

# Megazyme

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## PECTIN IDENTIFICATION ASSAY

KPECID 9/2003



## INTRODUCTION:

Pectins consist of the partial methyl esters of polygalacturonic acid and their sodium, potassium, calcium and ammonium salts, obtained by extraction in an aqueous medium of appropriate edible plant material, usually citrus fruits or apples. Pectin is recovered from solution by precipitation with an appropriate organic solvent such as ethanol, methanol or isopropanol. In some pectins, a portion of the methyl esters may have been converted to primary amide groups by treatment with ammonia under alkaline conditions. Older methods for the identification of pectin involve solvent precipitation. These methods are non-specific. The method described here measures the increase in absorption at 235 nm on cleavage of pectate by a highly purified and specific enzyme, pectate lyase<sup>1</sup>.

## PRINCIPLE:

Pectin is dissolved in deionised water and adjusted to pH 12.0 to catalyse demethylation with the production of polygalacturonic regions in the polymer i.e. conversion of pectin to pectate. The pectate is incubated with pectate lyase which cleaves the polygalacturonic acid releasing unsaturated oligosaccharides which absorb strongly at 235 nm. The JECFA method<sup>2</sup> for the identification of pectins is very similar to the current method, however, the pectate lyase supplied with this kit acts better at pH 8.0.

## KITS:

Kits suitable for performing 500 assays are available from Megazyme and consist of:

1. Concentrated Pectate Lyase enzyme
2. Low ester pectin extracted from citrus peel
3. High ester pectin extracted from citrus peel
4. Partly amidated low ester pectin from citrus peel
5. Pectin from sugar beet pulp
6. Iota carrageenan

## Reference:

1. Hansen, K.M., Thuesen, A.B. and Soderberg, J.R. (2001) "Enzyme assay for identification of pectin and pectin derivatives, based on recombinant pectate lyase." *J. AOAC International*, **84**, 1851-1854.
2. Compendium of Food Additive Specifications, FAO Food and Nutrition paper 52, Add. 9, Joint FAO/WHO Expert Committee on Food Additives (JECFA) 57th session, Rome, Italy, 5-14th June, 2001.

### **SPECIFICITY:**

The assay is absolutely specific for polygalacturonic acid.

### **ENCLOSED ENZYME:**

**Pectate Lyase** (Megazyme Cat. no. E-PCLYS). The enzyme is purified from a crude *Aspergillus* sp. recombinant preparation. The purified pectate lyase appears as a single band on SDS-gel electrophoresis and has a pH optima of 10.8. It is supplied at a concentration of approximately 14 Units/mL (pH 8.0, Tris-HCl buffer) [at the pH optima of 10.8 (CAPS buffer), the activity is 120 U/ml] in a solution of 50% glycerol plus preservative. The enzyme as supplied is stable for at least 2 years at 4°C, and for greater than 5 years at -20°C.

For use in the assay of pectin as described here, 0.5mL of enzyme is diluted to 50 mL with Tris/HCl buffer (pH 8.0). (i.e. a 100-fold dilution). The enzyme in buffer is stored in suitable aliquots in polypropylene containers at -20°C between use, and is stable to multiple freezing and thawing cycles.

### **ENCLOSED STANDARDS:**

1. Low ester pectin extracted from citrus peel
2. High ester pectin extracted from citrus peel
3. Partly amidated low ester pectin from citrus peel
4. Pectin from sugar beet pulp
5. Iota carrageenan

### **BUFFERS AND REAGENTS:**

#### **1. 50 mM Tris/HCl buffer plus 1 mM CaCl<sub>2</sub>.**

Dissolve 6.055 g of Trizma base (Sigma Cat. no. T-1503) and 0.147 g of calcium chloride dihydrate in 900 mL of deionised water. Adjust pH to 8.0 with 1 M HCl. Adjust volume to 1 litre. Store at 4°C.

#### **2. 0.5 M NaOH.**

Dissolve 20 g of NaOH in 1 litre of deionised water.

#### **3. 0.5 M HCl.**

Add 50 mL of conc. HCl (10 M) to 950 mL of deionised water.

#### **4. 1 M HCl.**

Add 100 mL of conc. HCl (10 M) to 900 mL deionised water.

#### **5. 2-Propanol (100%).**

### SAMPLE PREPARATION:

1. Moisten 50 milligrams (0.05 g) of the sample with 2 drops of 2-propanol.
2. Add 50 mL of deionised water and stir gently on a magnetic stirrer for 20-30 min (until the pectin dissolves).
3. Adjust the pH to 12 by careful addition of 0.5 M NaOH, and leave the solution for exactly 15 min at room temperature.
4. Lower the pH to 8.0 by dropwise addition of 0.5 M HCl.
5. Adjust the volume to 100 mL with deionised water.

