



Application of Peptides for Sustainability in Agriculture

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A. Peptide Incorporated Hydrogel Seed Coating

3. Method

- Step 01 Synthesis and characterization of the dipeptide
- Step 02 Investigation of hydrogel properties
- Step 03 Incorporation of micro nutrients into gel
- Step 04 Application of seed coating
- Step 06 Germination and seed vigor tests

Growth Parameters

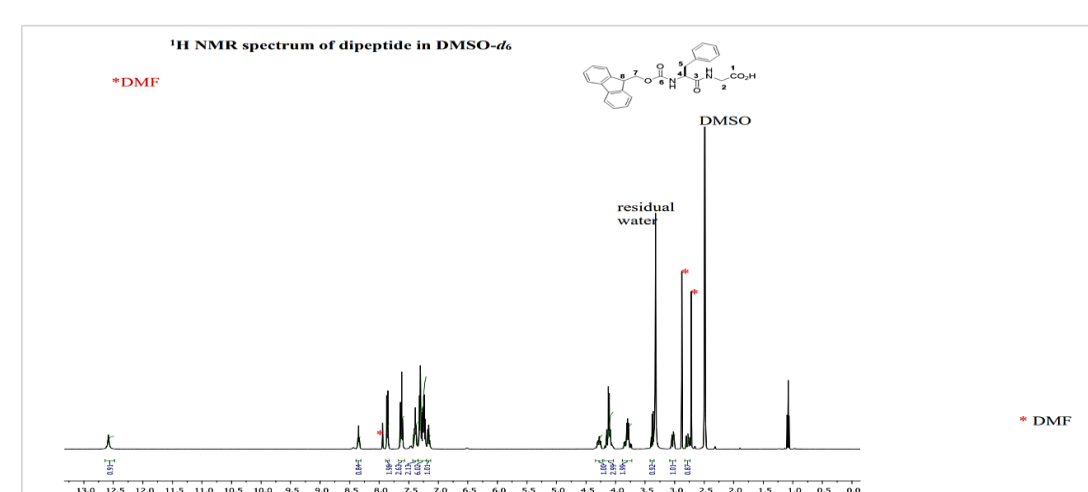
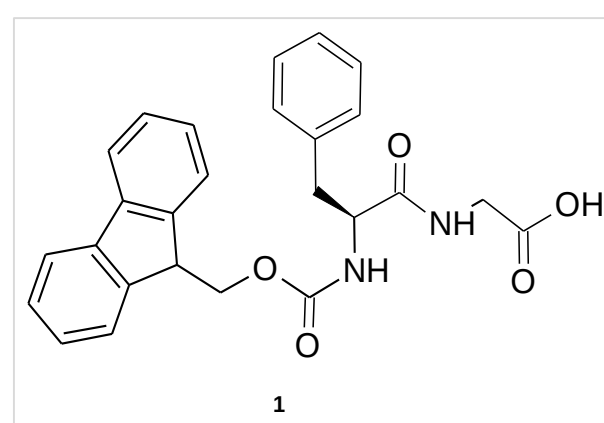
- Total germination percentage %
- Germination rate
- Seed vigor index
- Seedling dry weight

