

Accepted Manuscript

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PII: S0959-6526(15)00736-2

DOI: [10.1016/j.jclepro.2015.06.016](https://doi.org/10.1016/j.jclepro.2015.06.016)

Reference: JCLP 5663

To appear in: *Journal of Cleaner Production*

Received Date: 5 March 2015

Revised Date: 4 June 2015

Accepted Date: 4 June 2015

Please cite this article as: Pasandín AR, Pérez I, Ramírez A, Cano MM, Moisture damage resistance of hot-mix asphalt made with paper industry wastes as filler, *Journal of Cleaner Production* (2015), doi: 10.1016/j.jclepro.2015.06.016.

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Word count: 6,394

Moisture damage resistance of hot-mix asphalt made with paper industry wastes as filler

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Abstract

Certain paper industry wastes display high recycling potential. In this investigation, the feasibility of using green liquor dregs and biomass fly ash from the paper industry as filler in hot-mix asphalt (HMA) for road pavement construction is analysed. Particularly, the moisture damage resistance (i.e., water sensitivity) of an AC 22 base B50/70 G has been studied using the Indirect Tensile Strength Test at the Marshall mix design optimum asphalt content. The most important filler properties have been determined to study water resistance: filler water content, grain size distribution using light scattering analysis techniques, morphology using a scanning electron microscope (SEM), chemical and mineralogical composition using X-ray fluorescence (XRF) and X-ray diffraction (XRD) techniques, detrimental fines content using the methylene blue test and the stiffening effect of the filler in the mastic by determining the ring and ball (R&B) softening temperature and the bitumen penetration grade. Additionally, the Rolling Bottle method and Boiling Water tests have been conducted to analyse the asphalt-aggregate bond. A control filler (i.e., commercial limestone filler) was used to compare the results. Also the mechanical properties (stiffness and resistance to the permanent deformation) of the mixtures were studied. As a result, it can be concluded that dregs have poor water resistance. Additionally, fly ash displayed inadequate water resistance for HMA.

Keywords: paper industry waste; dregs; biomass fly ash; filler; hot-mix asphalt; water resistance.

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