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## Spreading and penetration of a water droplet on native and heat-treated wood

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**Abstract:** A custom device was conceived to place a water droplet (diameter c.a. 0.5mm) at the surface of wood and follow its evolution. The device comprises a minute needle, micrometric displacement stages, a backward light, a telecentric magnifying lens and a fast camera.

Before each test, the wood surface was carefully prepared using a sledge microtome. Due to the difficulty to cut heat-treated wood, the surface was always prepared before heat treatment (220°C, 1 hour). Earlywood and latewood samples of fir, before and after heat-treatment, were tested with the droplet placed on a transverse section (imbibition along the longitudinal direction). Image processing allows the evolution of droplet height, droplet diameter and apparent contact angle to be obtained.

Based on the Washburn's law, a theoretical model was developed to predict the evolution of the droplet height, using the evolution of the droplet diameter as input parameter. Simulated and experimental curves were matched by tuning one single parameter, the true contact angle.

This theoretical model allowed the competition between spreading and penetration depicted by the experimental data to be analyzed in detail:

- the porosity promotes penetration and weakens spreading,
- the contact angle is reduced by heat-treatment,
- the identified values of the true contact angle are always very close to 90°.

**Keywords:** Porous medium, capillary imbibition, surface tension, theoretical model, contact angle.