

CHAPTER I

INTRODUCTION

Poly (methyl methacrylate); PMMA, is an important unmodified acrylic materials manufactured in a variety of types such as a clear, colored, translucent, and semi-opaque sheet. These translate into a number of products such as a plastic glass, automotive parts, toys, etc. In order to improve the apposite properties of products for kinds of users, additives are available. The additives are also used to reduce costs and make the processes easier.

PMMA is produced through free-radical polymerization that is carried out in bulk, emulsion, suspension, and solution polymerization using a peroxide or azo initiator. PMMA sheet can be produced in three main processes. Cell casting or batch process is the extensive process for PMMA sheet production due to its simplify and flexibility. Generally, a batch, sheet-casting process can be divided into three steps: 1) pre-polymerization; 2) polymerization; and 3) annealing steps.

In the pre-polymerization step, methyl methacrylate (MMA) which consists of 10 ppm of inhibitor, and 2,2'-azobisisobutyronitrile (AIBN) are used as monomer and initiator, respectively, and are mixed in a reactor. Heat is also necessary to process to initiate and accelerate reaction. The product is called syrup, oligomeric polymer in liquid form. In order to use the suitable initiator at temperature of polymerization, 2,2'-Azobis-(2,4-dimethyl valeronitrile) (ADVN) is added to the syrup and mixed. Actually, the additives, such as color, UV stabilizer, lubricant, etc., are mixed in this step. After filtration and vacuum to eliminate contamination and bubbles, syrup is poured between two-glass molds sealed by a poly (vinyl chloride) (PVC) gasket. In the polymerization step, the filled glass mold is then transferred to a heat source where the syrup continues to polymerize. Once the polymerization reaction continues to a point where the average molecular weights are high enough such that the glass transition temperature T_g of molecules is greater than the reaction temperature, the rate of chain propagation reduces appreciably. In order to achieve high monomer conversion, the temperature of the product is raised to a temperature, which is greater than T_g of PMMA (i.e., annealing step). The PMMA sheet product is inspected for the appearance, the thickness, and cut the PVC gasket before

delivery. Although this process is commercially used to produce the PMMA sheets, the study of optimum conditions, reaction times, and developed processes extremely needs to enhance productivity.

Nowadays, because the economic world is on decline the Pan Asia Industrial Co., Ltd., one of the PMMA sheet manufacturers in Thailand, needs to develop process of making PMMA casting sheet to increase competitive world market by reducing overall production time while maintaining the good quality of the products. Two strategies, among others, were planned out. First, it was to establish a detailed study of its current PMMA sheet-casting process and it was to explore alternative processes to be used in the future.

Due to various types of the PMMA sheet, which depend on the applications, the effects of the thickness and the additives (pigments) are the attractive factors that should be studied for inspecting the optimum condition and reaction to reduce the time of production and also to improve the mechanical properties.