Sunflower Pectin:
Adding Value to Agricultural Biomass

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Overview of presentation

- What is pectin ?
- Why sunflower pectin?
- Market opportunity
- Conclusions

The Market Environment

Key issues facing global food manufacturers

- Consumers resisting artificial & GM additives and ingredients
  - ⇒ Food manufacturers want natural ingredients
- Ever increasing markets for pre-prepared and convenience foods demand better texture, taste, stability and low fat levels
  - ⇒ Food manufacturers want new functional ingredients

Pectin:
A versatile functional ingredient





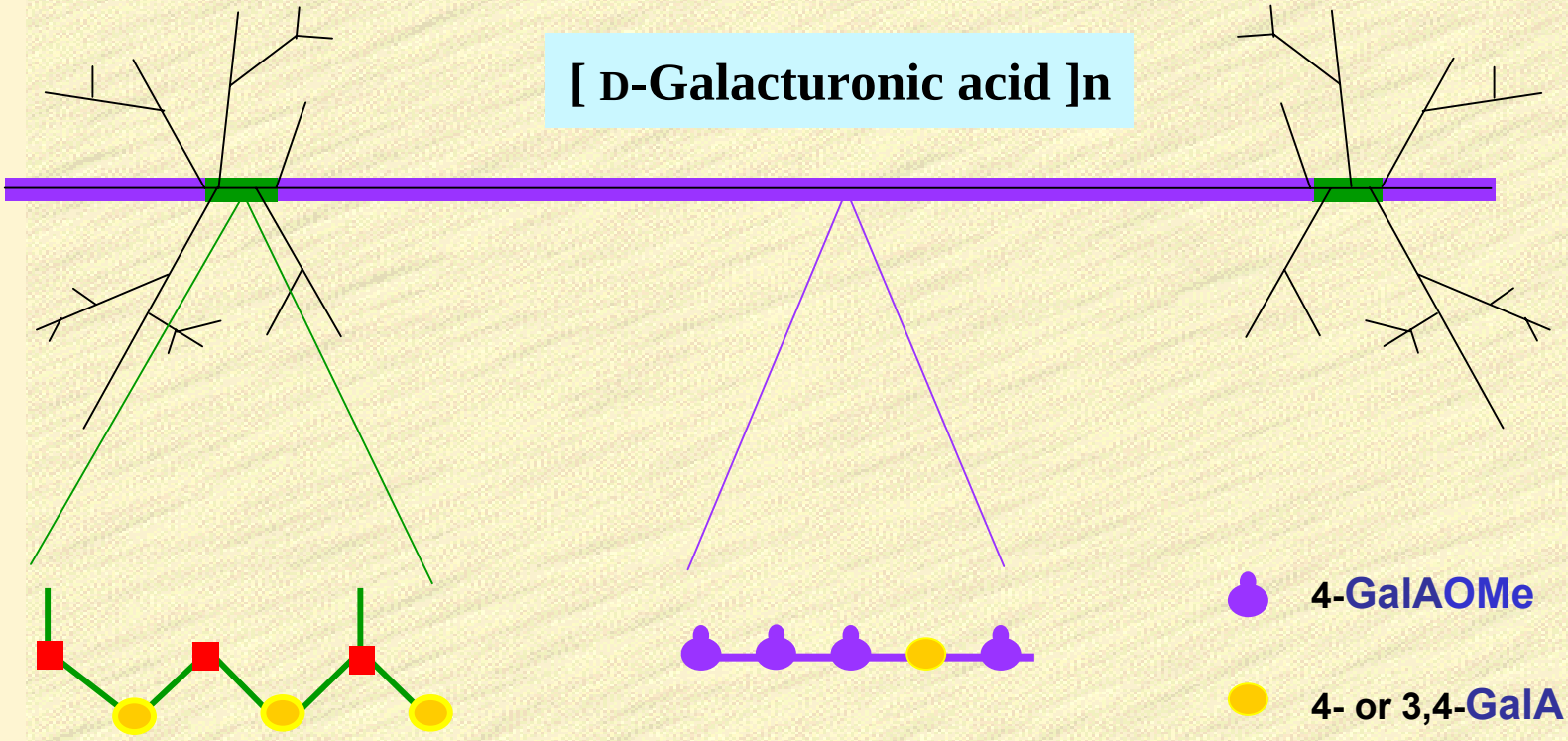

Characteristics of Commercial Pectin

- Food additive (code # 440 & E440)
- Several grades marketed for different applications