4. Results & Discussion

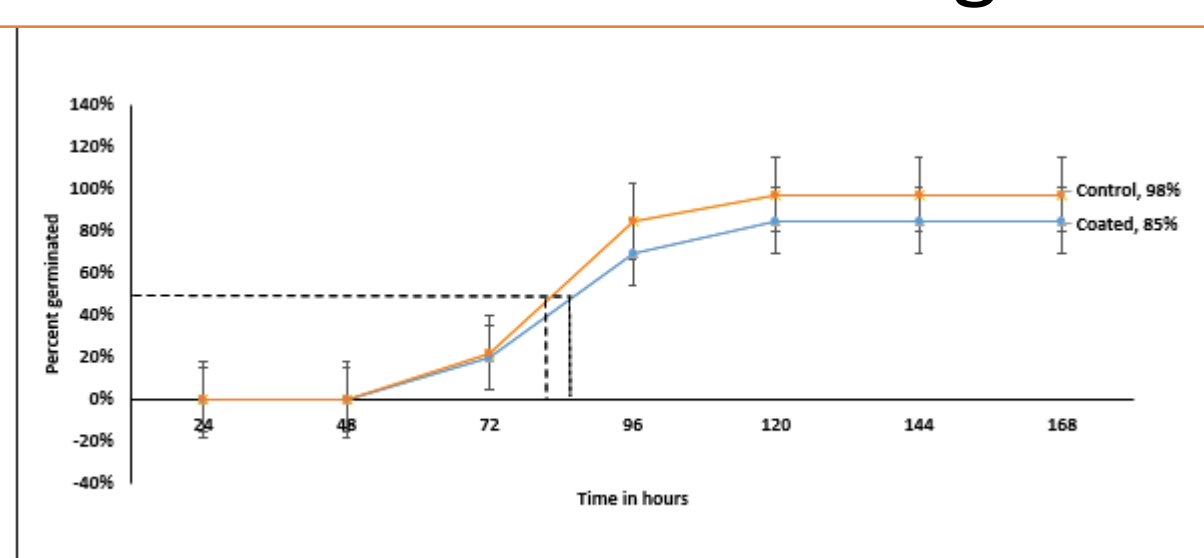
Phe(Fmoc)-Gly

- Low molecular weight
- Hydrogelator
- Bind with metal ions via electrostatic interactions

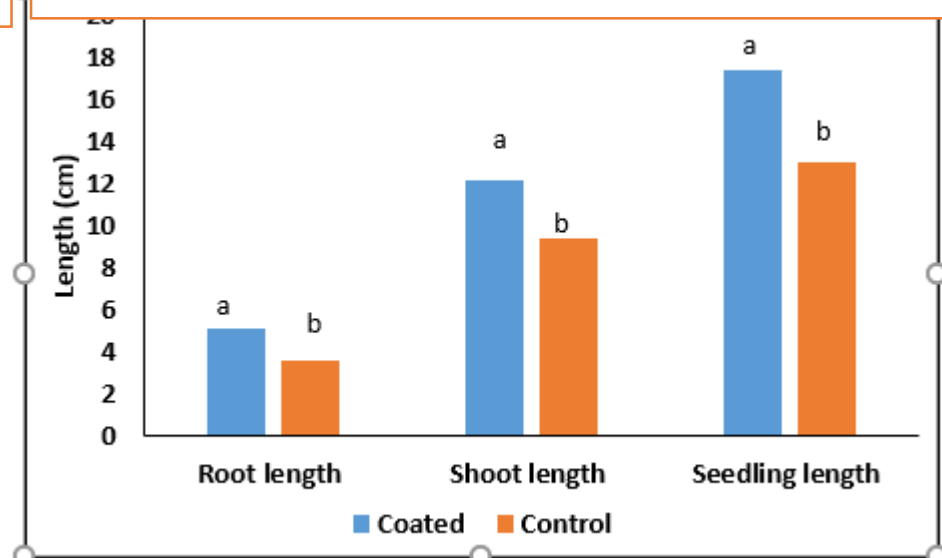
¹H NMR spectrum of synthesized Phe(Fmoc)-Gly in DMSO -d₆



