KINETIC DECOMPOSITION OF AZODICARBONAMIDE IN A COMPOSITE LMDPE/PINE FIBER USING A CAPILLARY RHEOMETER

Eduardo Ruiz Silva [1], Luis Carlos Rosales Rivera [1], Jorge Ramón Robledo Ortíz [2], Denis Rodrigue[3], Rubén González Núñez [1]

1. *Departamento de Ingeniería Química, Universidad de Guadalajara, Blvd. M. G. Barragán 1451, 44430, Guadalajara, Jalisco, México. lalo.ruiz1989@gmail.com*
2. *Departamento de Madera Celulosa y Papel, Universidad de Guadalajara, Carretera a Nogales, km 15.5 AP 5293, 45020, Zapopan, Jalisco, México.*
3. *Department of Chemical Engineering, Université Laval, Quebec City, QC, G1V 0A6, Canada*

Introduction

In this work, a capillary rheometer coupled with a closed die was used to study the decomposition kinetics of azodicarbonamide (ACA) in a composite of linear medium density polyethylene (LMDPE)/Pine fiber (PF). Thermogravimetric analysis (TGA) was also used for the characterization of the PF and the foaming agent (ACA).

Experimental Part

To obtain the experimental data of pressure *(P)* as a function of time *(t)*, one bore of the rheometer was used with a 68.95 MPa pressure transducer. Closed dies were placed at the bottom and top of the chamber to make a closed system. Experiments were carried out from an initial temperature (T_i) of 140°C to a final temperature (T_f) of 205, 210, 215 and 220°C. Decomposition tests were done using 20 g of LMDPE, 0.6 g (3% w/w) of ACA and different quantities of PF (0, 5, 10 and 15% w/w). The total gas pressure generated during the decomposition of ACA, was calculated as the difference between the pressure of the neat LMDPE and the pressure generated with the different blends.

TGA was conducted to test the behavior of thermal degradation of the PF and the foaming agent.

Results and Discussions

The gas pressure generated during the decomposition of ACA for experiments at a T_f =210°C and different amounts of PF is showed in Figure 1. An increase in the final pressure is showed with increasing the amount of PF in the mixture. This phenomenon can be attributed to the release of volatile compounds present in the fibers generated during the high temperature treatment.[1] Moreover, with the addition of PF, a decrease in time and temperature at which the decomposition reaction begins is observed, as shown in Table 1. Similar results have been detected with the addition of zinc oxide, which works as a catalyst.[2]

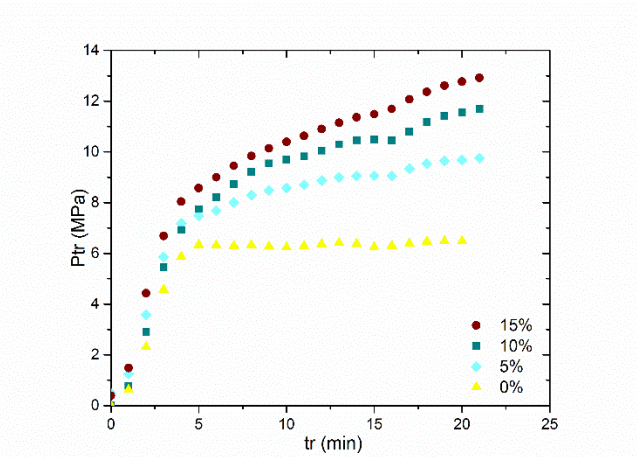

Figure 1. Pressure of the gases generated during the decomposition of ACA.

Table 1. Time and initial temperature for ACA decomposition. a) Without PF and b) with PF

$(t_0^a) = 12.6\ min$	$(T_0^a) = 205\ °C$
$(t_0^b) = 12.0\ min$	$(T_0^b) = 202\ °C$

Conclusions

The addition of PF was found to accelerate the thermal decomposition of ACA, producing a decrease in time and temperature at which the reactions begins. The use of natural fibers can help to reduce the amount of foaming agent, time and energy necessary to form foamed composites with special characteristics.

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References

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