UNIVERSITI TEKNOLOGI MARA

TENSILE PROPERTIES OF BOTTOM ASH FILLED POLYPROPYLENE COMPOSITES

NURFAZLYA BINTI ROZLAN

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ABSTRACT

Coal Bottom Ash (CBA) are commonly recycled for usage in the construction industry. The main purpose of this research work is to study an alternative application for CBA by using CBA as a filler in Polypropylene (PP) forming CBA-PP composite and testing its tensile properties. This research also aims to identify optimum temperatures at each zone in an injection molding machine (IMM). This IMM used to produce those composites (or known as plastic molding). The composite of CBA-PP undergo the tensile test with increasing content of CBA of 0% (PP100), 5% (CBA5PP) and 10% (CBA10PP) by using Universal Testing Machine (UTM). At least, 5 standard plastic molding for each composites number produced as to get the average results of tensile properties which then, the tensile analysis is based on the stress vs strain graph plotted. The optimum temperature zones set up in IMM are 200, 210, 215, 215 and 240^{o}C for zones 1, 2, 3, 4 and 5 respectively were identified. The other parameters are at fixed value including the injection pressure (60 bar), mold temperature (33^{o}C) and the cycle time is 67.35 seconds. For tensile properties, the max stress (MPa) of PP100, CBA5PP and CBA10PP composites are 315.28, 292.26 and 282.00 MPa respectively while the elongation at break (%) are 26.64, 21.67 and 20.88% for PP100, CBA5PP and CBA10PP composites respectively. The analysis of tensile properties showed that the plastic deformation decreases, fracture point of strain axis is shorter, necking region is shorter as CBA content increased. The yield stress, yield percent, max stress and elongation at break percent were decreasing as the CBA content increased. This means that the specimen with increasing CBA content will slightly decrease in the plastic deforms characteristics but still in acceptable range. The characteristic of the plastic molding with increasing CBA content in the composites can be used in plastic for packaging, stationery, loudspeakers, reusable container or textile industry. This shows that CBA can be recycled and not disposed the ashes at landfill anymore which leads to increasing pollution to surrounding also CBA can be used in plastic industry other than construction industry.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 Research Background

There are about 8 existing coal-fired power plants in Malaysia. For peninsular Malaysia, Jimah power plant (2009) by Jimah Energy Ventures Sdn Bhd located at Negeri Sembilan, two coal-fired power plants at Perak which are Manjung (2002-2003) and Manjung-4 (2015) power plants by Tenaga Nasional Berhad (TNB) Janamanjung Sdn Bhd, Sultan Abdul Aziz Shah power plant by TNB located at Selangor also known as the earliest coal-fired power plant in Malaysia operated 1988-2000 and Tanjung Bin 1-3 (2006-2007) and Tanjung Bin-4 (2016) power plants by Malakoff Bhd located at Johor. In Sarawak, there are also two coal-fired power plants which are Mukah power plant by Mukah Power Generation Sdn Bhd operated in 2009 and Sejingkat power plant (1997-2004) by Sejingkat Power Corp (Industcards, 2016). Coal is a source used by thermal power plant to generate electricity.

Mostly, generation of electricity at thermal power plant will produce solid waste (referred to as coal ash) as their by-product from the production because the process involves the combustion of bituminous coal as fuel. The solid waste (by-product) from the electricity production consists of coal fly ash (CFA), coal bottom ash (CBA), boiler slag and fuel gas desulfurization (FGD). Usually, CFA and CBA produced are 10% from the coal burned and the general production ratio of them is 80:20 respectively for years (Rafieizonooz et al., 2016). The type of furnace when pulverized the coal combustion will result to the type of by-product (i.e CFA, dry-CBA and wet-CBA). Consuming the large quantities of coal ashes are the result from the large utilization of coal from the large power plant.