BULLETIN: QUALITY CONTROLS IN THE PLASTIC INDUSTRY

1 INTRODUCTION

In recent years, the question has arisen: why apply quality controls in the plastics industry? One of the key factors in the search for high levels of competitiveness is quality. This is the answer to the question posed.

For a company to achieve this advantage, it is necessary for them to carry out different interrelated activities. This is how the concept of continuous improvement is generated, which makes different changes or modifications in the production processes and/or parameters, thus improving its operational performance.

1.1 Quality.

The word quality has multiple meanings. Basically, it refers to the set of properties inherent to an object that give it the ability to satisfy implicit or explicit needs. On the other hand, the quality of a product or service is the perception that the client has of it, it is a mental fixation of the consumer that assumes conformity with said product or service and its ability to satisfy their needs. Therefore, it must be defined in the context that is being considered, for example, the quality of the postal service, the dental service, the product, life, among others..

1.2 Product.

From the Latin productus, it is known as a product that which has been manufactured (that is, produced). This definition of the term is quite broad and allows very diverse objects to be included within the generic concept of product.

In this way and focused on the plastics industry, it can be said that a product is any article obtained through the transformation of a polymeric resin, namely: film, sheet, pipe, tank, bottle, among many others.

1.3 Transformation proccess.

An industrial process or manufacturing process is the set of unitary operations necessary to modify the characteristics of raw materials. These characteristics can be of a very varied nature, such as shape, density, resistance, size or aesthetics..

1.4 Parameters.

In relation to transformation processes, it can be said that a parameter is all that data (process variable and/or specification) involved in the production process that can be listed, measured or determined, depending on the process. Likewise, these allow better control of operations during the production process and, therefore, obtain a better quality product. Some examples of parameters are: pressure, temperature, humidity, among others.

1.5 Good manufacturing practices.

These are the aspects of quality assurance that ensure that materials and articles are produced and controlled in a consistent manner, to ensure that they conform to applicable regulations and quality standards suitable for their intended use..

1.6 Quality Control.

"The term quality control refers to a system within a manufacturing plant or organization, by means of which it is sought that the manufactured products conform to the specific parameters that define the quality of the product or service". (Norbert Lloyd, 1989).

1.7 System of quality assurance.

It is the sum total of the provisions organized and documented to ensure that materials and objects have the quality required by their conformity with applicable regulations and quality standards for their intended use.

2 PRODUCTION PROCESSES IN THE PLASTIC INDUSTRY.

The industrial process involves a set of operations designed to obtain, transform or transport one or more raw materials to obtain primary products. In this way, the purpose of an industrial process is based on the effective use of resources, in such a way that they become materials, tools, substances and/or products capable of more easily satisfying the needs of customers and consequently, improve your quality of life.

In industry, in general, as well as in plastic resin transformation processes, in particular, quality control is paramount to ensure that parts meet the desired standards. For this, it is essential to start with the proper control of the raw materials used in the production of finished products. The conditions of the transformation equipment involved and the operating variables are also likely to be controlled, in order to guarantee the best results. And, finally, the suitability of the finished product must be verified, for the purposes for which it is produced.

The quality chain, consequently, involves all the links of production.

2.1 Raw material

In the production of polymeric resins, the properties of the raw materials, reflected in their quality and/or technical sheets (specifications), represent information of great importance to the transformer. They are relevant in determining the control parameters of the transformation process with which they will be processed and even in the specifications that the finished products will have.

For polymeric resins, their specifications contemplate properties of various types:

- Thermal: Melting/glass transition temperature, thermal conductivity.
- Rheological: Melt Index, Viscosity, creep, crosslinking, curing.
- Mechanical: Resistance to impact, penetration, tearing, elongation, bending.
- Organoleptic: Color, smell.

For their part, manufacturers must establish the procedures for receiving the raw material, which may include the measurement and verification of some of the properties reflected in their specifications.

- ✓ For bulk resins, the usual control points are density and melt flow rate.
- ✓ In the case of inks or adhesives, the application parameters, curing times, drying.
- ✓ In the case of semi-finished products, those critical control parameters for subsequent manufacturing and/or handling must be required.