Total Germination Percentage and Rate

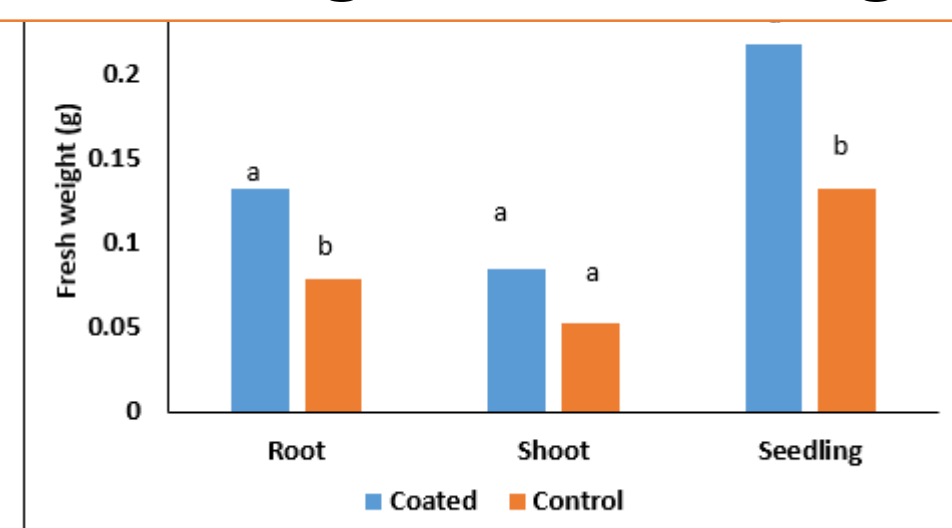


Dry Weight of Seedlings

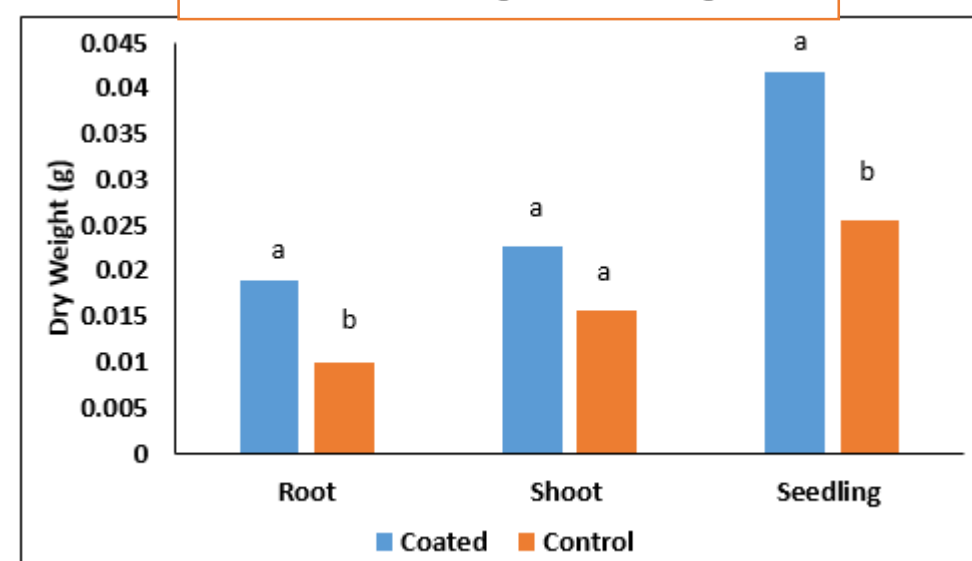


The cumulative percent germination of coated vs non-coated maize seeds after one week showed increased growth.

Fresh Weight of Seedlings



Seedling Length



5. Conclusion

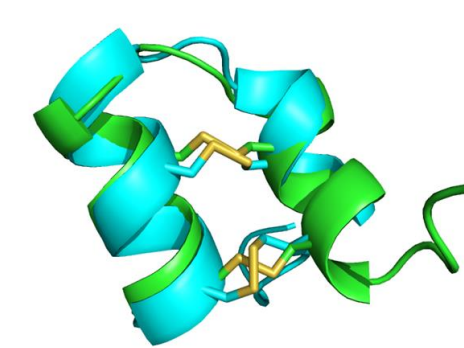
- A. Peptide incorporated hydrogel seed coating has showed a favorable impact on seed germination compared with the non coated control

1. Background

Conventional agricultural uses extensive of chemical fertilizers and pesticides, which have adverse environmental and health impacts.



- Application of peptide coatings is a recent advance in agriculture.