DE ≥ 50
- high methoxy (HM)
- rapid, medium or slow set (RS, MS, SS)

DE < 50
- low methoxy conventional (LMC)
- low methoxy amidated (LMA)

Cell Wall Pectin Structure



Neutral sugars:

Ara, Gal, Xyl, Glu

Commercial Pectins

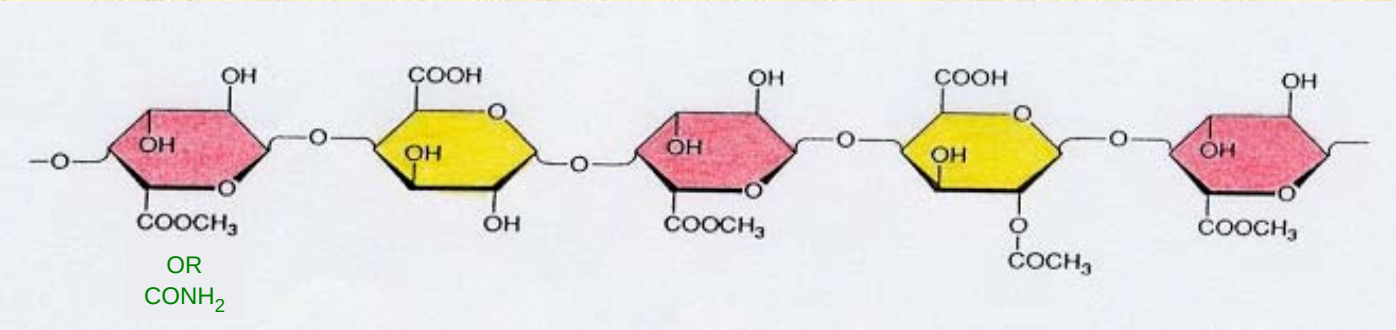
(Food Additive Code #440)

- **Extracted from**



- **Composed mainly of**

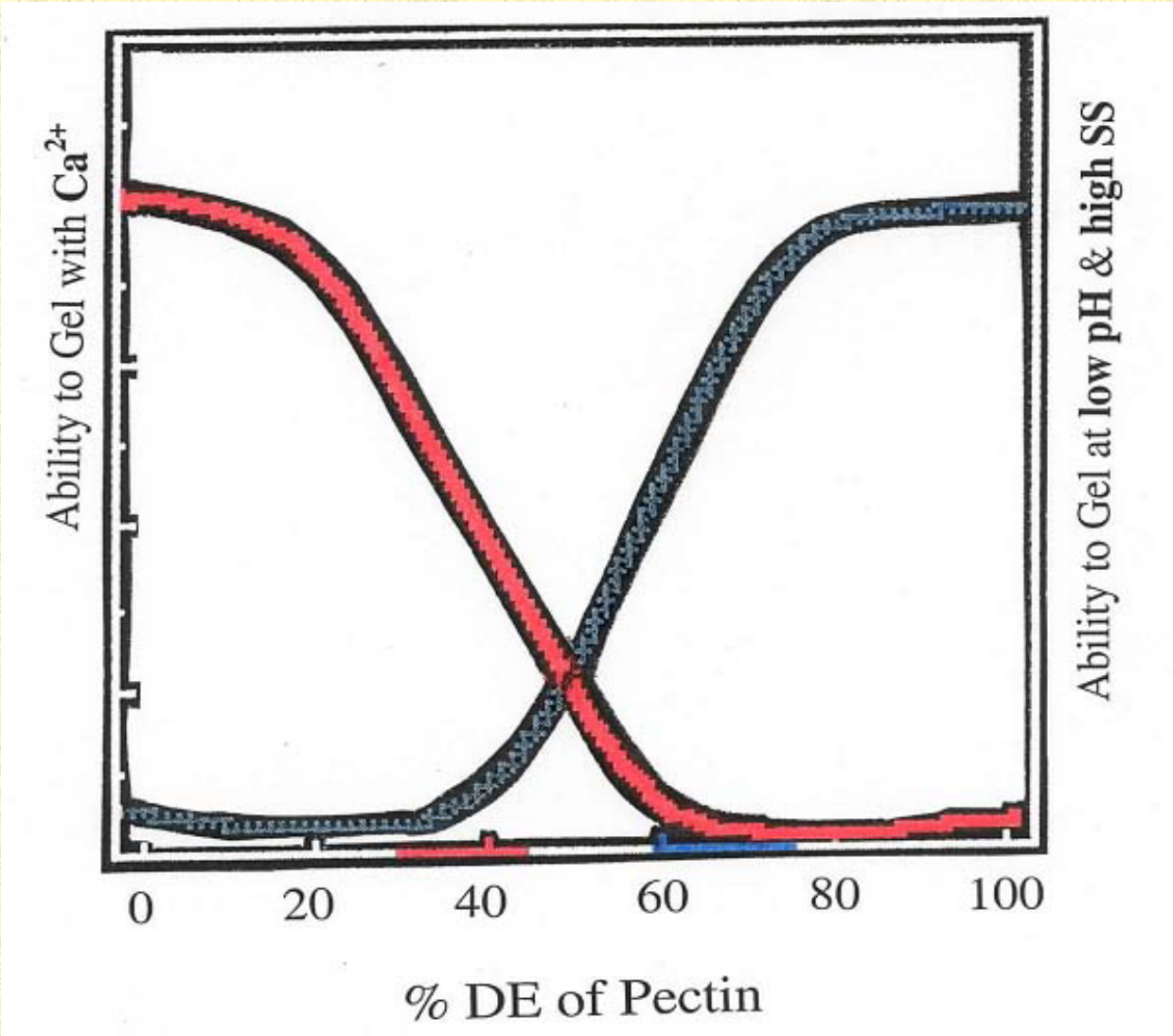
  galacturonic acid ($-COO^-$), its methyl esters ($-COOCH_3$) & amidated ($-CONH_2$)



