Equilibrium moisture content (EMC) in Norway spruce during the first and second desorptions

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It is a commonly accepted notion that the equilibrium moisture content (EMC) of wood at a given relative humidity (RH) is highest during initial desorption of green wood due to an irreversible loss of hygroscopicity during the 1st desorption. The basis for this notion is investigated by assessing how drying and saturation procedures influence the differences between the 1st and the 2nd desorption curves for Norway spruce (Picea abies (L.) Karst.) sapwood. The study establishes 1st and 2nd desorption isotherms for a variety of initial conditions and it covers the RH range from 60.1% to 99.9%. The state of the water is not affected by oven-drying and rewetting as demonstrated by time domain low field NMR relaxometry. The results challenge the conclusions of earlier studies and indicate that in these studies the 2nd desorption was initiated at much too low EMC and therefore fails to describe a boundary desorption isotherm. Instead, it becomes an intermediate desorption isotherm starting at the adsorption boundary curve and crossing over to eventually meet the desorption boundary curve. The results also show that vacuum drying at room temperature only gives a modest loss of hygroscopicity compared to the green state. Conversely, oven-drying at 103°C results in a more significant loss of hygroscopicity, except for RH above 96% where an increase in EMC surprisingly is seen.

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