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SIMULATION OF THE OPERATION OF A INFRARED GAS HEATERS FOR THE FINISHING OF LEATHERS

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Abstract. We present the study of a gas infrared operating dryer for leather finishing, using infrared thermography and simulation using finite element method, these studies and simulations are aimed at redesigning the infrared dryer to improve industrial efficiency. We hope to improve the simulation model for evaluating others radiation shield materials and wind knife for drying.

1 INTRODUCTION

Today, the strong global competition among companies has forced them to seek more efficient production processes, in order to gain advantages over their competitors. In this sense, the leather industry is no exception, especially in the problem of drying the leather finishing (J.Sanchez etc al., *JALCA 101,* 105-111,(2006); J.Sanchez etc al.,*JSLTC,* 92(4):162-166,(2008)). The digital infrared thermography is a technique that enables accurate temperature measurement at a distance and without the need for physical contact with the surface to observe (W. Minkina etc al., Jhon Wiley & Sons: United Kingdom, (2009)). This is achieved by capturing the infrared radiation of the electromagnetic spectrum, using thermo-vision cameras, which can convert the energy radiated in a temperature data. Infrared thermography was used to detect heat leaks and improve efficiency of the dryer prototype (see Figure 1).

Figure 1: IR dryer prototype

It is important to note that the interpretation of infrared thermography is fundamental in the redesign of the infrared dryer.

The objective of this paper, is to simulate the operation of a gas dryer for leather finishing using digital infrared thermography and finite element method, with the purpose to redesign and improve the efficiency of the dryer.

2 METHODOLOGY

In Figure 2 we show the techniques used in this investigation. Materials and equipment used were white crust leather, paint yellow and black color finish, a camera Ti45FT (FLUKE) with computer program (SmartView V2.1) for the analysis and interpretation of images and a roller machine for applying finish.

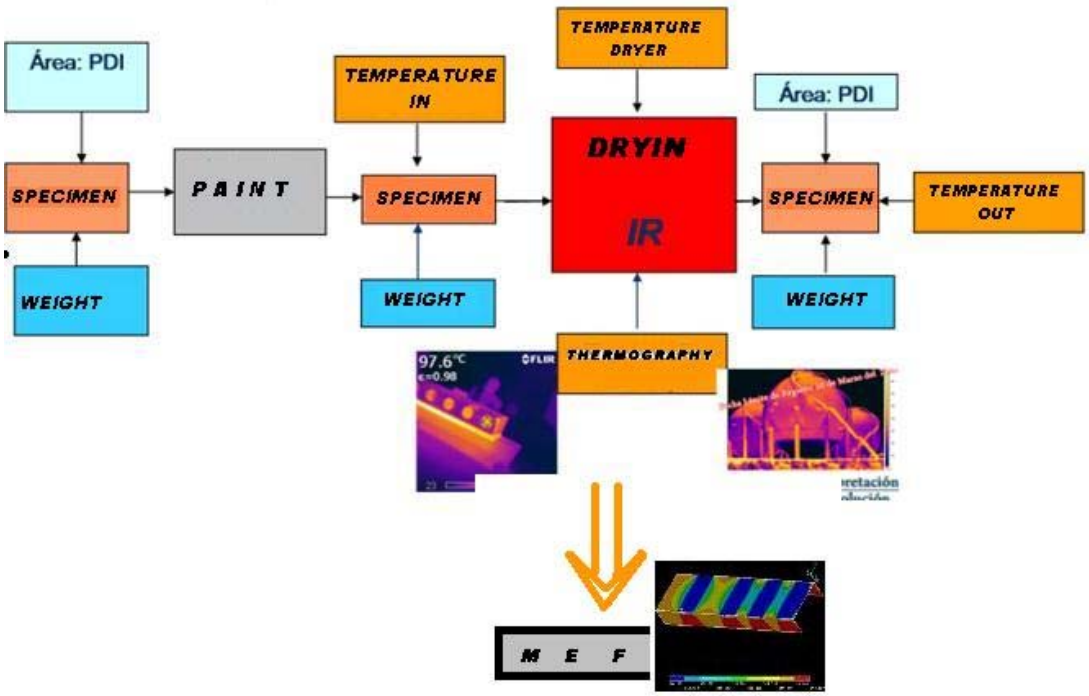

Figure 2: Methodology

3 RESULTS AND DISCUSSION

Figure 3 and 4 show the Left view IR dryer and the Interior view of the same respectively. The right side in each figure corresponds to the thermal image. Note that while the tone is closest to white higher the temperature.

Furthermore, in Figure 2 (right) we show a temperature difference of at least 39 ° C, the gradient must be reduced to improve energy efficiency.