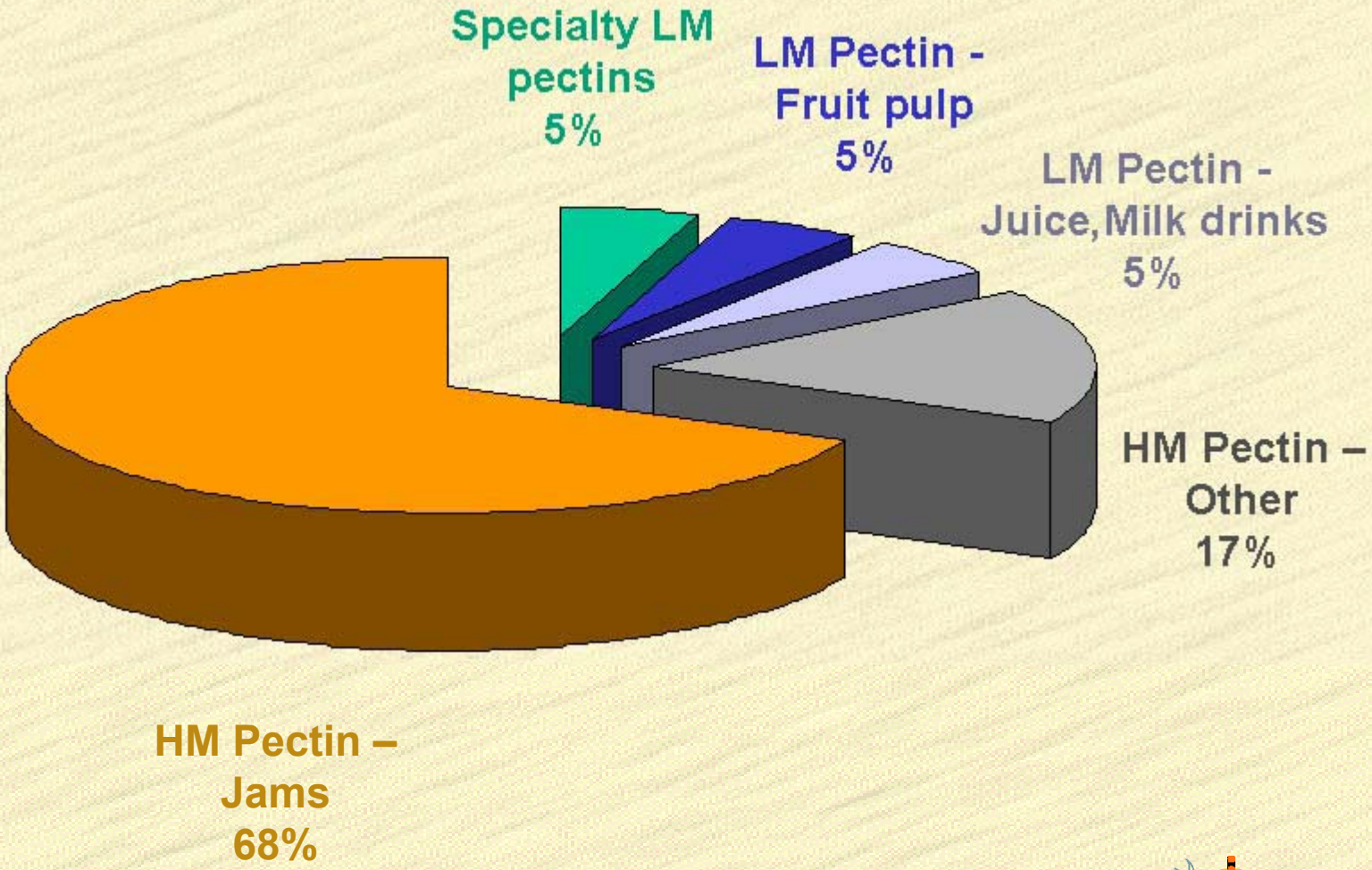
Pectins: Conditions for gelation

Conditions	HM	LM
pH	≤ 3.5 (range: 1.0– 3.5)	1.0 – 7.0 (or higher)
Soluble solids (S.S.)	≥ 55% (range: 55–85%)	0 – 85% (S.S. affects Ca^{2+} required)
Ca^{2+}	normally not a factor	required !!

Pectin gelation: HM vs LM



Global usage of pectins

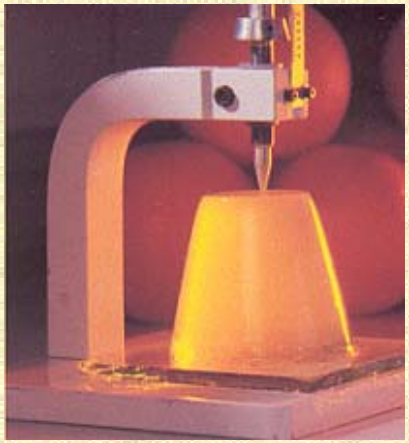


LM Pectin : Some special applications

- Reduced/low sugar jams & jellies
- Heat reversible jams, jellies & fillings
- Baking stable fruit preparations
- Cold setting milk jellies
- Fruit preparations for yoghurt
- Control of fruit separation: HM + LM

