NMR MICROIMAGING APPLIED FOR INVESTIGATION OF THE POROSITY OF NATURAL WOOD, WOOD-BASED MATERIALS AND A NOVEL WOOD – POLYMER COMPOSITE

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Numerous wood-based materials are still widely applied in modern building technology. Natural wood is used mainly for creating these parts which must have a relatively low mass and should be easy to processing. Wooden rafter framing is durable, easy to fabricate even in case of very difficult shapes of the roof. Nowadays application of pure natural wood is restricted mainly by its rapidly increasing price and restrictions caused by the dimensions of the available material. That is why more often the wood-based materials such as oriented strand boards (OSB) are used. It is easy to fabricate plates with the desired dimensions and thickness from 8 mm up to more than 30 mm. They are used not only for the interior but quite often also as construction panels for outside walls and even for small roofs (later covered by waterproof materials like ceramic tiles). Such an application demands high durability and resistance for water penetration. Recently novel wood-based materials based on the polypropylene and wooden fibers have been introduced. The aim of this work is to investigate the influence of water on such materials and compare it to the behavior of natural wood and OSB. As first example the mixture of pine-tree fibers with dimensions between 0.25 mm and 0.5 mm and a polypropylene was used. A cubic piece of this material (10 mm x 10 mm x 10 mm) was placed in a water and such a sample was examined by NMR imaging after increasing periods of imbibition. The Single Slice Multi Echo (SSME) technique was employed using Bruker AVANCE 300 MHz spectrometer. This led to the tomographic pictures with resolution 0.19 x 0.19 mm and a slice thickness of 1 mm. Additionally proton density profiles were obtained from the pictures. Similar cubic samples of natural pine-tree wood and commercial OSB were examined in exactly the same conditions. Obtained results clearly show that this novel material is much more waterproof than natural wood and OSB. The resolution of obtained pictures is sufficient to reveal that water which diffuses through the surface of OSB later is accumulated inside internal cavities between the strands. Such a bulk water can play an important role in the degradation of this material especially in case of cyclic freezing and unfreezing. Obtained results may lead to draw a conclusion that wood-polypropylene composites can be used for fabricating various parts used in the building even those which are subjects of the influence of water and wide range of temperatures.