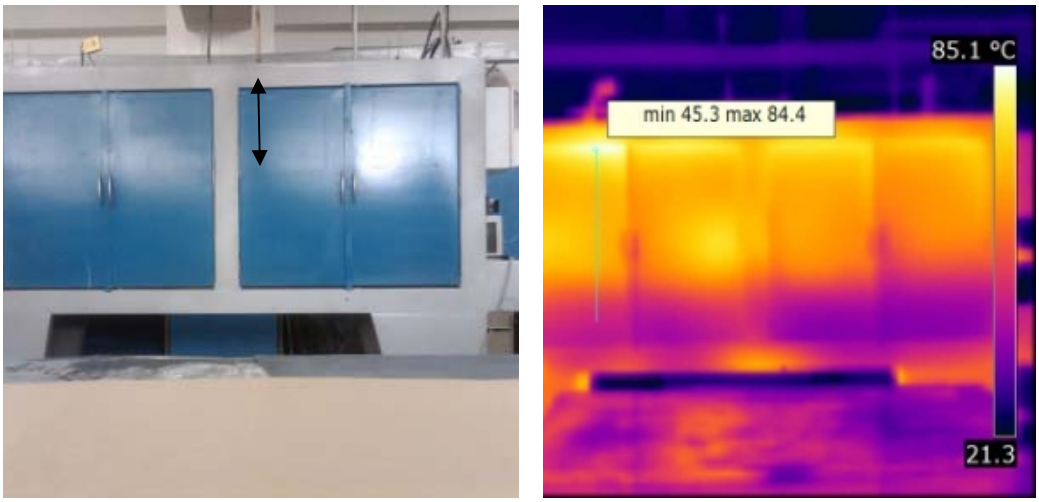

Figure 3: Left view the dryer IR

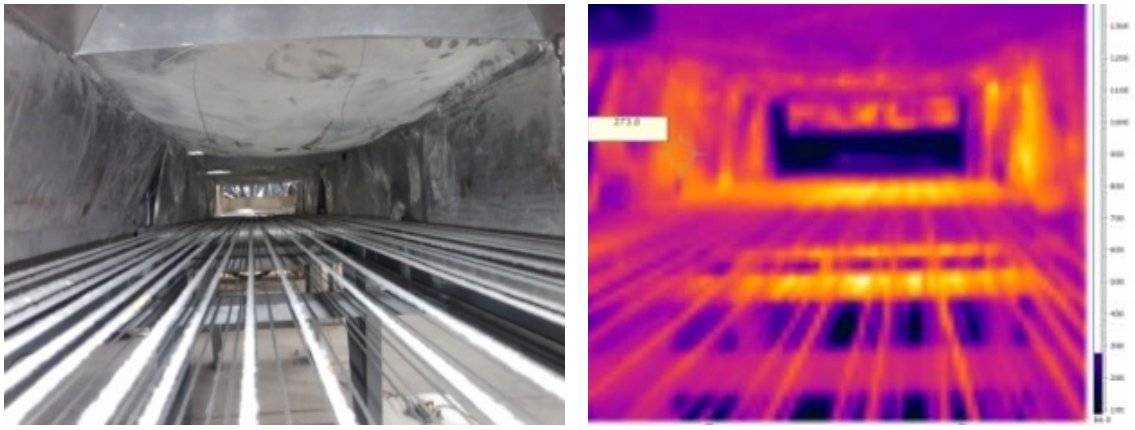

Figure 4: Interior view the dryer IR

The information obtained with the thermographic study, the geometry, as well as the physical and mechanical properties of the dryer, are the elements used for finite element method simulation of the operation of the dryer Figure 5, shows first results about this simulation.

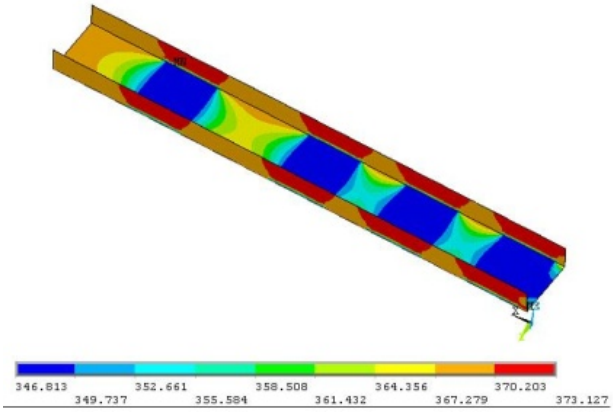

Figure 5: Simulate the operation of a gas dryer using finite element method.

4 CONCLUSIONS

After redesigning the dryer to improve energy efficiency using radiation shields with specific geometries. Table 1 summarizes the results of this research. That is, we conclude that the proposed prototype is halved and LP gas consumption is 25% less than convection dryers that are currently used in the tanning industry.

Therefore it is clear that the use of this technology will lead competitive advantages to companies that decide to adopt it.

	Convection	Infrared
Length (m)	12	4
Time (s) for drying 6 $\mathbf{gr/ft^2}$	33	27
Gas consumption (Kg/hr)	8	6

Table 1: Comparison of dryers.

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