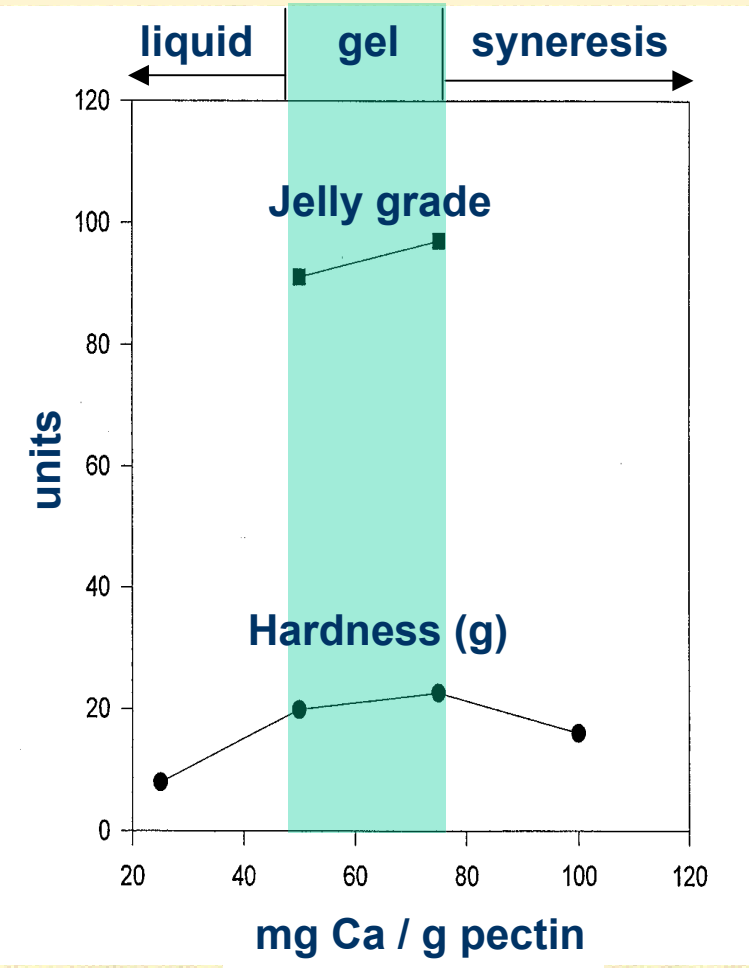
LM Pectin

Reduced (31%) sugar gel at pH 3 & different Ca^{2+} levels

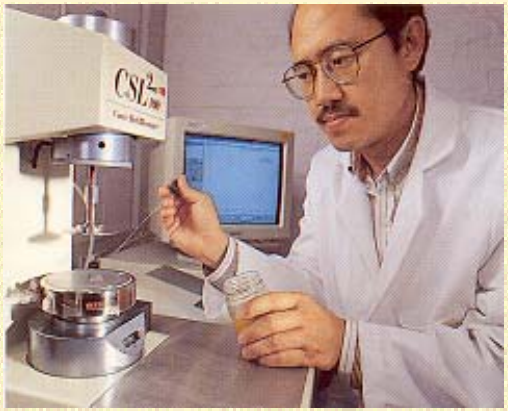


"SAG" test

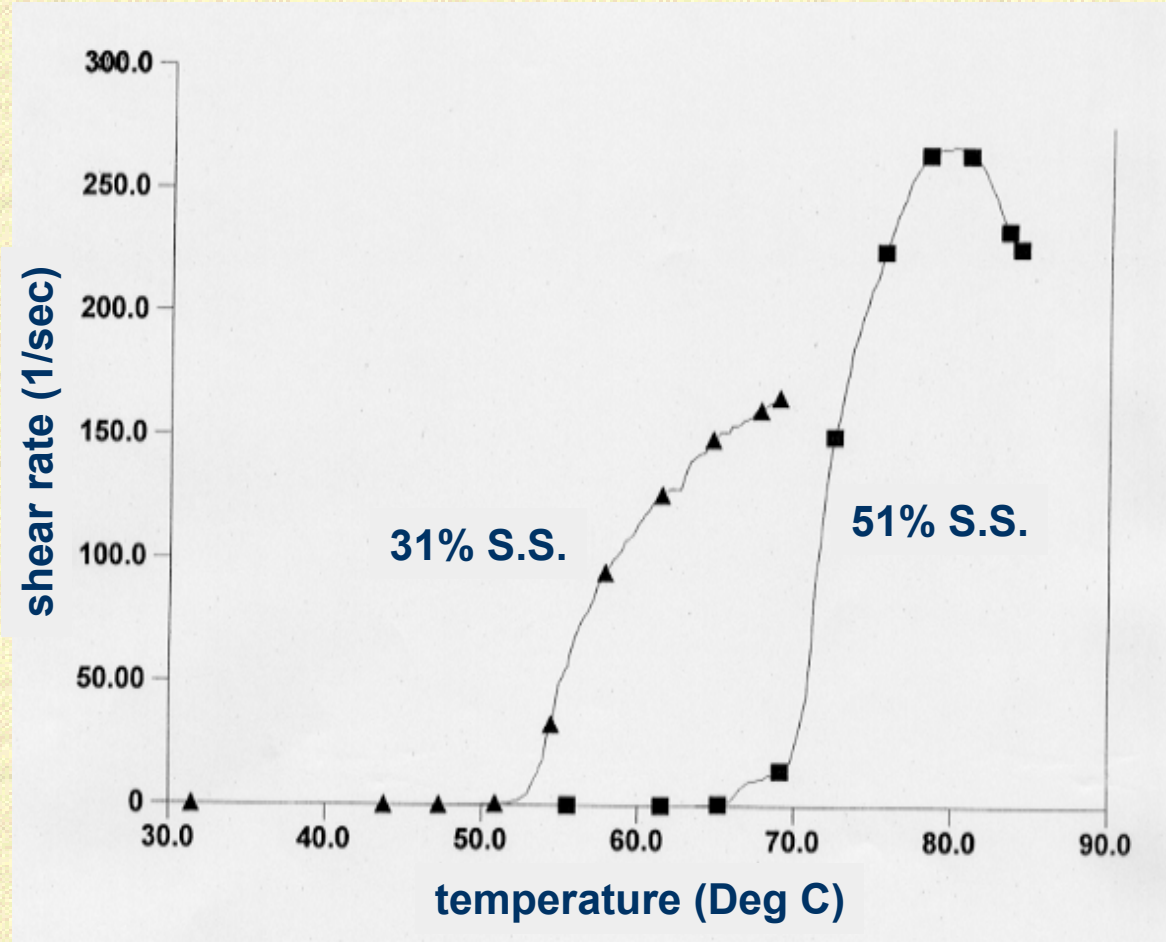
Texture analyser



LM Pectin
Heating curves (31% vs 51% S.S.)



Carri-Med Rheometer



(HM requires min. 55% S.S.)

Production of LM Pectin:
Traditional