Add the following to quartz cuvettes;

	Tris-HCl buff. (pH 8.0)	Sample	Deionised water	Diluted enzyme
Enzyme blank	0.5 mL	1.0 mL	1.0 mL	-
Sample blank	0.5 mL	-	1.5 mL	0.5 mL
Reaction	0.5 mL	1.0 mL	0.5 mL	0.5 mL

Mix the contents of the cuvettes well, and measure the absorbance values at 235 nm after 30 min.

### RESULTS:

The increase in absorbance for a given sample on incubation with pectate lyase is measured as follows:

**Blank Absorbance** = Enzyme Blank + Sample Blank  
(measured after 30 min).

**Absorbance** = Reaction Absorbance – Blank Absorbance.

From the increase in absorbance ( **Abs**) the amount of unsaturated product produced can be calculated as:

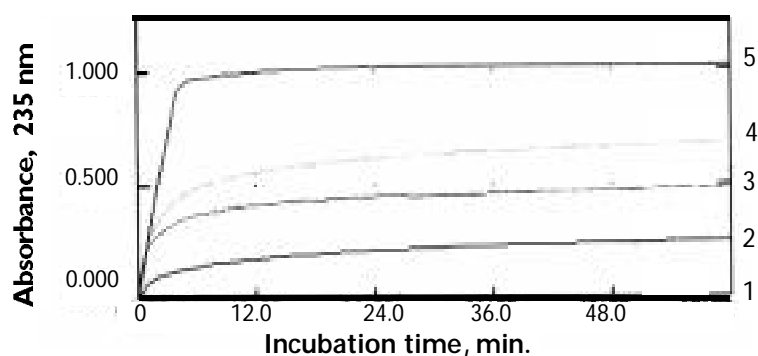
**Unsaturated product** = **Abs/L** x

where:

- Abs = Reaction Absorbance (after 30 min) – Blank Absorbance.  
L = path length of the reaction cuvette (= 1 cm).  
= the molar extinction coefficient of the reaction product ( $4600 \text{ M}^{-1} \text{ cm}^{-1}$ ).

This assay can be performed in a standard UV spectrophotometer simply by measuring the absorbance values of the reaction solution and the two blank solutions after the 30 min incubation. However, the reaction can also be followed in a recording UV spectrophotometer set-up for kinetic assays. The results for such a study are shown in Figure 1.

**Figure 1.** Increase in absorbance at 235 nm on incubation of pectic polysaccharides (or carrageenan) with pectate lyase.



**SAMPLES:**

- |                              |                      |
|------------------------------|----------------------|
| 1. Carrageenan               | 4. High ester pectin |
| 2. Sugar beet pectin         | 5. Low ester pectin  |
| 3. Amidated low ester pectin |                      |

**Incubation conditions:**

1.0 ml of sample (0.5 mg/mL) + 0.5 mL deionised water + 0.5 mL Tris/HCl buffer (pH 8.0, containing 1 mM  $\text{CaCl}_2$ ).

**Add:** 0.5 mL of pectate lyase (Megazyme product diluted 1:100 in Tris/HCl buffer; i.e. 0.14 U/mL).

**Mix** immediately, and follow the absorbance increase at 235 nm in a recording spectrophotometer thermostatted at 40°C.

**Table 1. Determination of content of unsaturated oligosaccharides in pectic and non-pectic polysaccharides**

Polysaccharide Type	Absorbance Values			Unsaturated product x 10 <sup>-4</sup>
	Enzyme Blank	Sample Blank	Reaction	
Carrageenan	0.008	0.051	0.061	0.002
Amidated low ester pectin	0.065	0.051	0.764	0.648
Low ester pectin	0.045	0.051	1.289	1.193
Sugar beet pectin	0.171	0.051	0.767	0.545
High ester pectin	0.096	0.051	0.855	0.708

Calculations:

$$\text{Unsaturated Product} = \Delta \text{Absorbance (30 min)} \times 1l \times 1/l$$

$$= \Delta \text{Absorbance (30 min)} \times 1/4600 \times 1$$

where:

Absorbance = Reaction Absorbance (Absorbance after 30min - Blank Absorbance)

$\epsilon$  = molar extinction coefficient (4600M<sup>-1</sup> cm<sup>-1</sup>)

L = cuvette path length (=1 cm)



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