IOCG 2025 Conference

The 1st International Online Conference on Gels

03–05 December 2025 | Online

MDPI

Design of novel biodegradable hydrogel scaffolds for the cultured meat production

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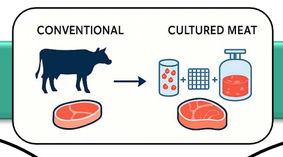
INTRODUCTION & AIM



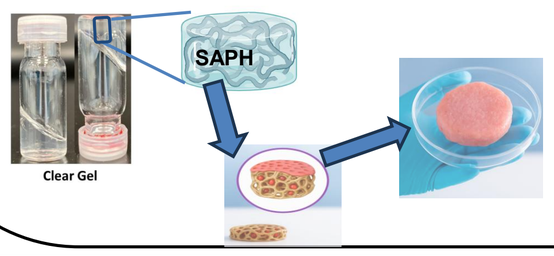
Traditional Meat Challenges

!! Global meat consumption has tripled since 1961 and is expected to increase by 76% by 2050, putting pressure on traditional livestock farming.

!! Increasing impact on sustainability and human health – *Environmental Impact (15%GHS), Animal welfare, Food security, Disease transmission and antibiotic resistance.*

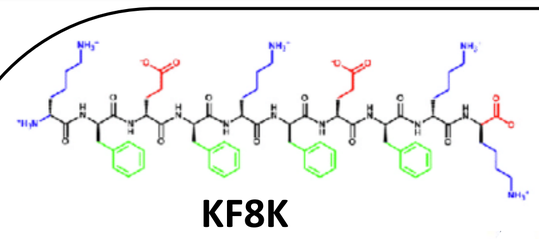
Design of 3D scaffolds for cell culture remains a significant challenge

Aim - 'Developing a ***cost-effective***, ***edible***, and ***scalable peptide hydrogel scaffold*** combined with a **microcarrier system**.

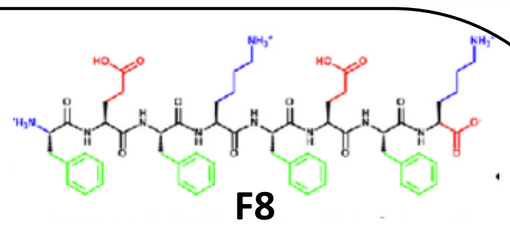


Peptide hydrogels are fully synthetic (reproducible), biocompatible (ingestible), and cost-effective (scalable production)

