Promoting Circular Economy around Plastic Waste: A New Design of Recycled Plastic Shredder

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Abstract. The development and construction of the plastic shredder presented here is part of the MAREA Plastic project, which aims to be a meeting point between the university community and society, through science and technology. The project's main goal consists in developing a circular economy environment that reduces both, the input of raw materials and the output of waste, closing the ecological and economic flows of resources. Thereby, this machine becomes essential for the continuation and proper development of such a research and social awareness project.

The new version of the plastic shredder entails a solid design that meets the needs and requirements of the task assigned in its working environment, focusing on its design and manufacture from a sustainable point of view, reusing parts of the prototype itself, as well as other disused resources, mostly provided by the University of Malaga. This concept of sustainability even extends to its operation, controlling the consumption of the engine and paying special attention to durability, reliability and, above all, the safety of both, users and the shredder itself.

Among other design priorities, the possibility to visualise and perfectly understand how and why the reused plastic passes through the shredder is one of the most important due to the educational purpose of the project towards a younger audience about circular economy. To achieve this, the machine should not only be able to show the process in an illustrative way, but also the interaction with the machine should be simple and fluid, without the need for previous knowledge or experience operating industrial machinery.

Keywords: plastic shredder, sustainability, circular economy, reduce, recycle

The final design and manufacture of the recycled plastic shredder resembles as follows (see Fig.7):

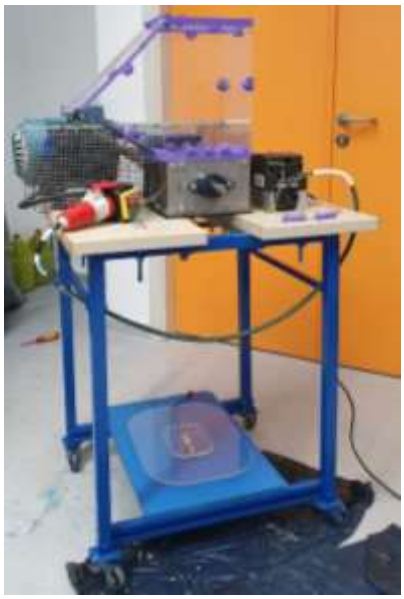

Fig. 7. Shredder final result

8 Conclusions

Regarding the methodology followed for the development of the project, the FMEA methodology played a key role to propose improvements and innovations with respect to the prototype. On the other hand, the DFMA methodology made a considerable contribution when it came to bringing the machine to life (physically), as well as for its assembly and the replacement of the different components. It should be added that in a project as collaborative as MAREA Plastic, where several machines must work together, the correct transmission of information is very important, as is the case with CI.

The reinforcement of the structure and the use of absorbent materials such as rubber, resulted very effective in preventing vibrations, shocks, noise and buckling of the elements that make the prototype up. This undoubtedly has a positive effect on the life of elements such as the gearbox and the engine, especially the latter as it is the oldest device in the whole assembly.

The safety of the structural elements has been increased far beyond than the initial prototype. Although the hopper already was an important component, its redesign has increased the stability of the whole. When the screening and the protective mesh

are added to the lower part of the blades box, , it is observed that the moving parts at the top covering of the hopper or those that reach a certain temperature become secured and protected. In addition, the protective mesh, although rigid, allows to see through to reach the elements secured inside and how they operate. All this generates a greater guarantee of protection and transparency for the user and the public in general.

Both connections performed, the modular redesign and the elastic standardised one, were fully effective: the former, due to its modular concept that allows for easy maintenance of the shredder, and the latter, besides transmitting sufficient impulse to tear the plastic, it is capable of absorbing the deviations caused by assembly and disassembly, or the lack of suitable tools for the task.

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