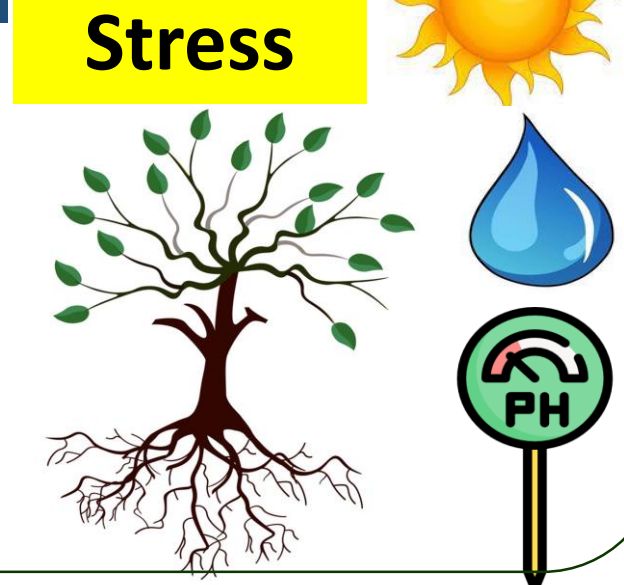


- Peptide based hydrogels are used to improve nutrient use efficiency of germinating seeds.
- Peptide based post harvest treatment for increased shelf life.

Bio-stimulants

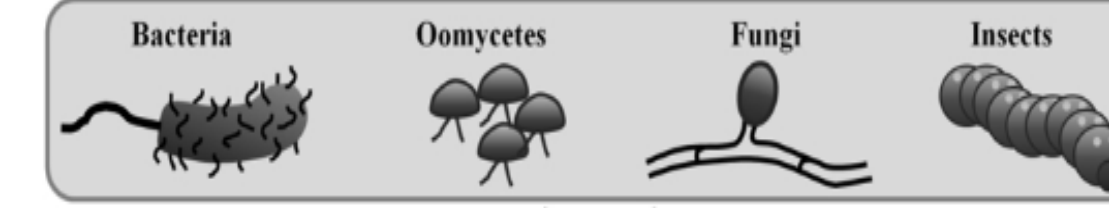
Compound or mixture of various organic compounds of natural origin that can promote plant growth under various environmental stresses

Abiotic Stress



Antimicrobial peptides (AMPs)

Biotic Stress



Peptides produced by a wide range of organisms and serve as their natural defenses against infection caused by bacteria, viruses and fungi.

2. Objectives

- To incorporate peptides into the hydrogel and formulate the seed coating for seed germination and seedling growth of maize seeds
- To develop an anti-microbial peptide formulation to reduce postharvest damage of strawberries

6. Future Direction

- Incorporation of nanocomposites can enhance the delivery and stress degrading of peptides in soil. Reduction of the coating thickness.
- Study the postharvest treatment on the other fruits

7. Acknowledgement

We would like to acknowledge the university of Sri Jayewardenepura (ASP/01/RE/SCI/2022-14) for funding.



8. References

- Yongsawatdigul, J.; Hamzeh, A., Bioactive Peptides from Agriculture and Food Industry Co-Products: Peptide Structure and Health Benefits. Innovation in the food sector through the valorization of food and agro-food by-products 2021.
- Shubha, K.; Kumar, R., Bio-Stimulants: An Approach towards Conservation Agriculture. Kumar Rakesh and Koteswara Rao, K.(eds.). 2018, 254.
- Keymanesh, K.; Soltani, S.; Sardari, S., Application of antimicrobial peptides in agriculture and food industry. World Journal of Microbiology and Biotechnology 2009, 25, 933-944.