- Citrus / apple HM pectin
- R-COOMe + H_2O $\rightarrow$ R-COOH + MeOH
  - aq. acid or aq. acid/org. solvent
  - aq. alkali (other than amidation)
  - enzymic
- Conditions
  - quality profile of starting HM pectin
- Minimum cleavage of pectin backbone
- Downstream processing

Sunflower residues

(NOT seeds)

- Sunflower heads
  - pectin (15-25% dw)
  - GalA content (>65% w/w)
- Source of “natural” LM pectin
- No chemical conversion required
- Reduced product variability
- Supplementary raw material
- Unique properties

Sunflower LM pectin
(Laboratory scale)

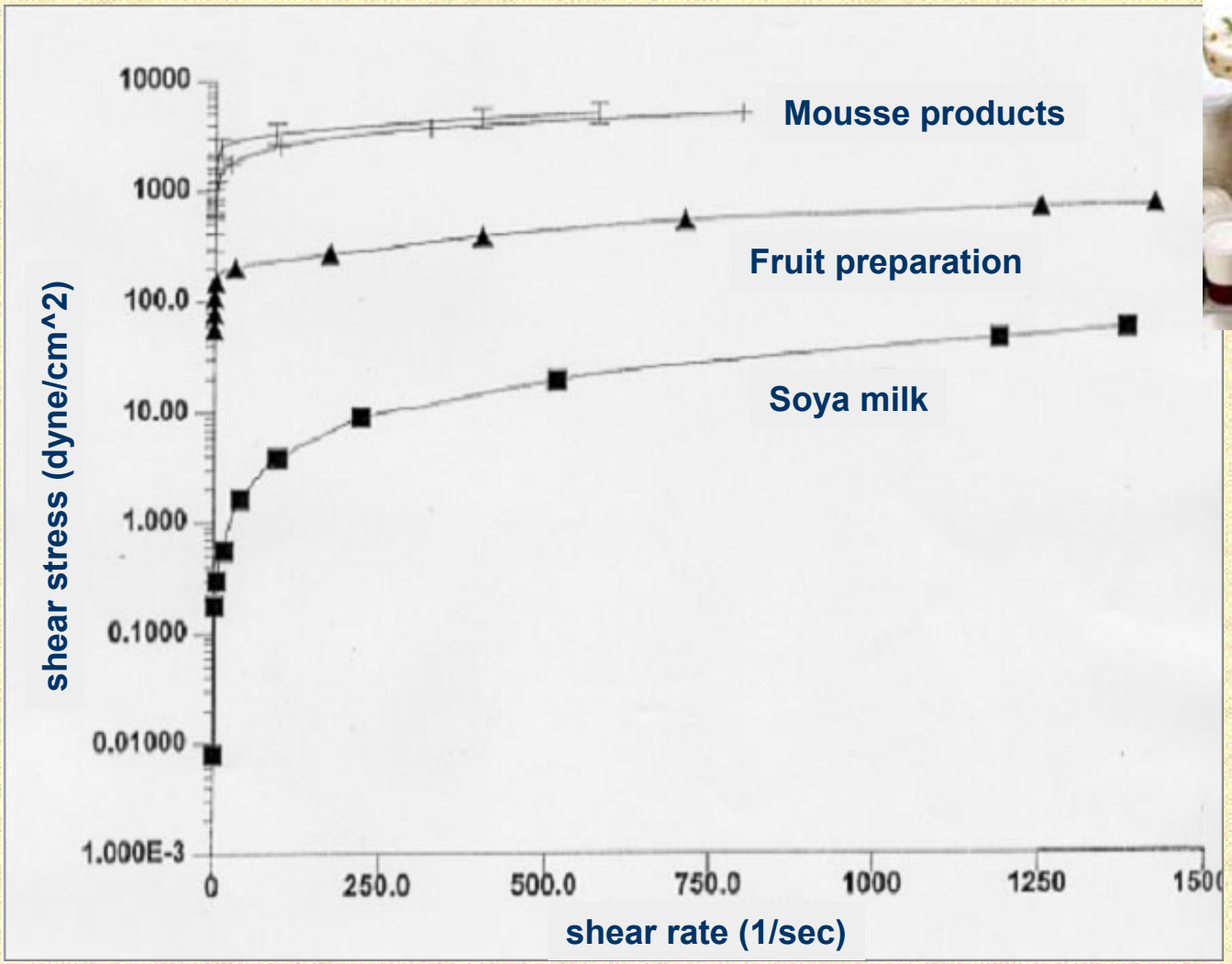
- Sunflower heads: (Dr C Lambrides, UQ)
  - Hysun 25 & Hysun 45
- Seed removal, drying, stabilisation
- Protocols: extraction & downstream processing