The packaging of the raw material is also of special importance; Suppliers must pack the product in such a way as to minimize possible external contamination. The transformer can implement the inspection at the reception, as part of its quality control protocol, keeping records in which the deviations presented from said inspection are documented. The supplier, for his part, must indicate the ideal storage conditions for the product (temperature, humidity and maximum storage times).

In cases where the raw material is used in processes with strict biosafety controls (food industry or medical supplies), the raw material supplier must:

- Provide the declaration of conformity or suitability of the resins for this purpose.

This information may be contained in the product technical sheet.

- Communicate to the client any variation in the composition that you can see affected compliance with current legislation.
- Update the declaration of conformity at the moment new data appears, new legislation or the current ones are modified, as long as these affect the raw material that it supplies.

2.2 Transformation Processes

The response of a plastic product to various conditions and combinations of load, temperature and cycle of use depends, to a large extent, on the material with which it was manufactured. The properties of effort, resistance to tension, viscosity at a certain temperature or resistance to melting, are fundamental in the final quality of the plastic.

The foregoing is based on the selection of the appropriate resin and the appropriate process to obtain the desired product. In addition, a complete knowledge of the process is essential, hand in hand with the skills required to handle the equipment. The most common transformation processes in the plastic industry are briefly described below.

2.2.1 Extrusion

Mechanical process, in which the polymeric material is fed by means of a hopper at one end of the machine and due to the pushing action it melts, flows and mixes in the barrel, obtaining the molten polymer (or in a visco-elastic state). at the other end. This is forced to pass through a die, called a head, by means of the thrust generated by the action of a spindle (Archimedean screw) that rotates concentrically in a chamber at controlled temperatures.

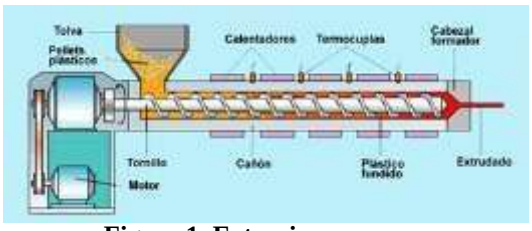

Figure 1. Extrusion process.

2.2.2 Injection

This technique represents a relatively simple way of manufacturing components with highly complex geometric shapes. This requires an injection machine that includes a mold. In the latter, a cavity is made whose shape and size are identical to those of the part to be obtained. The cavity is filled with molten plastic, which solidifies, maintaining the molded shape.

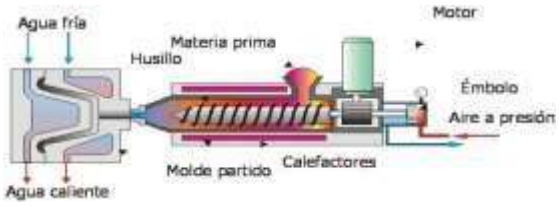

Figure 2. Injection process.

2.2.3 Blown

Process used mainly to manufacture hollow plastic parts thanks to the expansion of the material. This is achieved by means of the pressure exerted by the air on the walls of the preform, in the case of injection-blow molding, or by the parison, in the case of extrusion-blow molding.

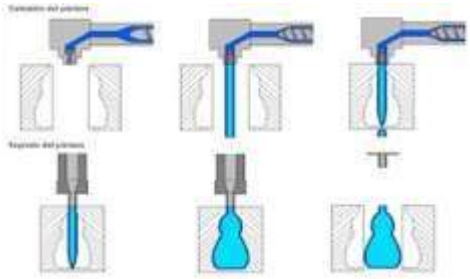

Figure 3. Blowing Process.

2.2.4 Rotational Molding

Also known as rotational molding or rotocasting, it is a process used for the manufacture of hollow plastic products, in which a polymer in liquid or powder state is introduced into a mold and this, by rotating on two mutually perpendicular axes, adhere to the surface of the mold. Although it competes with blow molding, thermoforming, and injection molding for the manufacture of hollow products, rotational molding has particular advantages in terms of relatively low levels of residual stress and low-cost molds. It is used in the manufacture of tanks, but can also be used to make complex medical products, toys, recreational boats, and highly aesthetic products.