B. AMP formulation to reduce postharvest damage of strawberries

3. Method

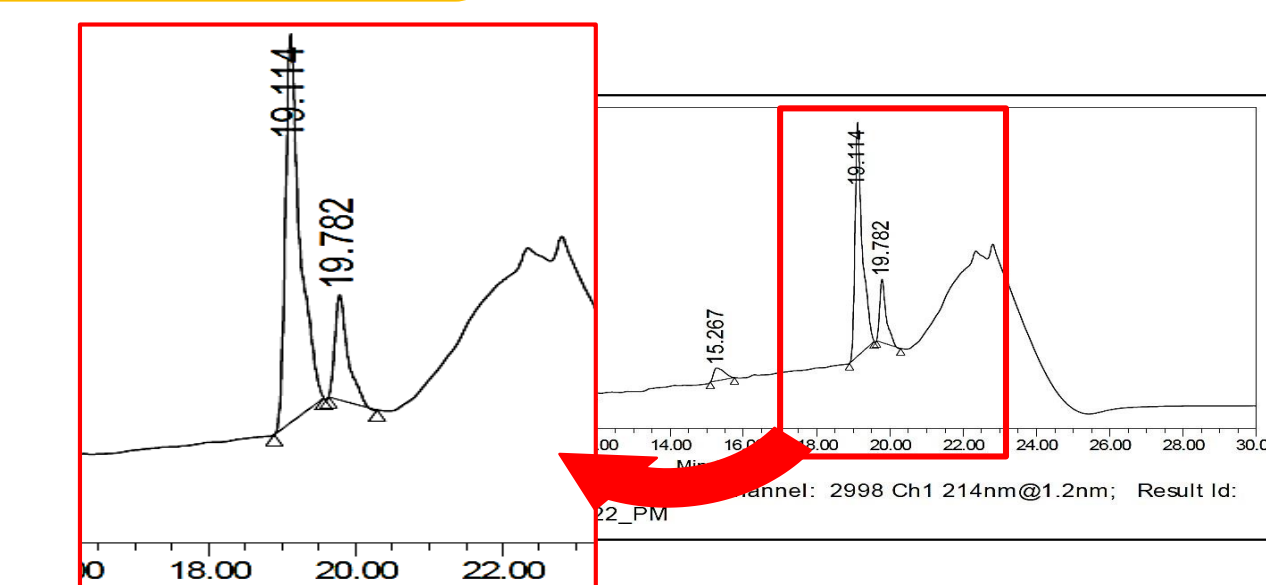
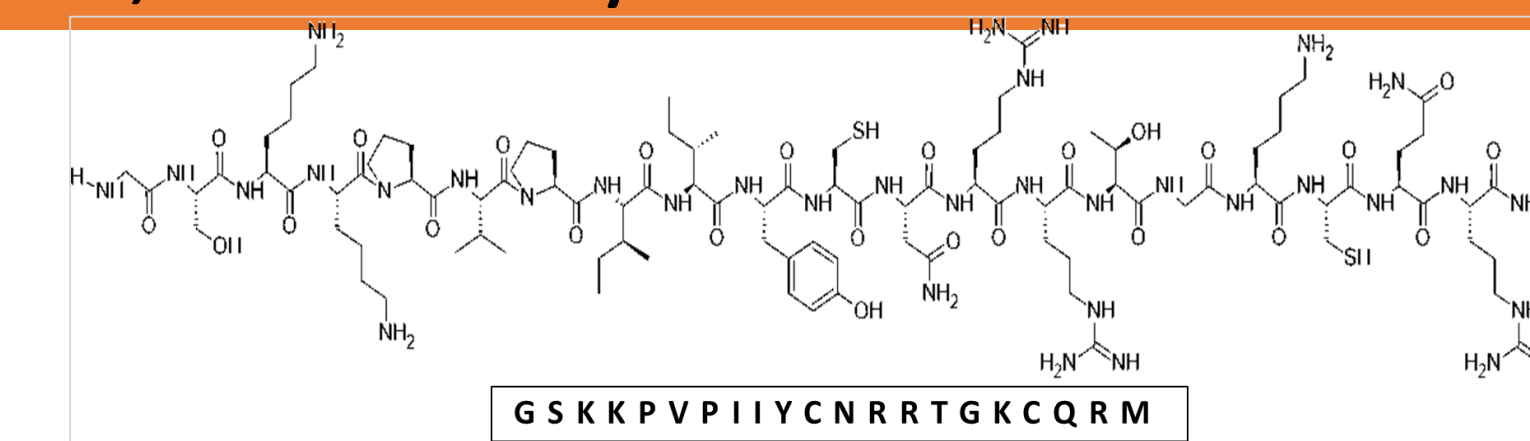
- Step 1 Synthesis of the peptide
- Step 2 Characterization of the peptide Optimization of Pectin coating thickness
- Step 3 Development of coating formulations
- Step 4 Application of the coating on strawberries
- Step 5 Determination of the postharvest quality of strawberries