Chemical & rheological properties of sunflower head LM pectin

LM Pectin	Yield (%)	DE (%)	Hardness (g)	Initial stress (dynes/cm^2) x10^3
Cold water washing				
Hysun 25	13.7	41.3	21.2	3.296
Hysun 45	12.6	37.8	20.3	2.603
Hot water washing				
Hysun 25	14.3	41.4	n.d	n.d
Hysun 45	9.5	38.3	43.0	5.422

Sunflower LM pectin:

Suspending particulates (yield stress)



Market overview: Pectin

• Total global market	30,000 tonnes
- Australian market	400 tonnes
- LM pectin (~15%)	~5,000 tonnes
• Overall growth rate	6%
- LM pectin	10-20%
• Current price (US/EU)	HM: US$11.00/kg
	LM: US$12.90/kg

Global pectin market:
High growth applications

Application	Growth Rate
Fruit preparations	15 – 20%
Fruit spreads (low sugar jams)	10% +
Yoghurt and dairy	15 – 20%
Acidified milk drinks, high-sugar jams	2 – 5%
Fruit juices & high calcium drinks	10 – 15%
Baked goods, confectionary	5%
Fat replacers	20% +

Pectin : CRC technology package

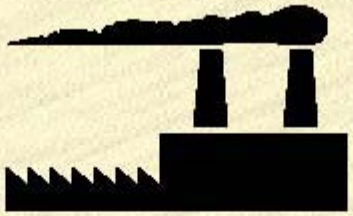
- Proprietary technology
- Raw material: fresh citrus peel
- Product range
  - HM pectin (RS, MRS, SS)
  - LM pectin: conventional (LMC), amidated (LMA)
- Proposed production plant at Leeton
- Output = ~8% total global market (~2,000 tonnes)
- Key advantages
  - availability of fresh peel and water
  - use of novel separation & drying techniques
- product quality meets international standards
- Capital & operating cost savings ~40% compared with traditional process

GRDC Project Proposal:
Sunflower LM pectin evaluation

- Feasibility study: collection/stabilisation of biomass
- Alliance with breeding program:
  quality assessment of biomass
- Extraction & down-stream processing protocols:
  food or non-food grade pectin
- Integration with CRC technology package
- Structure/function relationship of different pectin lines
- Application studies & product development

Sunflower: Industry players

FARMERS



CRUSHERS

PROCESSORS

SEED COMPANIES
(Pacific, Agseed, Pioneer)

RESEARCHERS
(ASA, GRDC, Govt)

FOOD SERVICE
INDUSTRIES

PECTIN PRODUCTION? (CRC for Bioproducts)

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