

Impact of Humidity on Efficiency of Triboelectric Separator for Mixture of Plastic Particles

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Abstract—A device for electrostatic separation of triboelectrically charged plastic particles is experimentally verified. A mixture consisting of high-density polyethylene and polymethyl methacrylate is used for the experiment. The goal of the experiment is to find out the efficiency of the separation depending on the temperature and humidity of the air in the charger, because the high humidity deteriorates the efficiency of the device.

I. INTRODUCTION

Nowadays, an intensive research is aimed at the possibilities of recycling plastic materials [1]. The necessary prerequisite of this reprocessing is a high-quality separation of particular kinds of plastic materials ground into small particles.

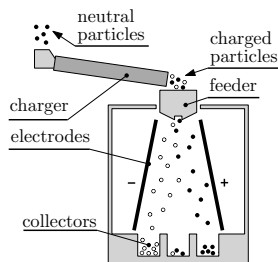


Fig. 1. Basic arrangement of free-fall triboelectric separator

II. FORMULATION OF PROBLEM

The structural parts are made of non-conductive materials. Each aluminum electrode is divided to three segments and they are connected to 20 kV. The charger consists of a high-speed induction drive with frequency converter and polypropylene pipe which is connected with the drive by a plastic belt. The charger is dried by hot air fan.

The experiment was performed for 100 g of mixture consisting of 50 g of the HDPE grains and 50 g of the PMMA grains. The particles were charged for 60 s in a pipe rotating at 100 rpm.

III. RESULTS OF EXPERIMENTS

During the drying we measured humidity and temperature inside the charger. It was used a hot air fan which had two positions. From the picture 2 shows that steady numbers,

mainly humidity, are after 60 s. The figure shows dependence of temperature T and humidity RH on the time for two different temperatures of drying.

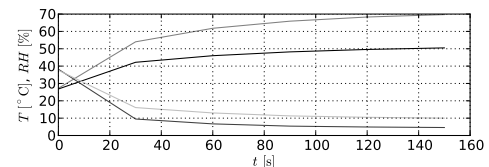


Fig. 2. Dependence of temperature T and humidity RH

TABLE I
 EFFICIENCY OF HUMIDITY RH AND TEMPERATURE T

T [°C]	PMMA		HDPE	
	RH[%]	Eff[%]	RH[%]	Eff[%]
27.5	55.4	27.9	44.6	
53.6	13.7	83.2	93.6	

IV. CONCLUSION

As you can see on the table I, the efficiency is very high when the pipe is dried. The better results are for HDPE and efficiency approaching 94 %. Further work will be aimed at the separation of materials that are used (PET, PS, PE, PP, PVC) and the shape optimisation of the electrode system.

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