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PII: S0143-7496(16)30199-3
DOI: http://dx.doi.org/10.1016/j.ijadhadh.2016.10.003
Reference: JAAD1907

To appear in: *International Journal of Adhesion and Adhesives*

Received date: 29 August 2015
Accepted date: 6 October 2016

Cite this article as: Byung-Dae Park, Nadir Ayrilmis, Jin Heon Kwon and Tae Hyung Han, Effect of microfibrillated cellulose addition on thermal properties of three grades of urea-formaldehyde resins, *International Journal of Adhesion and Adhesives,* http://dx.doi.org/10.1016/j.ijadhadh.2016.10.003

Effect of microfibrillated cellulose addition on thermal properties of three grades of urea-formaldehyde resins

Byung-Dae Park[1], Nadir Ayrilmis[2], Jin Heon Kwon[3*], Tae Hyung Han[3]*

[1]Department of Wood and Paper Sciences, Kyungpook National University, Daegu, 702-201, Republic of Korea
Email: byungdae@knu.ac.kr

[2] Department of Wood Mechanics and Technology, Forestry Faculty, Istanbul University, Bahcekoy, Sariyer, 34473, Istanbul, Turkey
Email: ***nadiray@istanbul.edu.tr***, Tel: +90 212 3382400, Fax: +90 212 338 2424

[3] Department of Forest Biomaterials Engineering, College of Forest and Environmental Sciences, Kangwon National University, 200-701, Chuncheon city, Republic of Korea
Emails: ***kwon@kangwon.ac.kr***; *thhan212@kangwon.ac.kr*
Tel.: +82 33250 8324, Fax: +82 33256 8320

**** Dual corresponding authors***

Abstract

Three grades of liquid urea-formaldehyde (UF) resins with different formaldehyde emission levels such as super E0 (SE0), E0 and E1 were modified by adding different amounts of microfibrillated cellulose (5wt% MFC and 95 wt% water) that had been isolated by mechanical disintegration of pulp fibers. Thermal properties of these UF resins were investigated to understand thermal curing and degradation behaviors of the modified UF resins, using differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). The DSC thermograms showed an exothermic curing reaction, and the curing peak temperature of modified UF resins heavily depended on the emission resin grade with an increasing order from E1, E0 to SE0. The addition of MFC suspension into the UF resins gradually increased curing peak temperature suggesting a decrease in the resin reactivity. TGA results showed three main thermal degradation temperatures for the modified UF resins except the SE0 UF resin, which had four degradation temperatures.

Keywords: microfibrillated cellulose; thermal stability; urea-formaldehyde; formaldehyde emission grade