Determination of the Postharvest Quality

- Weight Loss
- Brix Index
- pH value
- Titrateable Acidity
- Visual Observation

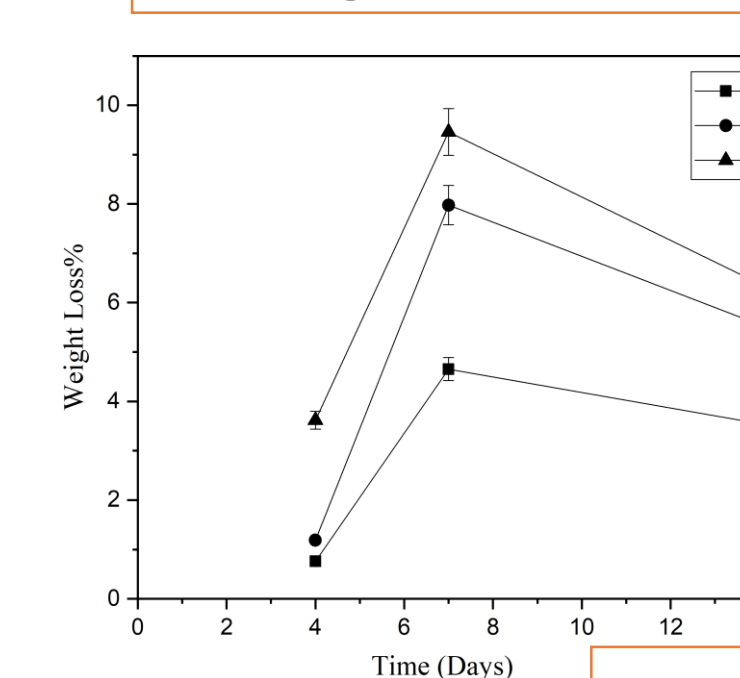
4. Results & Discussion

Thanatin-AMP, No toxicity on mammalian cell lines.

