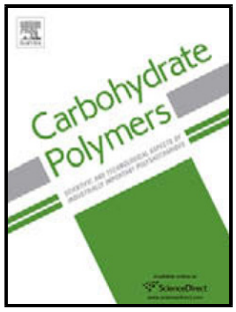

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Changes of pectin nanostructure and cell wall stiffness induced *in vitro* by pectinase

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Highlights

- Cell wall pectins treated with pectinase under *in vitro* conditions
- Atomic force microscope was used to study pectin structure and cell wall stiffness
- Changes of pectin nanostructure occurs due to pectinase treatment
- Successive removal of pectin fractions reduces cell wall stiffness

ABSTRACT

Structural modifications of fruit cell-wall pectins are controlled by various enzymes. In this *in vitro* study, the cell wall material (CWM) from pear fruit (*Pyrus communis* L.) was treated using pectinases in two concentrations. Water soluble (WSP), chelator soluble (CSP) and sodium carbonate soluble (DASP) pectin fractions were extracted from CWM. By visualization of enzymatic-induced changes of structure and CWM stiffness using an atomic force microscopy (AFM), the role of pectins in the mechanical properties of cell walls was shown. Galacturonic acid (GalA) content in pectin fractions was assayed as well. This experiment unveiled evidence of the structural degradation of molecules in pectin fractions extracted from CWM caused by *in vitro* pectinase action and softening of CWM due to pectin removal that might be related to the creation of empty spaces in the cellulose-hemicellulose network.

Keywords: Atomic force microscopy; Cell wall; Nanostructure; Pectins; Pectinase; Stiffness
Abbreviations: *AFM* atomic force microscopy, *CWM* cell wall material, *WSP* water soluble pectins, *CSP* chelator soluble pectins, *DASP* sodium carbonate soluble pectins, *GalA* D-galacturonic acid

1. Introduction

The mechanical function of the cell walls in plants is one of their most important functions. Cell walls together with turgor pressure and tissue cellular organization are key components maintaining mechanical strength, and rigidity, and therefore determining fruit sensory texture and firmness, as well as protecting cells from outside pathogens (Brummell & Harpster, 2001; Cosgrove, 1985, 2000, 2005; Darvill, McNeil, Albersheim, & Delmer, 1980; Fry, 1988; Gwanpua et al., 2014; Jarvis, 2011; Sakurai, 1991; Sankaran et al., 2015). The cell wall assembly is considered to be a continuum of matrix polysaccharides and glycoproteins. Three main classes of polysaccharides have been distinguished in the primary cell walls: cellulose, hemicelluloses and pectins in the ratio of approximately 15-40%, 20-30% and 30-50%, respectively (Cosgrove & Jarvis, 2012; Fischer & Bennett, 1991; Jarvis, 2011).