



Sustainable practices applied in heat treatment processes: literature review and case study

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Abstract

The study is based on a literature review of sustainable practices applied in heat treatment processes, followed by a case study in a company of the area, verifying the applicability and recurrence of these methods.

Key words:

Heat treatment, sustainability, energy efficiency

Introduction

The manufacturing process transforms the basic product, adding economic value and generating prosperity to the sector, but this cycle often does not apply to the social, economic and environmental dimensions of sustainability. In view of this, a cleaner production approach employed in various processes and segments within an industry in order to increase efficiency in the use of raw materials, water and energy is remarkably increasing. In the scenario, the heat treatment process demands a large amount of energy, besides subjecting the operator to various health and safety risks, such as the inhalation of toxic gases and fire. This project aims to identify in the academic literature the main sustainable practices of the manufacturing process and to study its applications in a company belonging to the area. This work is part of a master's project on sustainability in manufacturing processes coordinated by professor Robert Cooper Ordoñez, Roraima Academic.

Results and Discussion

Initially, a literature review research was carried out in order to obtain the main sustainable practices applied in the heat treatment process. The practices identified were: 1 - Mapping of the energy consumption; 2 - Simple measures aiming at less energy consumption; 3 - Automatic opening of the oven doors; 4 - Recovery of the refractory; 5 - Heat recovery; 6 - Temperature simulation tools; 7 - Laser-assisted heat treatment; 8 - Control of the composition of the oven atmosphere; 9 - Distribution of the oil as a separating medium; 10 - Grease and more ecological oil; 11 - Action to prevent fire and against exposure to toxic gases. Subsequently, a questionnaire was developed with the purpose of gathering information about the recurrence and applicability of these practices in a company in the area. The questionnaire was submitted and approved by the Unicamp Research Ethics Committee. The number CAAD 0003018-8/2020 was obtained. From the answers obtained, an analysis could be made comparing what was researched with what is practiced. In relation to practice 1, the company reported that energy mapping is carried out throughout its plant, allowing greater control of consumption, and it was recorded that approximately 80% of its energy consumption is directed to the heat treatment process. In view of this, some actions within practice 2 adopted by the company are: periodic furnace maintenance; optimization of the assembly of the loads placed in the furnaces; opening the oven doors automatically together with an individual time counter for each product; and preventive maintenance of furnaces

every 8 months using thermocouples to the diagnosis of the refractory lining. The company mentioned that there are devices capable of measuring practice 3, but they are difficult to operate and they have a high implementation cost. According to the company, it is only used to check the deformations of the parts subject to the process, thus avoiding waste. Practice 4 is not used in the company. After practice 5, greater control is achieved at greater control of the process, allowing properties of the product and a better quality. The replacement of the quenching oil (practice 6) is shown to be of great interest to the company, avoiding several tempering tests performed in the furnace, reducing one of the greatest fire risks of the process, besides the unhealthy smoke generated by the oil. The company mentioned that preventive and fire-type measures are taken but did not detail them in question. The company was very concerned about the health and well-being of the worker, with medical visits at the operations stations and daily tests of concentration of toxic gases in the factory. Finally, an analysis can be made of the practices cited and the objectives of the UN Agenda 2030, noting that some of these goals are achieved, more specifically those set out below.



Image 1. UN Sustainable Development Goals - Agenda 2030.

Conclusions

The research method used allowed to identify the main sustainable practices applied in the heat treatment process and how they are inserted in a company of the area, creating material that allows the growth of sustainability.

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