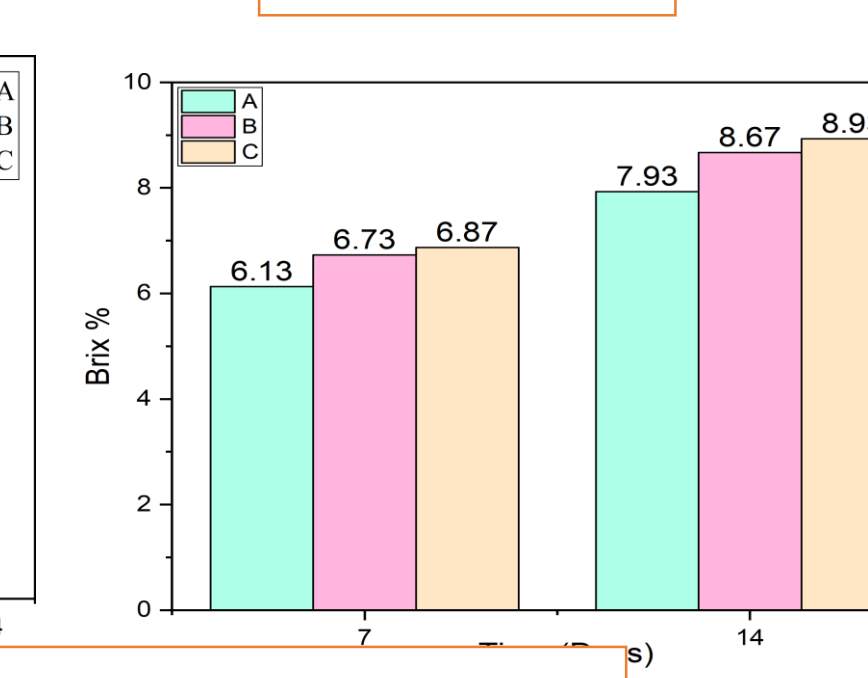


Analysis of the peptide using HPLC

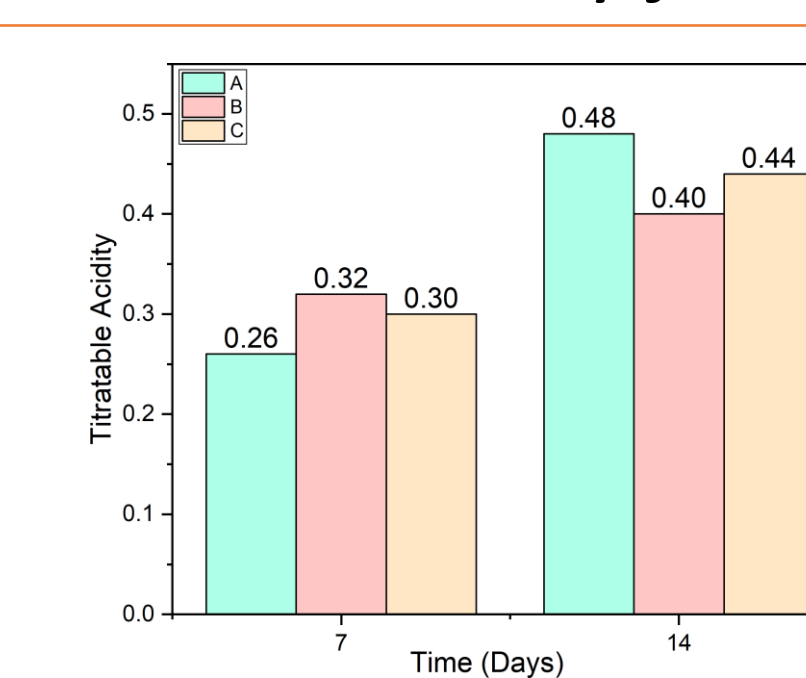
Weight loss %



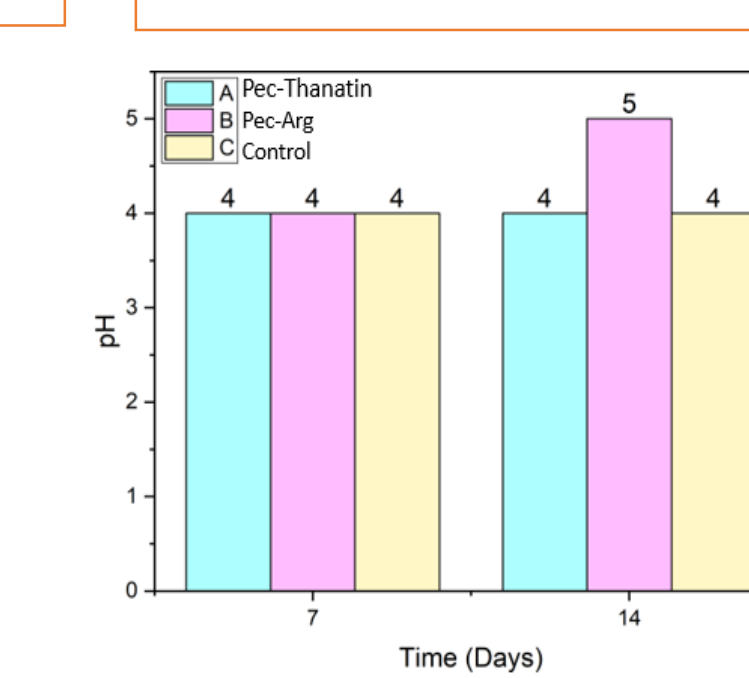
Brix Index



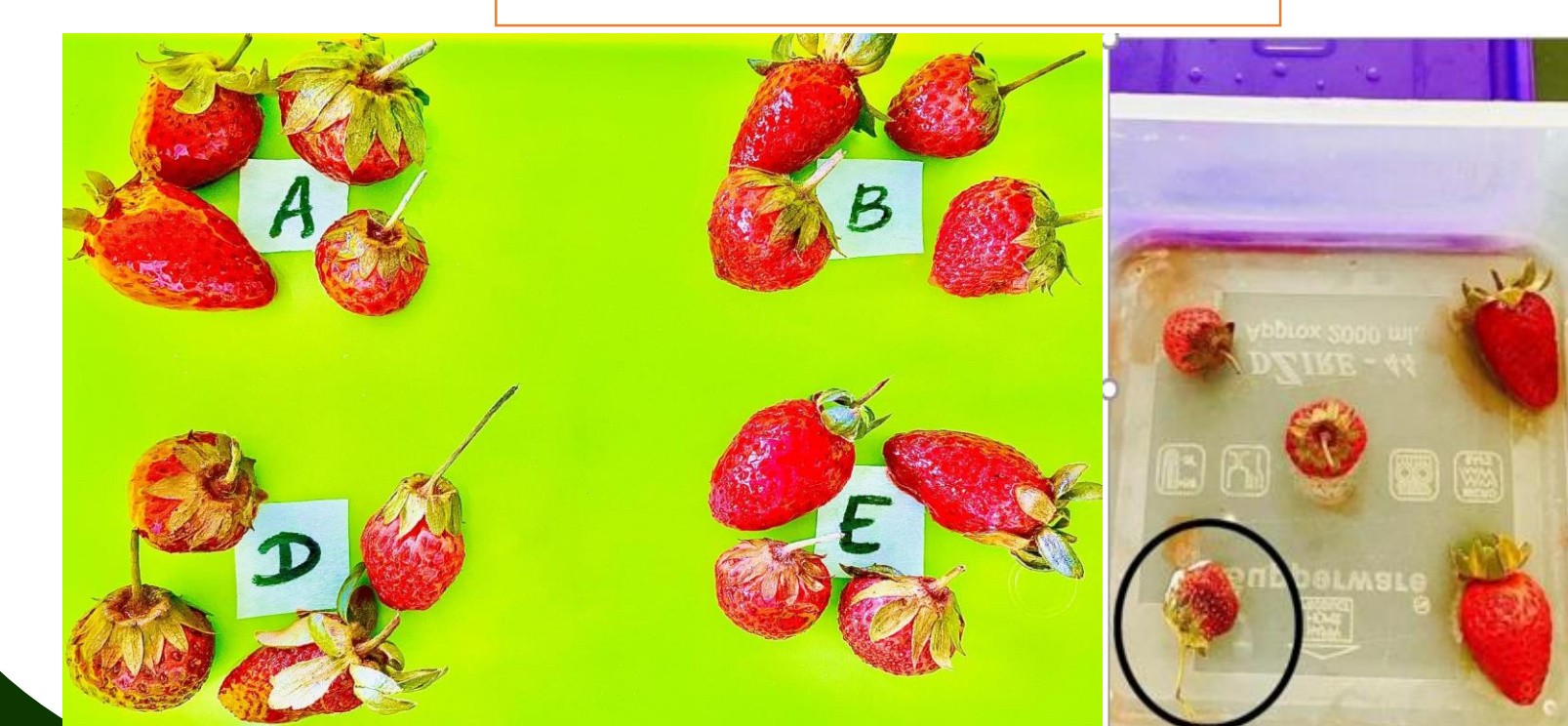
pH of strawberry juice



Titrateable Acidity



Visual Observations



- High effectiveness in Thanatin-Pectin coating was concluded based on weight loss%, Brix index, pH value, titrateable acidity and visual observations.
- Effectiveness of Pectin-Thanatin coating was significantly higher than the Arg-Pecting and uncoated fruits in to measure 14th day after coating.

5. Conclusion

- Peptide treatment attenuates postharvest decay and maintains quality of strawberry fruit