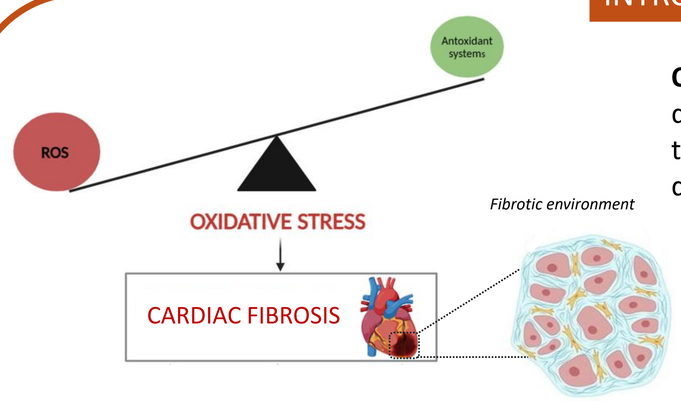
# Chitosan hydrogels for the modulation of oxidative stress in cardiac fibrosis

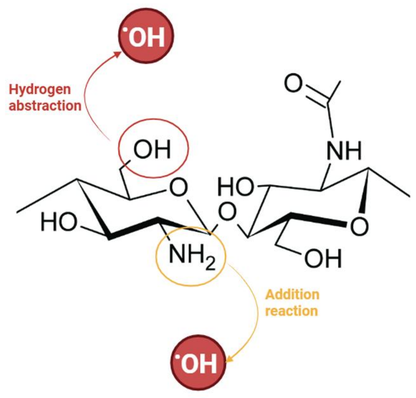
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## INTRODUCTION



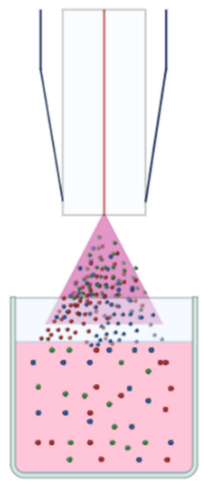

**Oxidative stress** plays a central role in **cardiac disease**, driving **fibrosis**, inflammation, and tissue remodeling through excessive reactive oxygen species (ROS) that disrupt redox signaling and damage cells [1].



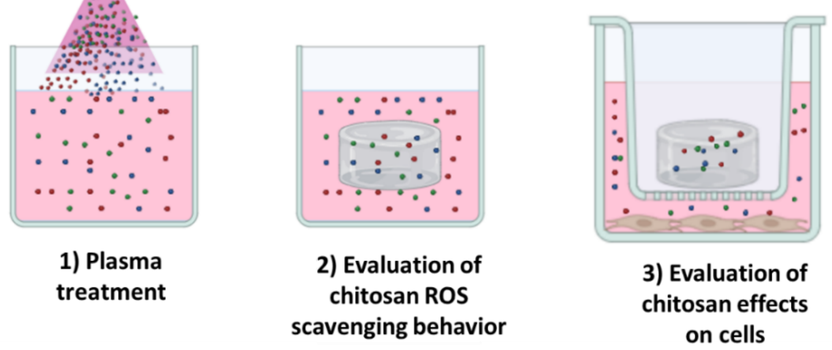

**Synthetic ROS scavengers**, particularly **biomaterials** with tailored properties, offer a strategic solution, thanks to the controllable chemical synthesis [2].

**Chitosan**, a biocompatible biomaterial bearing **ROS-reactive amino and hydroxyl groups**, offers promising redox control [3,4].

## AIM OF THE WORK



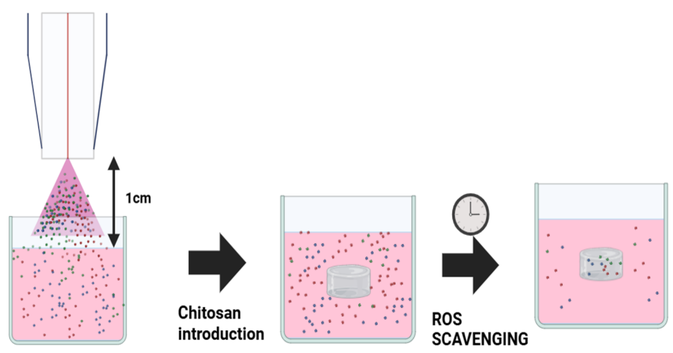
Investigation of **chitosan hydrogels** as **oxidative stress modulators**, highlighting their capacity for ROS neutralization and attenuation of **cardiac fibrotic** response *in vitro.*




## MATERIALS AND METHODS

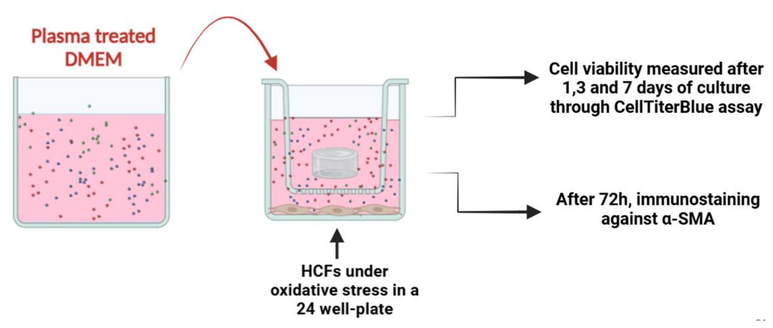
Chitosan hydrogels at **different concentrations and deacetylation degree** were prepared.

