Adsorption/desorption of water to polysaccharides as studied by infrared spectroscopy

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Plants like mosses can live on rocks, where the stable supply of water seems difficult. Although extracellular polysaccharides in plant cell walls such as pectin are supposed to retain water, their water retension mechanims and abilities have not been clarified. In this study, adsorption/desorption of water on a pectin film has been studied by infrared spectroscopy and quartz crystal microbalance (QCM) under controled relative humidity (RH%).

In difference IR spectra from that at low RH, OH bands around 3510, 3380 and 3260 cm^{-1} increased with RH. These bands are called here as free water for the 3500 cm^{-1} band, intermediate water for the 3380 cm^{-1} band and bound water for the 3260 cm^{-1} band. Together with the band around 3440 cm^{-1} due to OH species of pectin (carboxyl: COOH), the OH bands in the original spectra were fitted by 4 Gaussian OH components (3510, 3440, 3380 and 3260 cm^{-1})(Fig.1a).

The results show that more bound water than free water is adsorbed on the pectin film (Fig.1b). Upon RH decrease from 60 to 20%, the pectin film loses continuously free water. However, only 20% of bound water was lost until RH 40% and remained mostly constant at lower RHs. Water in pectin can be retained as bound water under low RH conditions, possibly by its C-O bonds.

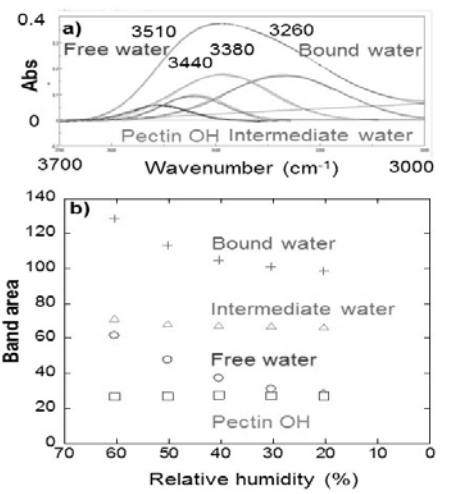

Fig.1. (a) Curve fitting of OH stretching band of pectin film by four Gaussian components.
(b) Changes with relative humidity in band areas of 4 OH components.