], Muhamad Zameri Mat Saman[a], and Noordin Mohd Yusof[a]

[a]Faculty of Mechanical Engineering, Universiti Teknologi Malaysia (UTM), 81310 UTM Johor Bahru, Johor, Malaysia.

Corresponding Author's E-mail: salwamahmood@gmail.com

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EXTENDED ABSTRACT

The world's supply of fresh water is finite and threatened by pollutions such wastewater distributed from industries. Membrane technology has received increasing attention for the wastewater treatment lately [Kumar *et al.,* 2014; Melin *et al.,* 2006]. The membrane function performance usually identified, while the performance from sustainability perspective have received less attention.In line with the Malaysian government policy, the membrane system used for wastewater treatment needs to be scrutinized to ensure sustainability according to Triple Bottom Line aspects including environmental, social and economic. However, this paper focusing on environmental sustainability aspects. The potential environmental burdens calculated are global warming potential (GWP), acidification potential (AP), eutrophication potential (EP) and waste potential (EP).

Previously, several tools or frameworks have been developed for assessing environmental burdens. However, most of the available tools are focusing on certain aspects only as well as limitation of scope [Singh *et al.,* 2012]. Life Cycle Assessment model for membrane system was developed to analyze of environmental burdens of membrane system and identifying the parameters involved that crossing the system boundary by using GaBi software. System boundary selected are from *cradle-to-grave* consists of material, fabrication process, transportation, usage and end of life phases. Figure 1 shows the process flow diagram for overall life cycle of hollow fiber membrane.

In this research, a methodology for assessing environmental-sustainability of membrane system has been proposed by using fuzzy logic approach for intermediate assessment of membrane system in between *sustainable* or *non-sustainable* hollow fiber membrane. This paper elaborated the fuzzy logic approach including the sample of calculations during the development of proposed methodology. A case study of hollow fiber membrane was successfully conducted. The results indicate that the environmental sustainability level of hollow fiber membrane module is good, while fabrication process needs much attention in term of sustainability.

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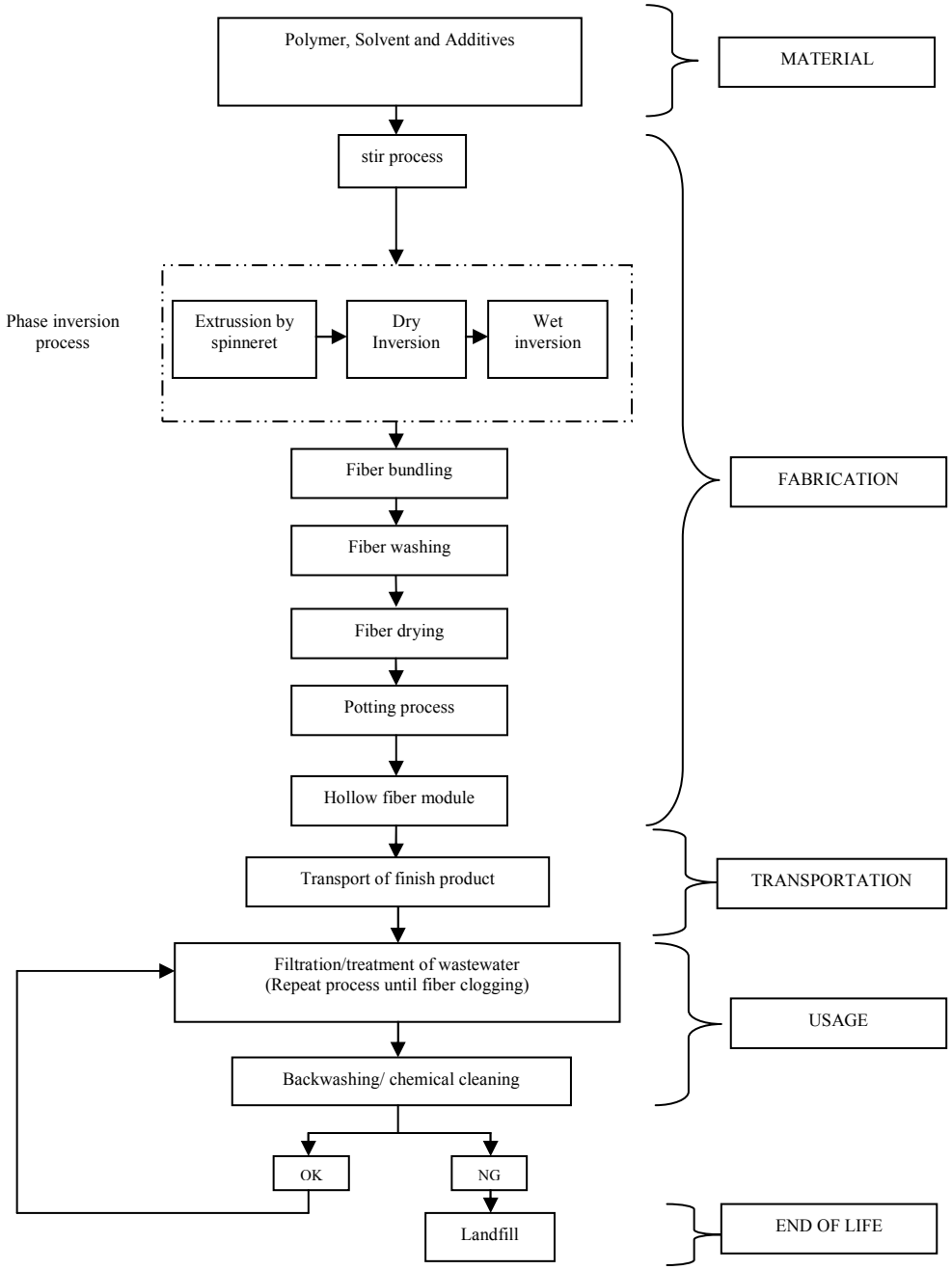

Figure 1: Process Flow Diagram for Overall Life Cycle Phase of Hollow Fiber Membrane

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