Figure 4. Rotational molding process.

For these and all plastic transformation processes, in general, it is necessary to establish a technical sheet with the control parameters used in the production of the various products.

The creation of the production technical sheets, as well as that of the operating procedures, guarantee their compliance, support the work of the equipment operators, and leave evidence of the results obtained. In addition, the records of non-conforming product form the basis for the improvements that the processor must implement.

2.3 Finished product.

In the quality control of finished products, there tend to be differences between the processing companies in terms of the way of inspection and sampling of the final product.

Some of the factors to control in the final product, according to the type, are:

- Physical specifications: size, weight, dimensions (width, length), volume, thickness.
- Mechanical specifications: tensile strength, deformation, penetration, tightness.
- Optical specifications: brightness, color, transparency, light transmission.
- Thermal specifications: maximum temperatures of use, conductivity, resistance to UV radiation.

Regarding the control tests associated with the type of product, each case must be taken into account. In plastic films, especially those destined for food packaging, permeability tests constitute a key performance property of the product. In containers, its resistance to free fall impact is critical. Another important aspect to evaluate in containers intended to contain food is its chemical resistance, in such a way that it allows predicting if it is possible that the content of the container causes the migration of certain components of the container, becoming contaminated with them. For this purpose, extraction tests with different solvents are carried out. In pipes, the resistance to hydrostatic pressure must be evaluated.

In short, plastic products must pass tests that certify their quality and ensure that they are suitable for proper performance. To do this, companies must have a sampling plan for inspection and quality control tests of their products in their different forms and applications. The record of the results obtained, the description of the inspection method (and the associated standard), as well as a code that allows its traceability from the raw material used, the manufacturing process, storage and dispatch, complete the control cycle of quality that every company should have

.

3 SUMMARY

The finished products in the plastics industry are the achievement of a number of operational, conceptual, design variables, as well as the appropriate raw materials.

These variables or specifications are what give it the respective characteristics as a compliant product, maintaining quality controls on raw materials and transformation processes.

A quality control and assurance system must be essentially preventive and cover all stages of processing, obtaining raw materials and supplies, and distribution of finished products. To do this, you must have:

- ✓ Specifications of raw materials and finished products, which define the quality of all the products involved in the production of the product. They must include clear criteria for their acceptance and release or retention and rejection.

- ✓ Documentation on plant, equipment and process. Instruction manuals, guides and regulations must be available where the essential details of equipment, processes and procedures required to manufacture products are described. These documents must cover all factors that may affect the quality.

- ✓ Officially recognized or standardized sampling plans, laboratory procedures, specifications and test methods in order to guarantee or ensure that the results are reliable.

4 CONCLUSIONS.

Quality control and assurance in the plastics industry is not limited to laboratory operations, but must be present in all decisions related to product quality.

The Quality Control of a process does not only mean correcting or reducing defects; It must prevent these from happening, which requires the establishment of a quality philosophy, creating a new culture, maintaining leadership, developing staff and working as a team, developing suppliers, having a customer focus and quality planning.

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If you wish to make any comments or suggestions, please write to us at the email address: info@polinter.com.ve, which can be accessed through our website www.polinter.com.ve or through our commercial agent: Corporación Americana of Resins, CORAMER, CA (http://www.coramer.com).

The information described in this document is, to the best of our knowledge, accurate and truthful. However, due to the fact that the particular and variable uses of the transformation processes are entirely beyond our control, the adjustment of the parameters that allow us to achieve the maximum performance of our products for a specific application, is the power and responsibility of the user and we trust in which the information contained therein is of your maximum benefit and usefulness.

To obtain more detailed information on the safety aspects related to the handling and disposal of our products, we invite you to consult the safety data sheets (MSDS) of Polyethylenes Venelene®.