Molecular probes for pectin analysis

Identification

Key words  
monoclonal antibody, pectin, pectin methylesterase, PME, inhibitor against pectin methylesterase, PMEI

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How does it work?

Primary objective  
Analytical tool. Screening for presence and precise localization of  
1. specific pectin structures (having particular functional properties such as for example good gelifying properties)  
2. pectin methylesterase (influencing pectin’s degree of esterification and thus pectin functionality)  
3. and the inhibitor of pectin methylesterase in diverse food matrices by the use of monoclonal antibodies and/or an inhibitor-based molecular probe.
**Working principle**

*Pectin*, a main plant cell wall component, contributes to many quality attributes of fruit and vegetable based food products, chiefly in relation to texture. Furthermore, extracted pectin is widely used in the food industry as an ingredient/additive, mainly relying on its gelling capacity. Through pectin remodeling, the enzyme *pectin methylesterase* (PME) can have both beneficial and detrimental effect on food quality. Activity control is therefore often pursued. In this context, intelligent process design as well as the *PME inhibitor* (PMEI) are particularly relevant. This technology is based on the recognition of pectin, pectin methylesterase or pectin methylesterase by *monoclonal antibodies* (i.e. immuno response molecules that elicit only an immunological response on one specific antigen, the target molecule). A large number of monoclonal antibodies against specific pectin structures (such as for example the antibody PAM1 against low-esterified homogalacturonan) are commercially available and more recently, monoclonal antibodies against PME from different plant sources, against fungal PME and against PMEI have been developed (1-2). Also recently, the toolbox of molecular probes for pectin analysis has been extended by the development of an inhibitor-based molecular probe for PME (activity) in complex food matrices (3). Using the above-mentioned probes, the presence of specific pectin structures, PME and PMEI in complex food matrices can be screened for. Moreover, the probes allow precise localization at tissue as well as at cellular level. Some examples:

- **Monoclonal antibodies against pectin** can be used to detect changes in degree of esterification in for example carrot, broccoli (4) and eggplant tissue (5) caused by food processes, typically used as pretreatments in the context of pectin engineering for control of texture/rheology in fruit and vegetable based food products. The monoclonal antibodies can also be used to localize specific pectin structures in milk products such as yoghurt (6) to get in-depth insight into the role specific pectin molecules as gelling agents.

- **Monoclonal antibodies against PME** can be used to localize endogenous PME in for example tomato and carrot tissue (1) and fungal PME (that is used in food industry as a processing aid in the context of fruit firming) infused in apple (7). The inhibitor-based probe against PME can be used to localize PME activity in carrot, tomato and broccoli (3). Knowledge on the precise localization of PME can be very useful in the context of site-specific PME stimulation or inactivation through precision processing: food processes can be executed in such a way that PME at specific, desired locations is actually reached.

- **Monoclonal antibodies against PMEI** can be used to screen for the presence of PMEI in for example green and gold kiwi fruits (2, see Figure). These probes could be extremely valuable for fast screening of various fruits and vegetables for the presence of PMEI-like compounds. Through pre- or post-processing addition, PMEI-like compounds may be exploited as a technological adjuvants to inhibit undesired PME activity in food applications remaining after (mild) processing, e.g., to obtain cloud-stable juices.

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**Images**

**Additional effects**

Knowledge on the presence and localisation of specific pectin structures, PME and PMEI is very useful in the context of pectin engineering and texture (link to datasheet ‘Pectin engineering and texture’).

**Important process parameters**

protein denaturing process conditions.

**Important product parameters**

pectin structure and concentration, concentration and conformation of PME, concentration and conformation of PMEI-like compounds.
What can it be used for?

Products  
Fruit and vegetables derived food products and food products (such as for example dairy products) in which pectin is added.

Operations
Analytical tool to assess effect of stabilizing, structure forming operations

Solutions for shortcomings
Additional antibodies, for example against specific pectin structures or specific PMEs for which no monoclonal antibodies are developed yet, can be developed.

What can it NOT be used for?

Products
If the concentration of the targeted epitope(s) (i.e. specific pectin structure, PME or PMEI), is very low or the epitope is masked by other food components (such as for example possible masking of pectin by other cell wall polymers), false negative results may be obtained. Good positive and negative control samples are advised.

Operations
None

Other limitations
None

Risks or hazards
None

Implementation

Maturity 
Analysis tool is available at laboratory scale.

Modularity/Implementation
This analysis methodology is destructive and thus can’t be used in-line.

Consumer aspects
The production monoclonal antibodies involves animal (typically mice or rats) testing.

Legal aspects
None

Environmental aspects
None

Facilities that might be interesting for you

Further Information

Institutes
KU Leuven LFT, Wageningen UR - FBR, INRA, University of Leeds, Lyon 1 - LRGIA

Companies
DSM, PlantProbes
References


Source: