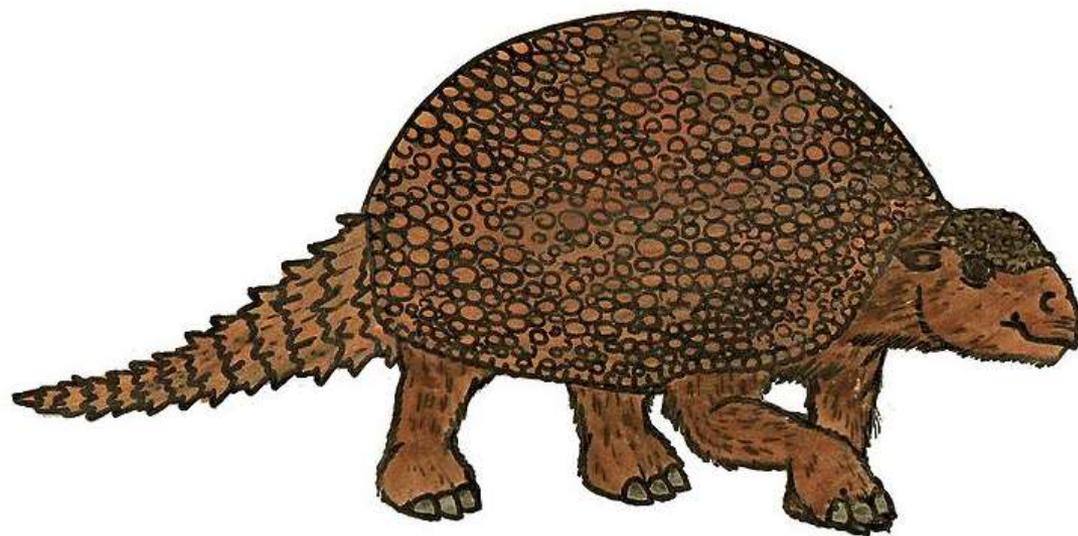


# Two diverse potential bio-polymer applications for kafirin, the prolamin protein of sorghum

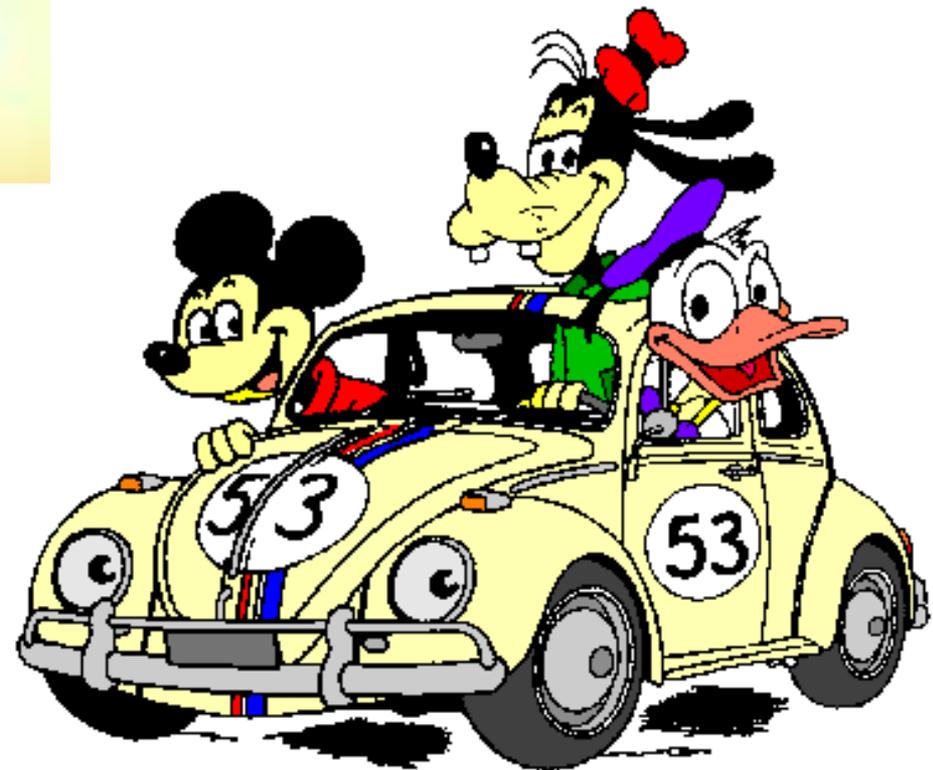
Janet Taylor, Amanda Minnaar, Monique Muller,  
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## Kafirin

- Prolamin storage protein of sorghum
- Hydrophobic, with some hydrophilic characteristics,
- Readily forms disulphide cross-linkages,
- Resistant to pepsin digestion
- Non-allergenic
- Can be formed into films, coatings, microparticles, scaffolds and fibres

# **Kafirin coatings to extend the storage and eating quality of avocados**

**High value, sub-tropical, climacteric fruit exported in large quantities South Africa and Mexico**

**Very fast ripening rate**

**Suffers flesh browning and softening**

**Subject chilling injury**

**All reduce quality and marketability**

**Objective:** To determine the effect of a kafirin based coating containing different additives on the respiration rate, shelf-life and sensory qualities of 'Hass' avocados

**Methodology**

Export quality Hass avocados



Coat by dipping

Treatments

Control (no coating)

Kafirin + Plasticiser (PG)

Kafirin + Plasticiser + Acidulant (GDL)

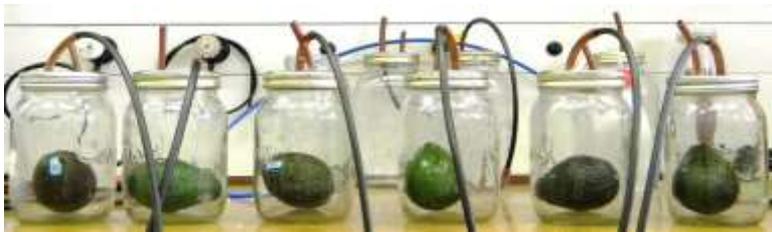
Storage 18° for 22 Days

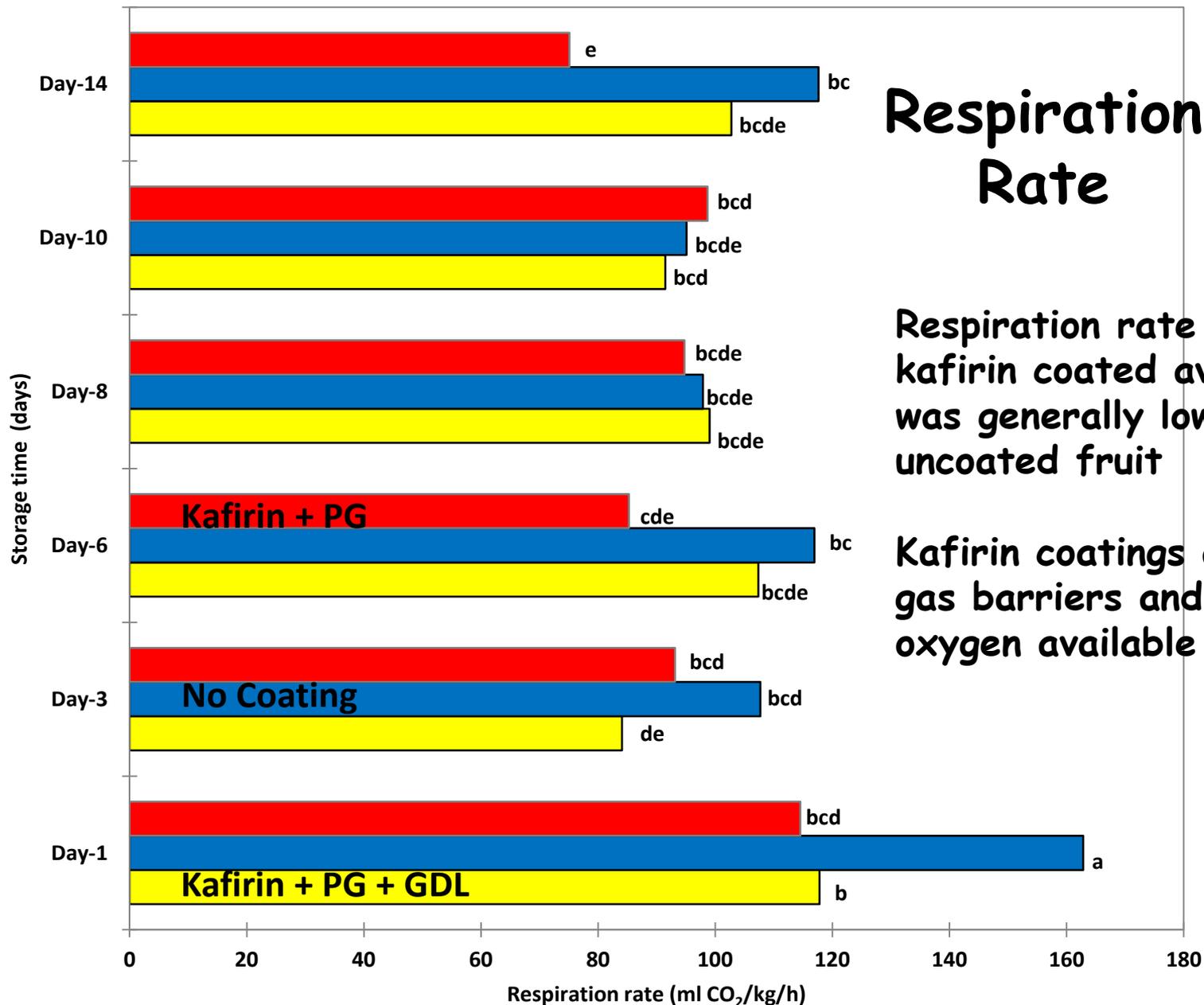
Respiration Rate  
Gas analyser

Ethylene Production  
GC

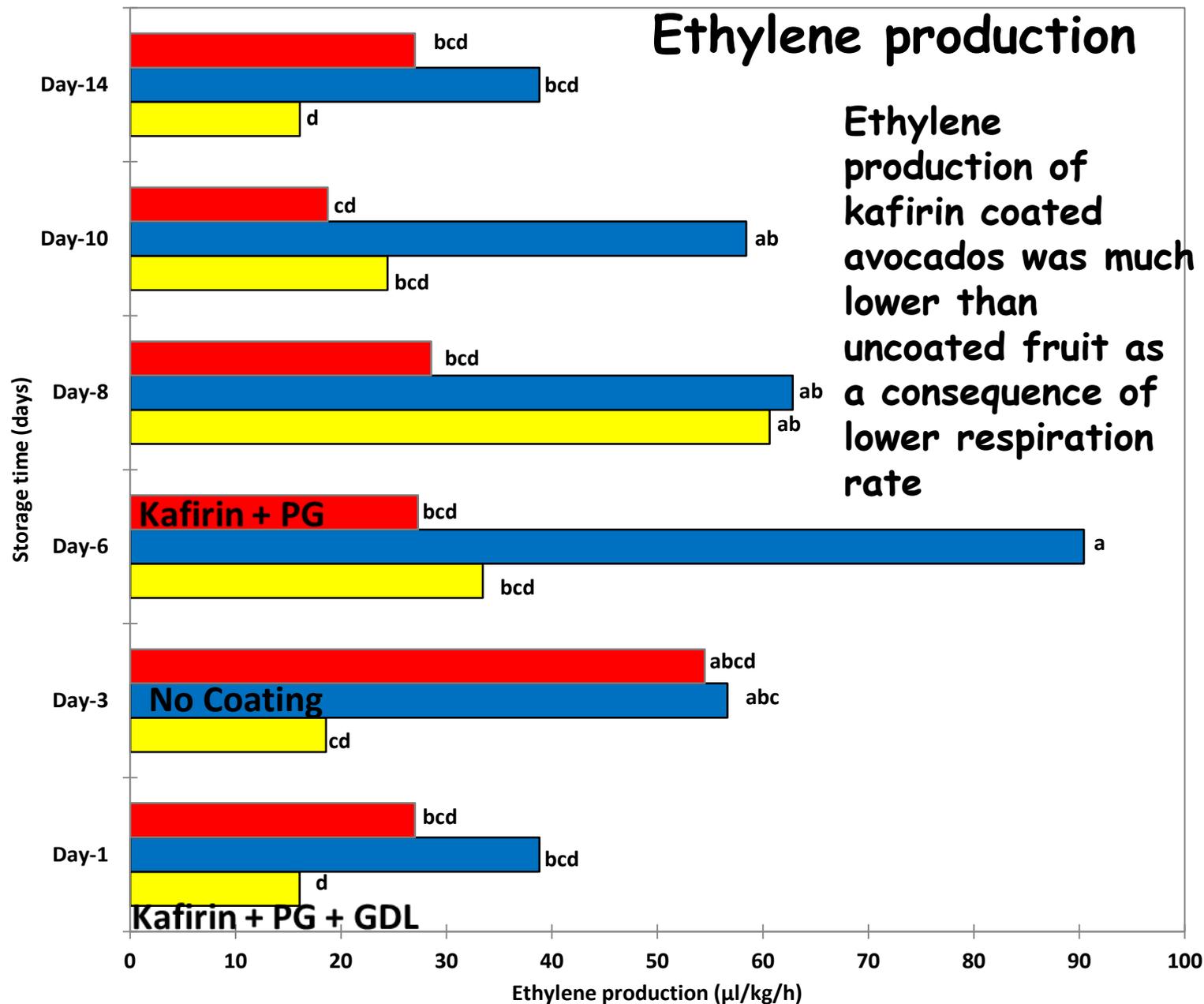
Texture  
Densitometer

Sensory Evaluation  
Trained Panel

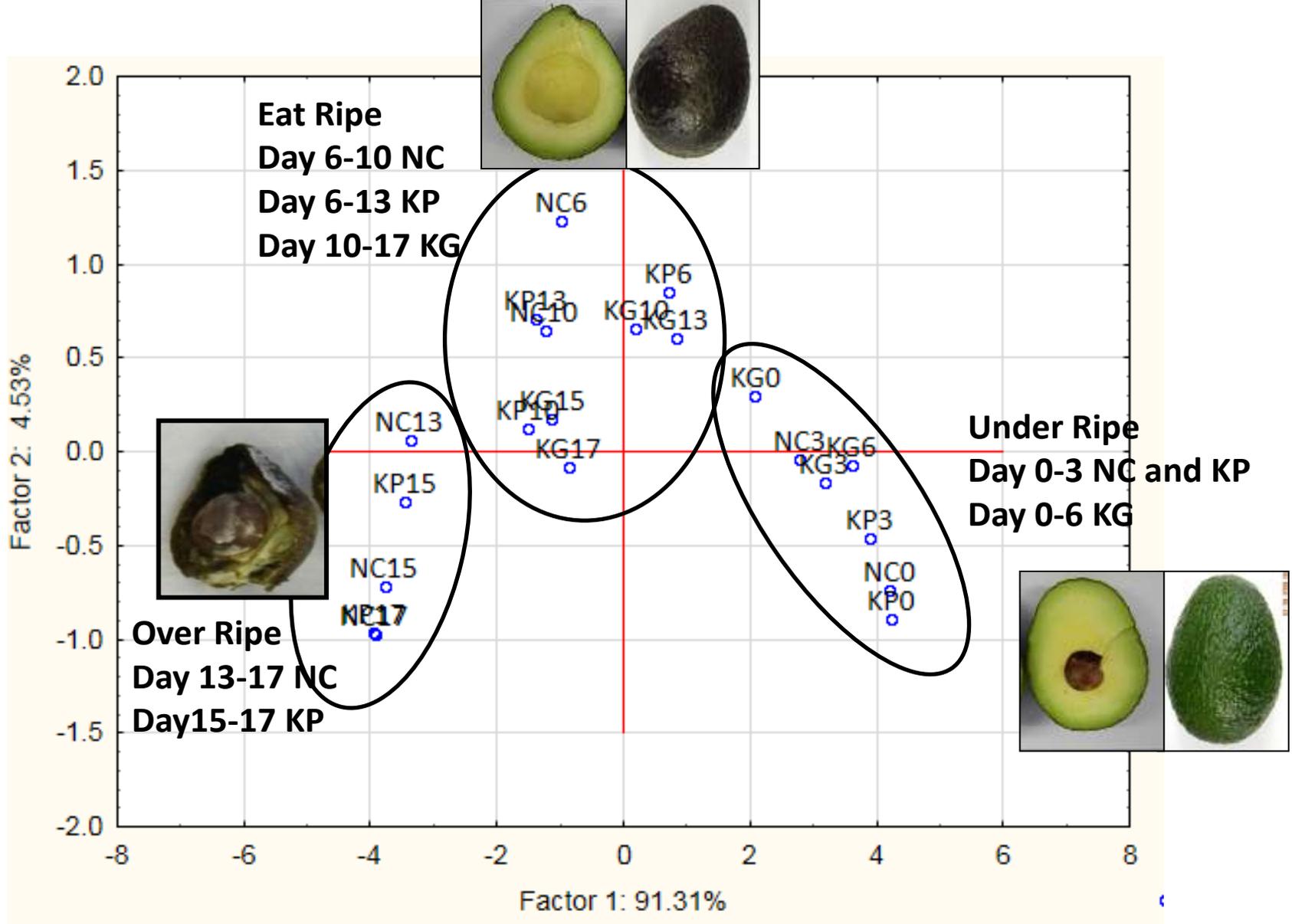


**A**

Mean values with different lower case letters differ significantly from each other (Treatment\*Day p < 0.0001)

**B**

Mean values with different lower case letters differ significantly from each other (Treatment\*Day p < 0.0001)

**B**

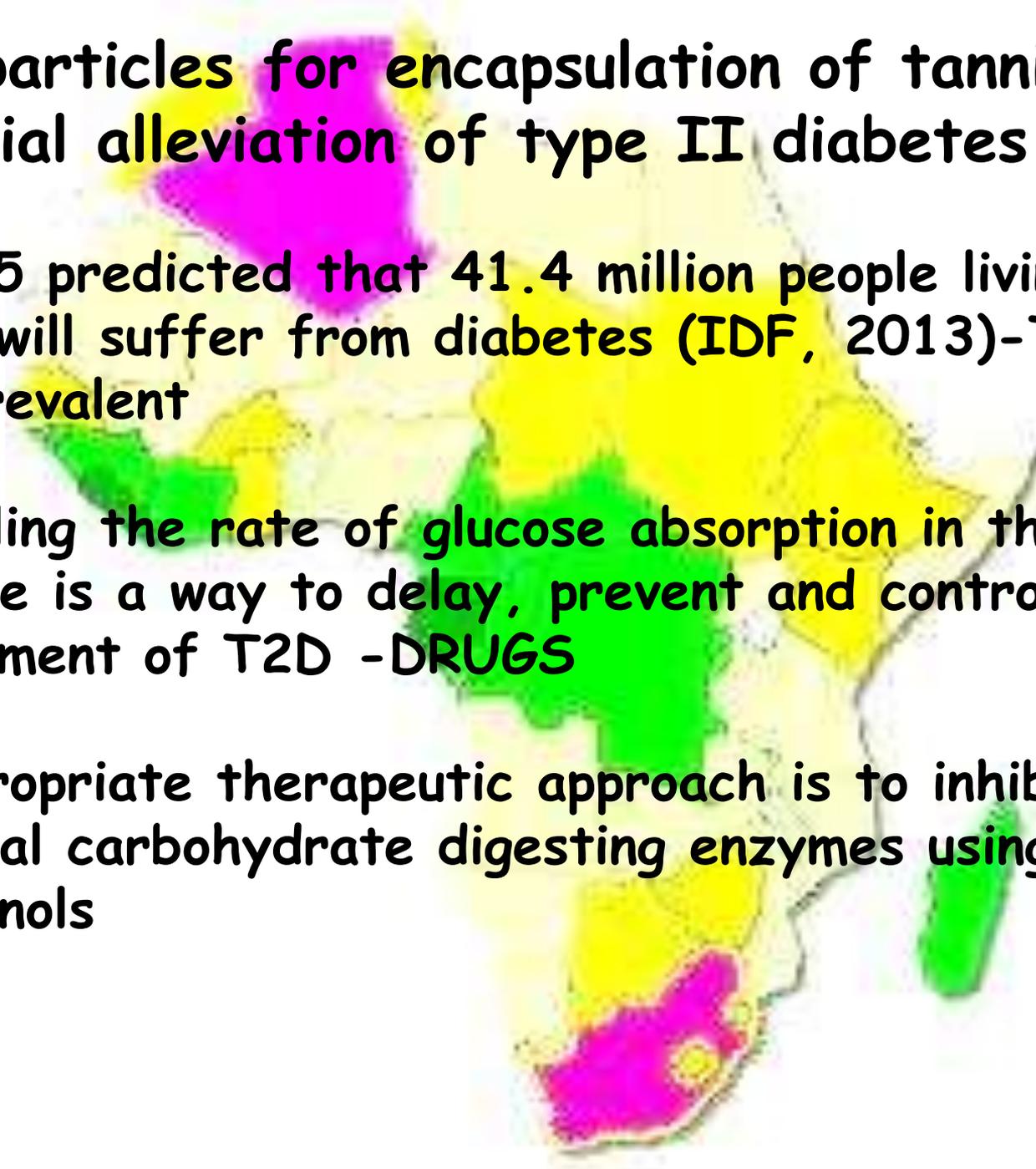
Principal component analysis loadings for all coated and uncoated avocados analysed on days 0 to 17 of the shelf-life study. NC-No coating, KP-Kafirin-PG, KG- Kafirin-PG+ GDL

# **Microparticles for encapsulation of tannins for potential alleviation of type II diabetes**

**By 2035 predicted that 41.4 million people living in Africa will suffer from diabetes (IDF, 2013)-Type 2 is most prevalent**

**Controlling the rate of glucose absorption in the small intestine is a way to delay, prevent and control the development of T2D -DRUGS**

**An appropriate therapeutic approach is to inhibit intestinal carbohydrate digesting enzymes using plant polyphenols**



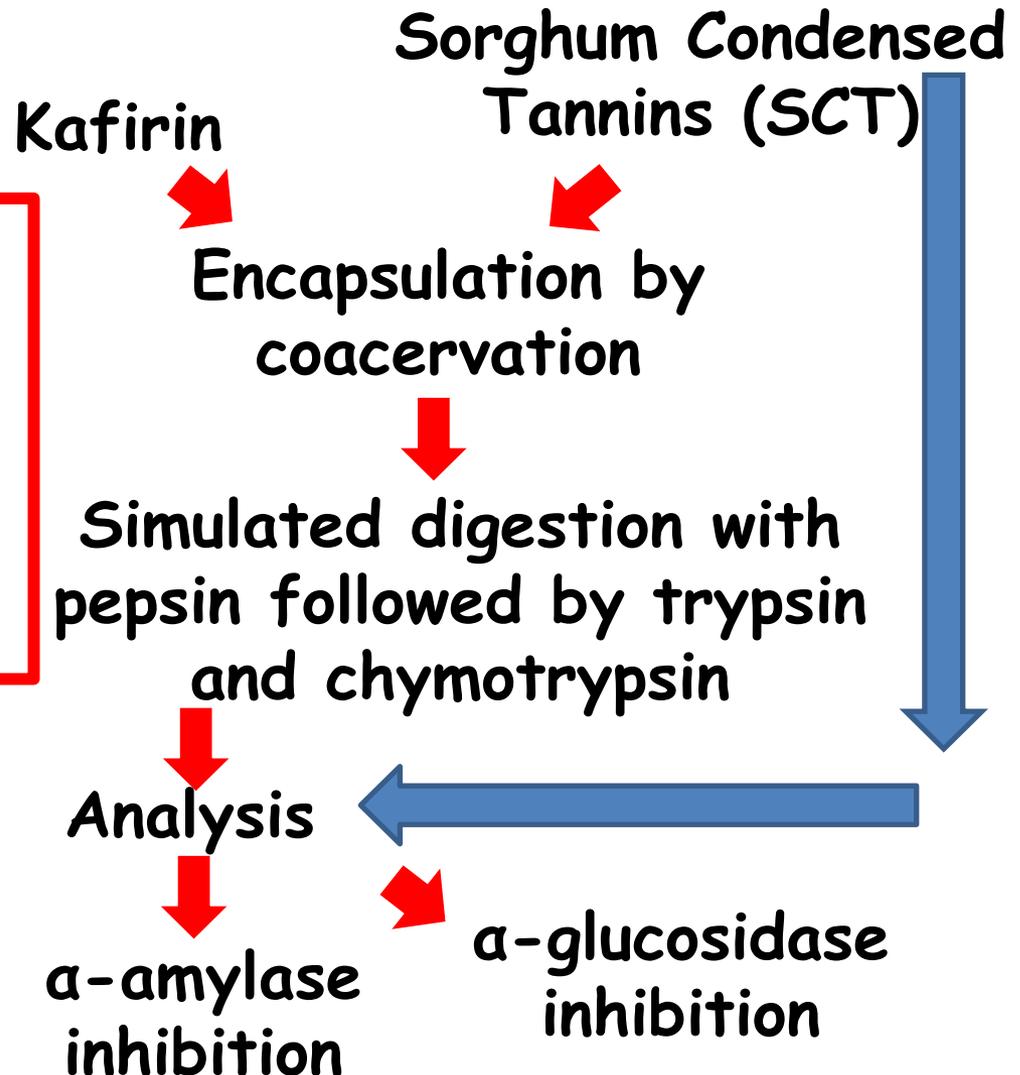
**Objective :** To determine the potential of encapsulating sorghum condensed tannins in kafirin microparticles as a simple delivery vehicle for sorghum condensed tannins (SCT) to the small intestine to inhibit digestive amylases.

**Methodology:**

**Treatments:**

- Kafirin microparticles
- SCT encapsulated in kafirin microparticles
- Acarbose (anti diabetic drug)

Microscopy  
SEM, TEM



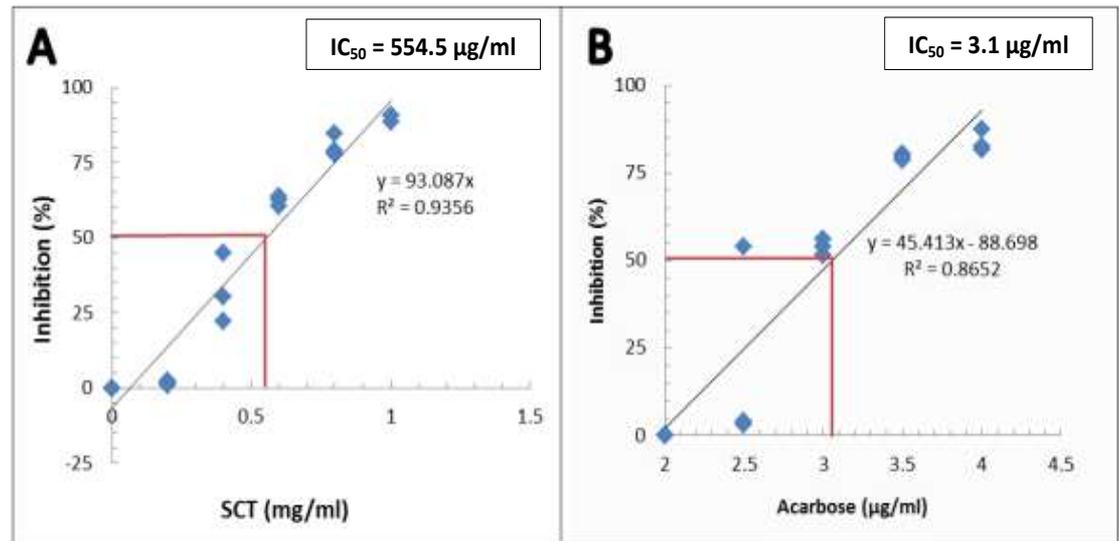
# Enzyme inhibition of sorghum condensed tannins compared with acarbose

SCT were effective inhibitors of  $\alpha$ -amylase and  $\alpha$ -glucosidase

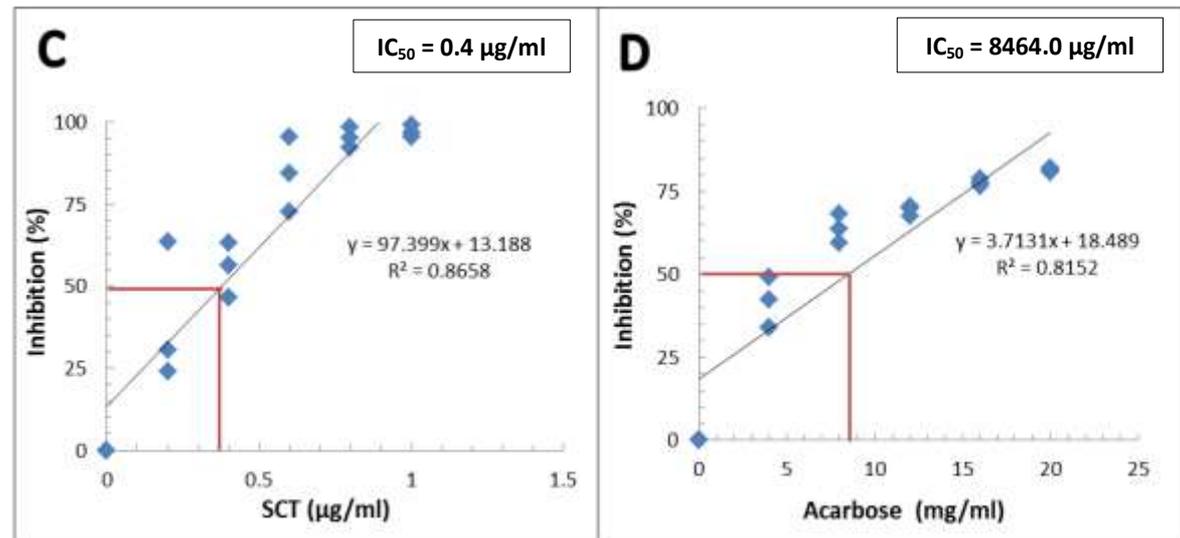
Acarbose was a more effective  $\alpha$ -amylase inhibitor (180 times higher) than SCT

SCT was much more effective  $\alpha$ -glucosidase inhibitor (approx. 20 000 times higher) than acarbose