METHOD

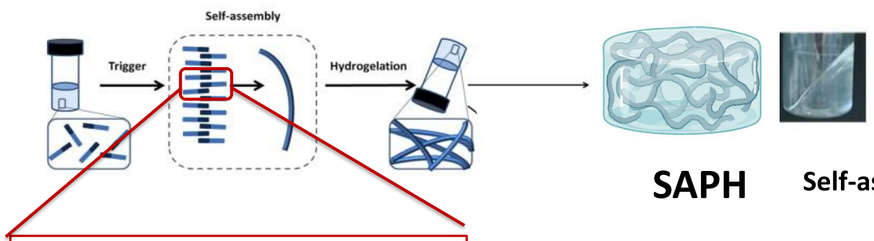


KF8K



F8

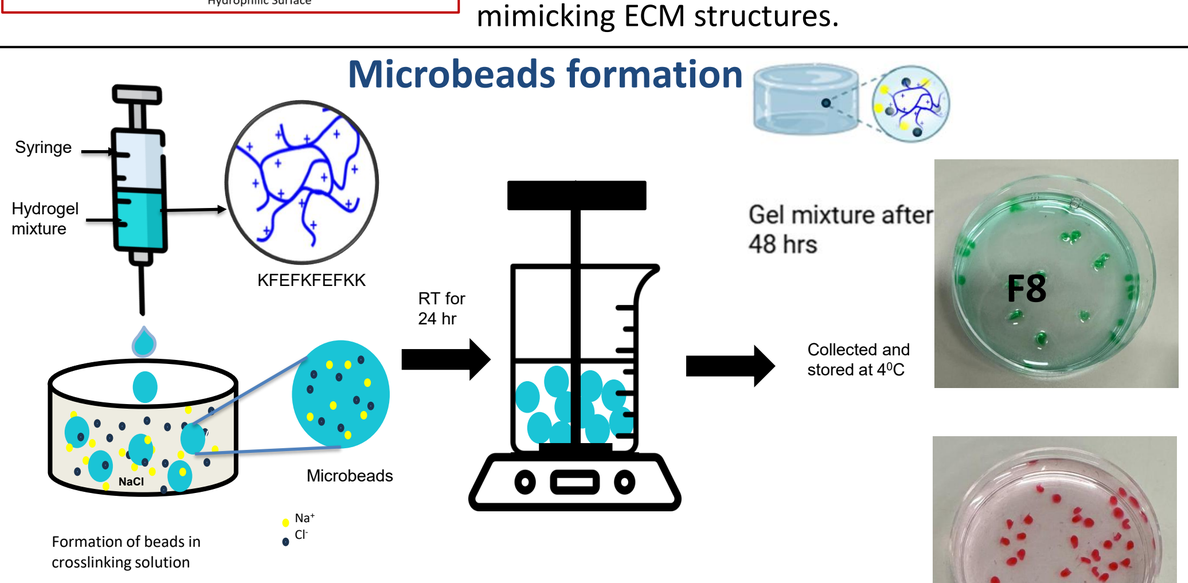
SAPH formation



SAPH **Self-assembly β-sheet formation**

Peptide hydrogels form via self-assembly driven by non-covalent interactions like hydrogen bonding, π-π interactions and hydrophobic interactions from the β sheet arrangements, producing fibrous networks mimicking ECM structures.

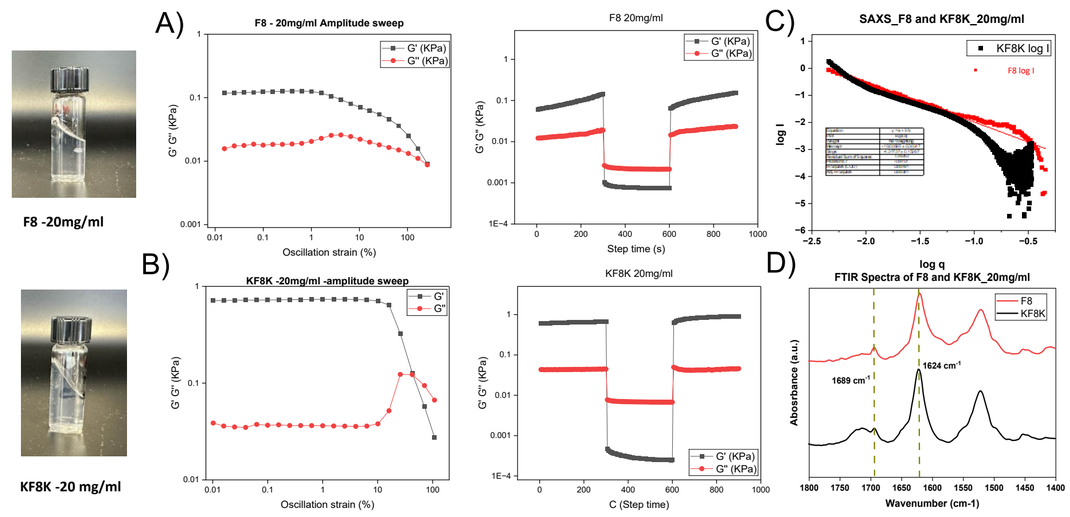
Microbeads formation



A tiny particle that helps cells to grow and multiply by providing them a surface to attach to either in the form of beads or fibres with the size range 100 – 300 µm. A 3D environment that mimics natural tissue.

