Adaptive Control in the Plastic Injection Molding : A new paradigm in Manufactures Process Green Technologies

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ABSTRACT

Progress in the manufacturing industry is growing very rapidly. But it had an impact on environmental pollution. One of them is contamination caused by plastic. Plastic contamination is the most severe pollution because plastic elements can not be broken down by decomposer bacteria. This paper discusses the need for an action to minimize pollution caused by plastics. The principle is to use as much as possible recycled plastic to be re-processed into useful plastic products and minimize plastic waste products. With increasingly sophisticated technology in the field of control, adaptive control is a real-time control method for monitoring plastic raw materials to be processed and can instantaneously adjust to the plastic mold control panel that minimizes product defects. Therefore, the use of adaptive controls in the plastic molding process can minimize waste from plastics that are part of the green technology.

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1. INTRODUCTION

From research [1] on the Environmental Quality Index (IKLH) shows that for the last 5 years nationally the index of environmental quality shows a declining trend. When further investigated the pollution of rivers and soil that occurred one of the causes of industrial waste from the factory. The waste is in the form of waste of processed water from factories that have not been properly managed or in the form of many industrial products whose waste is difficult to decompose in the soil such as plastics. The increasing number of factories that dispose of waste in the river causes the level of pollution of the river water is increasingly alarming.

According to research results [2], in addition to causing physical contamination, certain plastic materials also cause chemical contamination. Physically, plastic waste can clog waterways, pollute the environment, cause siltation of the river and disrupt the soil structure. Plastic waste collected in the soil will form a watertight layer, thus disrupting the entry of water into the soil. Disruption of water entry into the soil can lead to flooding in the rainy season. Meanwhile, if the layers of palstik garbage under the land overgrown with plants will cause the plant is difficult to get water so that its growth is disrupted. Chemical contamination of plastic will occur when there is burning of plastic waste. Plastic materials containing chlorine, such as polyvinylchloride (PVC), when burned, emit spicy fumes containing harmful organochlorine ingredients, such as hydrogen chloride (HCl) and dioxin. HCl gas when exposed to the lungs with water grains in the air will produce highly corrosive liquid hydrochloric acid. HCl can also react with mixed-in mixed materials in PVC that break down when burned. Excessive consumption of plastic, also resulted in a large amount of plastic waste. Because it is not derived from biological compounds, plastics have a hard nature degraded (nonbiodegradable). Plastic is estimated to take 100 to 500 years to be able to decompose (decomposed) perfectly. Plastic bag waste can contaminate the soil, water, sea, even air. From these conditions the government began to promote various rules and policies that are environmentally friendly.

2. RESEARCH METHOD

This study uses a combination of real experiments and simulations. The real experiment is used as a stage to find the input values for use in the next stage of the simulation phase of the application of adaptive control. From previous research on the plastic molding process as well as research on adaptive control [3], [4], [5], [6] and [7], it can be made the following research stages:

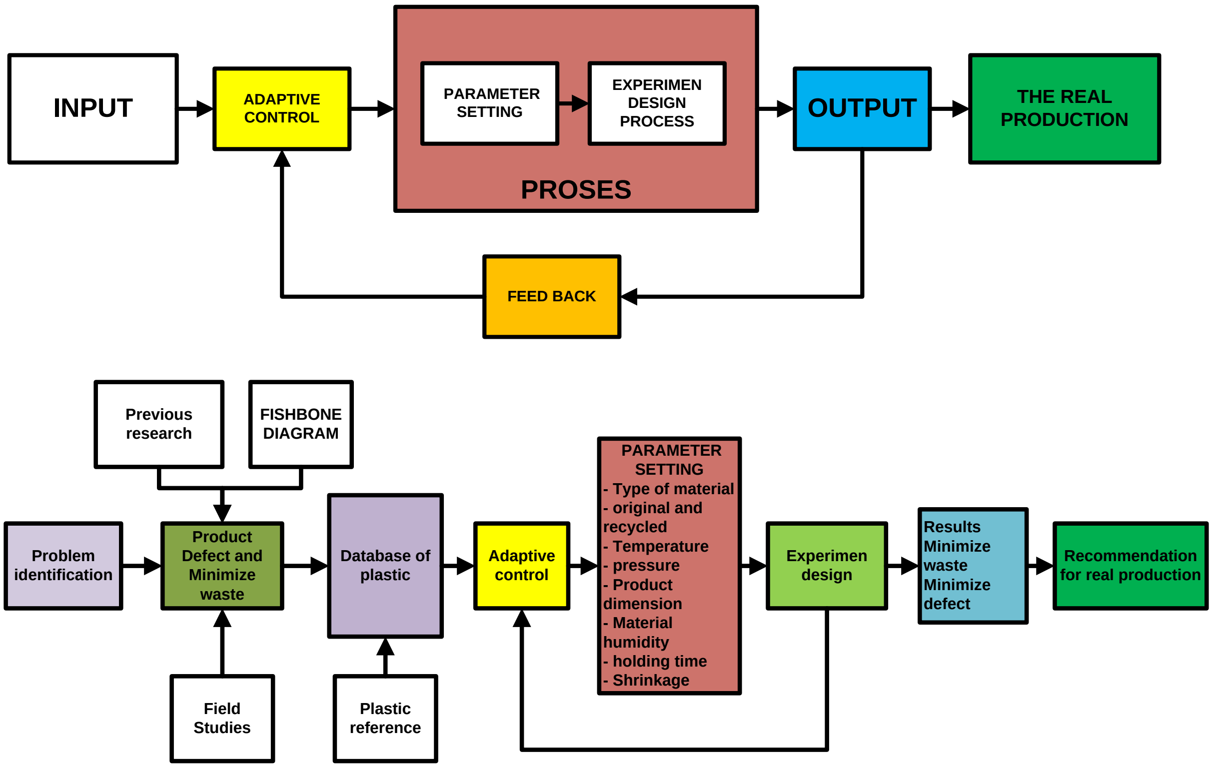

Figure 1. Concept framework and metodology resdearch

3. RESULTS AND ANALYSIS

The plastic experimental experiments that have been done have 2 stages. Phase 1 is conducting experiments about testing the strength of the composite mixture's attractiveness between original and recycled plastic prints with certain composition variations. While stage 2 is to conduct an experiment to find the best combination of injection temperature, injection pressure, injection speed, clamping force and retaining time that can minimize defects and plastic waste.

3.1. Sub section 1

To improve the quality of plastic products and utilize plastic waste can be obtained by combining recycled plastic and pure plastic ore of the same type, pressure and temperature accordingly. With the Taguchi Experimental Design, the best composition for mixed materials to obtain the best quality is composed of 70% pure plastic ore and 30% recycled plastic from the volume of the product. With the use of recycled plastics it can do the cost efficiency of plastic material raw materials because recycled plastic is easy to obtain and the price is very cheap.

In addition to the plastic molding process, proper pressure and temperature determination can also improve the quality of plastics and minimize defects. From the result of Tensile Test, the combination of 30% recycled material treatment, 180^{o}C temperature and 6.5 atm pressure resulted in average tensile strength of S / N (larger is better) ratio of 59, 93.

3.2. Sub section 2

To improve the quality of plastic products and at the same time can minimize waste plastic in the plastic molding process can be used Taguchi method by performing controlled factor level optimization at both injection pressure, injection speed, clamping force, retention time and injection temperature. The optimal combination of controlled factors lies in injection pressure of 66 atm, 99 m / s of incubation rate, 75 m / s2 clamping force, 5 s retaining time and 255 C injection temperature.

This research can still be continued and developed again to obtain a more in-depth study such as by increasing the combination of controlled factors such as material variation, pressure and temperature and studying the stress and strain aspects of the plastic tensile test.

4. CONCLUSION

This research has succeeded in making a breakthrough on how a green technology is applied to the plastic processing manufacturing industry. By integrating various plastic experimental results that have been done with adaptive control technology then we can produce the best findings on how to get products that minimize defects and plastic waste simultaneously at one time.s.

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