ANALYSIS OF THE POTENTIAL FOR INTEGRATION OF LOW TEMPERATURE SOLAR THERMAL ENERGY SYSTEMS IN POLYMER PROCESSING CHAINS

Viatcheslav Kafarov[1], Víctor Alexis Lizcano-González[1], Nelcy Daniela Socha-Rojas[1], Khamid Mahkamov[2]

[1]Universidad Industrial de Santander, Colombia, [2]Northumbria University, United Kingdom

Polymer processing requires large amounts of energy, usually in the form of electricity for heat generation. Reducing this primary energy demand has been shown to be the best strategy for mitigating the industry's impact on global energy needs [1]. One alternative to achieve such a reduction is the incorporation of solar thermal technologies at different stages of plastics processing [2]. Currently, almost all low- and medium-temperature solar thermal collectors can reach temperatures above the melting points of most industrial polymers. For this reason, the present work explores the possibility of partially replacing thermal energy consumption in a plant producing flexible pipe for crop irrigation from recycled polyethylene in Bucaramanga, Colombia. TRNSYS software was used to simulate the performance of a solar thermal energy system (STES) integrated in the drying stage of the material and as preheating prior to extrusion. The energy demand was estimated using both secondary and primary data obtained in a production plant. The solar thermal irradiance data set was obtained from the analysis of the information reported in different databases for the area under study. The technical parameters of the STES were obtained from secondary data, complemented with the performance analysis of a solar heating system implemented in previous research. The use of concentrating and non-concentrating solar thermal collectors was evaluated, while for the final use of heat, it was proposed the utilization of continuous furnaces in order to avoid the energy cost of heating air, as has been reported in the literature [3]. Preliminary results show that it is possible to replace between 5% and 10% of the thermal energy demands for the company's current production volume, the main constraint being the high-power levels required. Although the use of concentrating collectors allows easily reaching higher temperatures than non-concentrating ones, both allow working above the melting temperature of polyethylene, so that economic and logistic factors should be considered when making decisions. Likewise, the results allow us to conclude that by increasing the scale of application of the technology and the thermal energy production capacity, it would be possible to consider the design of facilities that operate with almost all their heat demand supplied from solar thermal energy. Authors would like to thank The Royal Society for supporting this research through the Enabling Harvesting of Solar Energy for Remote Applications in the Andes Region (LA-SOLAR ENHANCE- ICA\R1\191201) project.

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