RESULTS & DISCUSSION

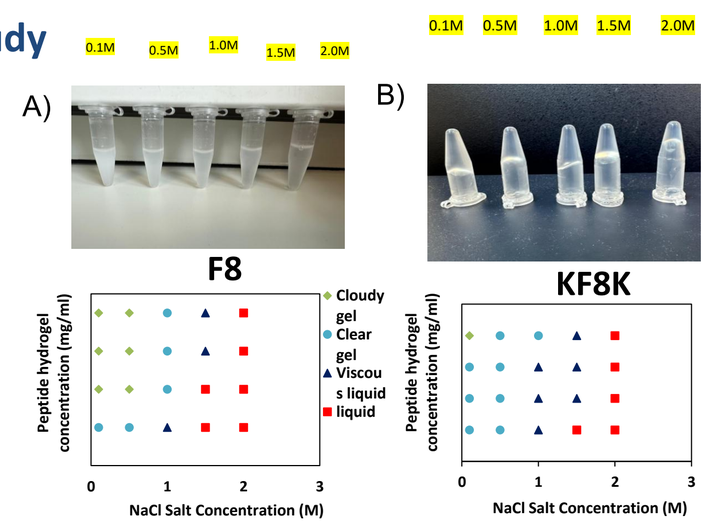
F8 –KF8K physiochemical study



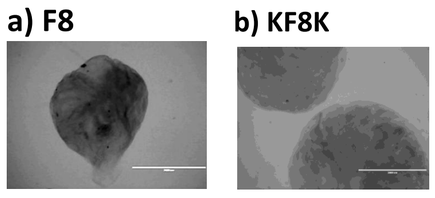
A) Amplitude sweep test of F8 followed by time sweep, B) Amplitude sweep test of KF8K followed by time sweep, C) SAXS data of both F8 and KF8K to show the fibre diameter. D) FTIR data of F8 and KF8K show the β sheet peaks

Effect of Salt on F8 –KF8K Study

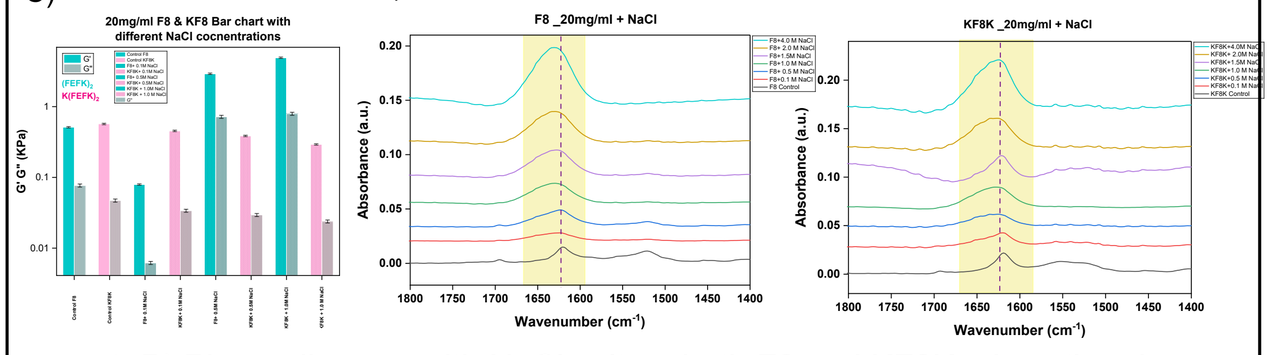
Phase changes – Low to high Salt concentration leads to more liquid phase from the cloudy phase.



a) F8 **b) KF8K**



Optical images of microbeads



A), B) Phase diagram with NaCl salt on both F8 and KF8K – how the phase changes when NaCl salt. C) Oscillation strain vs Storage modulus (G') – effect of salt on peptide hydrogels, indicating gel stiffness when adding NaCl from lower to higher concentration. D) FTIR data show the presence of a β-sheet peak even after adding NaCl salt in both F8 and KF8K.

CONCLUSION

This work demonstrates the potential of F8 and KF8K as promising scaffolds for cultured meat production. By tailoring the F8 and KF8K composition, salt-induced assembly, and good culture conditions, we can create tunable, edible, and biocompatible structures that support both muscle and fat cell growth.

FUTURE WORK / REFERENCES

- Conduct cell culture studies with bovine muscle and fat cells to evaluate biocompatibility and tissue formation.
- Integration of cell and microcarriers for cell proliferation
- Integrate bioactive molecules (e.g., growth factors) to enhance proliferation and ECM deposition.
- Optimise 3D bioprinting parameters to fabricate structured muscle–fat constructs.