## $\alpha$ -amylase inhibition



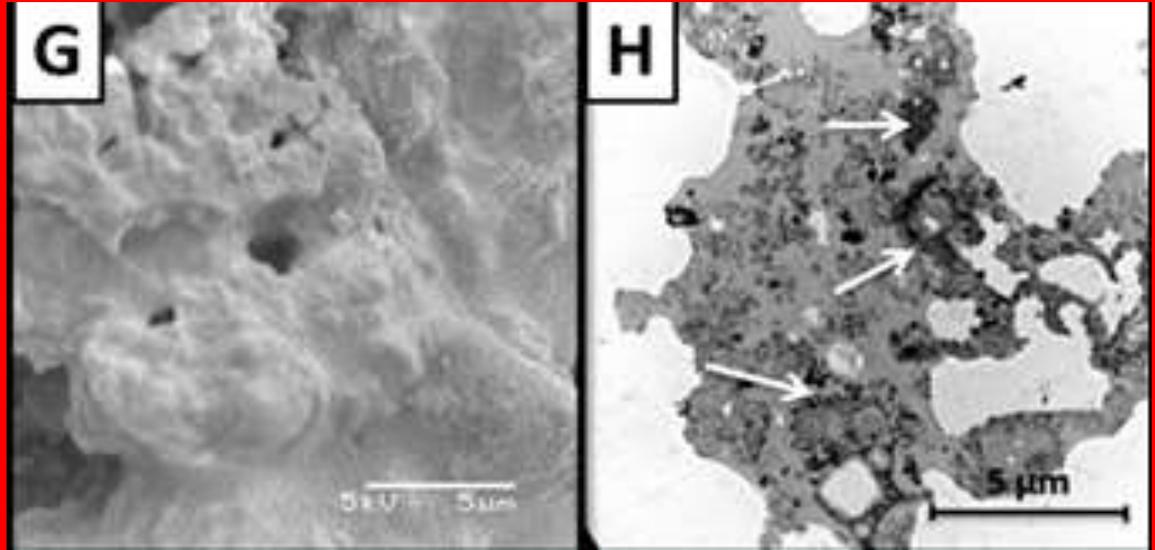
## $\alpha$ -glucosidase inhibition



**Kafirin  
microparticles  
encapsulated  
sorghum  
condensed  
tannins**

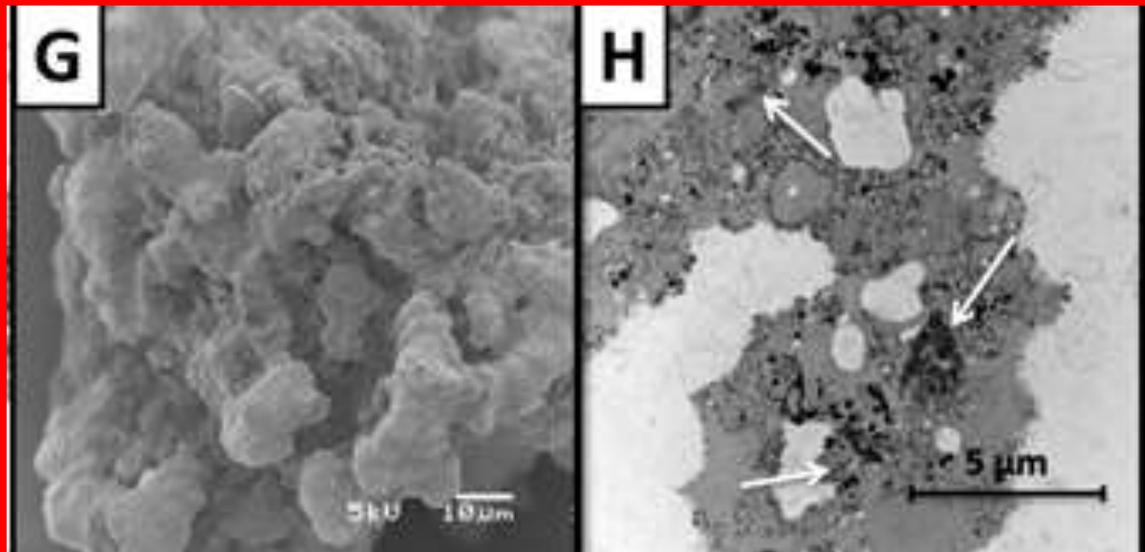
**Total digestion  
12%**

**Pepsin digestion after 120 mins**



**SEM**

**TEM**



**Trypsin/chymotrypsin digestion after 120 mins**



After 2h pepsin digestion followed by 2h trypsin/chymotrypsin digestion SCT encapsulated within kafirin microparticles retained almost 100% of its inhibitory activity

SCT alone lost all its inhibitory activity on digestion

# Some thoughts:

- Shown kafirin coatings can extend shelf life and eat ripe quality of climacteric fruit
- Shown kafirin has potential as an encapsulating agent for nutraceuticals
- Trained two students
- Published two papers

Taylor, J., Muller, M. and Minnaar, A. (2015). Quality Assurance and Safety of Crops and Foods In Press

Links, M.R. Taylor, J. Kruger, M.C. and Taylor, J R.N. (2015). Journal of Functional Foods 12:55-63

**But are we any nearer to having this bio-plastic material commercially available?**



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