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Food Under The Microscope

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After colour and appearance texture is one of the most important factors in determining acceptance or rejection of food by humans. Cell walls are a major contributor to the structure of cells and thus the texture of plant tissues. Many changes occur in the texture of fruit tissues during their development [1]. These modifications are mostly associated with the cell walls especially the pectic polysaccharides which are the major non-cellulosic polysaccharides in cell walls of ripening fruit. Cell walls also undergo changes, particularly to the pectic polysaccharides as a result of cooking [2].

The texture of food is commonly assessed using instrumental techniques or by human participants. But most of what is known about plant cell walls comes from analytical studies on the chemical composition of the constituent polysaccharides after the walls have been isolated and fractionated. Techniques such as solid-state ^{13}C nuclear magnetic resonance spectroscopy give information on the architecture of the polysaccharides wall in the near native state [3]. Information of the localization of specific components in walls can be obtained by various labeling techniques and microscopy. Examining the structure of foods in their native state by microscopy is attractive. However, since cell walls and other food systems are highly hydrated, techniques which require the removal of water using solvents can make interpretation problematic. Our objective was to investigate the texture of some plant foods using techniques that at least avoid harsh chemicals in the preservation steps.

The texture of aubergine (*Solanum melongena* L.) was investigated because for its size it is light in weight, appears quite spongy to the eye and often disintegrates completely when cooked. Chemical analysis of the cell walls indicated they were rich in pectic polysaccharides. Light microscopy of hand-cut sections indicated that the flesh of aubergine had an aerenchyma-like morphology. When observed by cryo-SEM an open network of cells was seen as well as the external surfaces of cells, which appeared to be quite smooth (Figure 1A). Higher magnification showed detail of adhesions between cells lying adjacent to each other (Figure 1B). Fine threads of attachment could be seen but the precise nature of these is not yet known.

To understand more about the changes in texture associated with fruit ripening and its control as well as to improve our interpretation of cryo-SEM images, we grew cherry tomatoes (*Lycopersicon esculentum* var*, cerasiforme* Dunal A. Gray) and examined the adhesion between the plasma membrane and cell wall of unripe and fully ripened tomatoes. Hand-cut sections of fresh tissue from the outer wall of the pericarp were plasmolysed by drawing 1 M NaCl through the section. Interactions between the plasma membrane and the cell wall were monitored over time using conventional light microscopy. Small pieces of whole tissue were also immersed in 1 M NaCl for 15 min and then rapidly frozen, fractured and examined by cryo-SEM. Hechtian threads and sub-protoplasts, which were visible in the hand-cut sections, could not be seen in the cryo-SEM images. However, in images of fully ripe tomatoes some walls had separated (Figure 2A) leaving fine connecting threads (Figure 2B). This feature was not seen in the corresponding untreated control or in equivalent preparations from unripe tomatoes. Again the nature of these threads is unknown. Cryo-SEM gave insight on the nature of cell surfaces and cell wall

behaviour but we interpret the data with care while we learn about more about the effect of the procedures on the native state.

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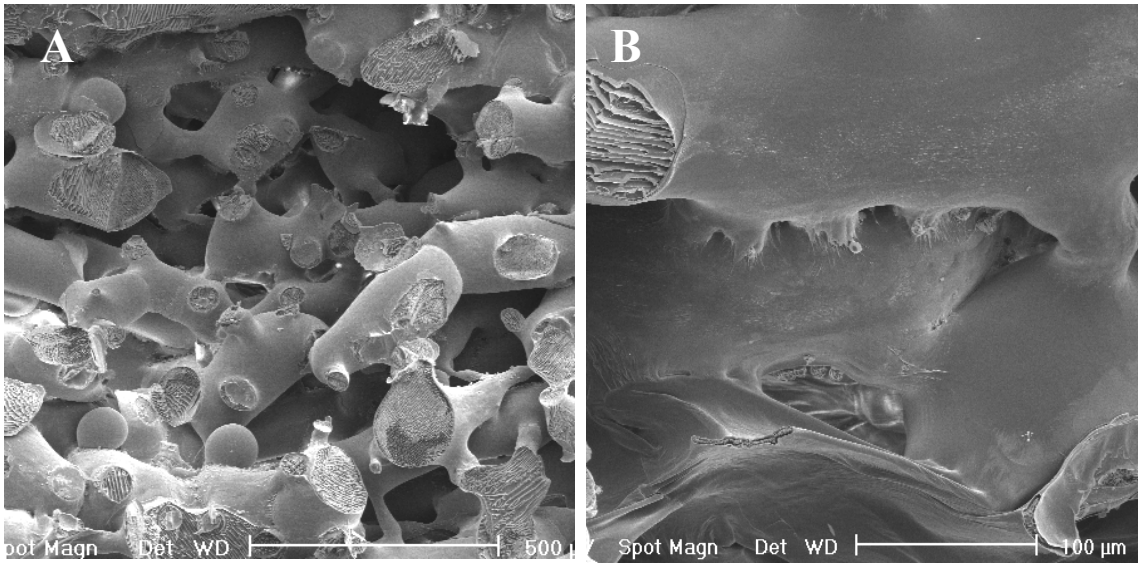

Fig. 1. Longitudinal section of aubergine. A. Tissue morphology. Scale bar = 500 µm. B. Adhesions between cells. Scale bar = 100 µm.

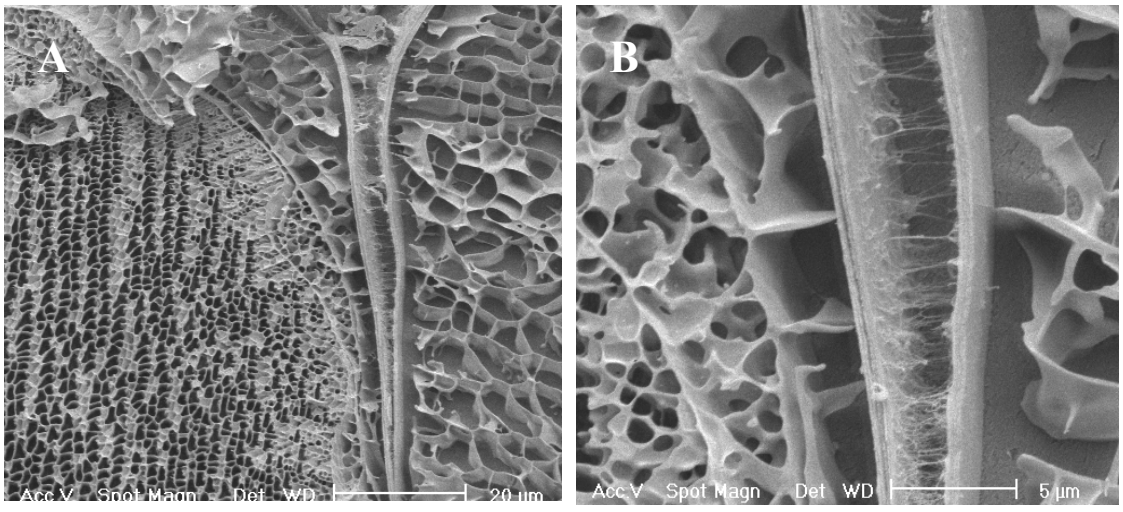

Fig. 2. Fully ripe cherry tomato treated with 1 M NaCl 15 min. A. Separating walls. Scale bar = 20 µm. B. Magnified view showing fine interactions between two walls. Scale bar = 5 µm.

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