**Controlled ROS doses** were generated in physiological medium using an atmospheric pressure **plasma jet system** to mimic pathological oxidative stress conditions.



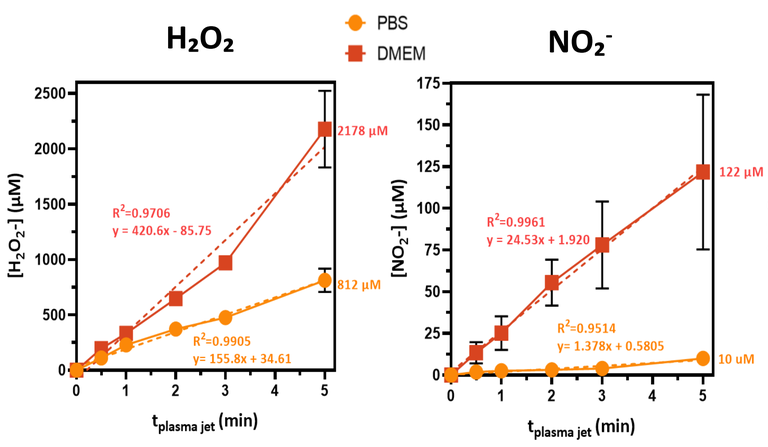

**Antioxidant activity of hydrogels** was derived from **ROS depletion** of **APPJ-treated medium** in contact with chitosan hydrogels and by *in vitro* tests with human cardiac fibroblasts (HCFs).

**Cell viability** and **α-smooth muscle actin (α-SMA)** expression served as indicators of **redox balance** and **pro-fibrotic activation**.



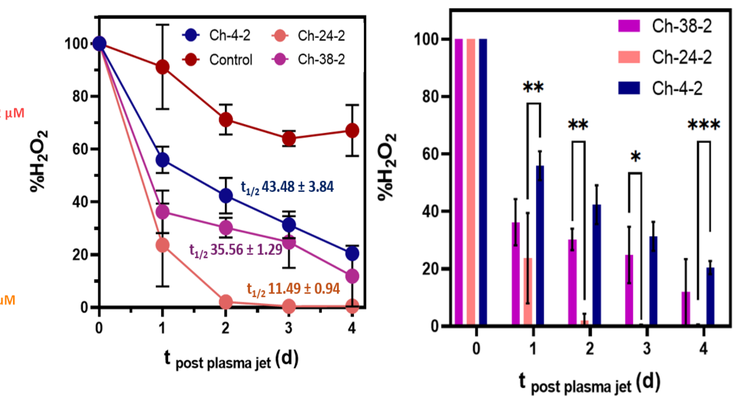

## RESULTS

### $NO_2^-$ and $H_2O_2$ generation in physiological media



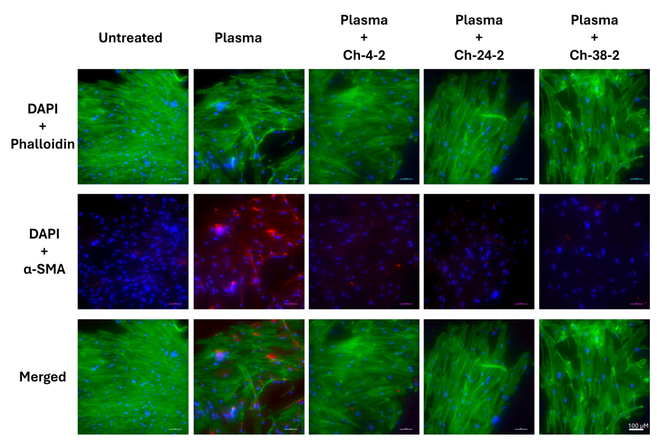

**$NO_2^-$ and $H_2O_2$** generation in PBS and DMEM showed a **linear increase** with the increasing of plasma treatment time, allowing to generate a **controlled ROS doses**.

### Chitosan scavenging effect on $H_2O_2$




Chitosan hydrogels showed **marked ROS-neutralization activity**, confirming their antioxidant properties with **intermediate DA achieving optimal ROS neutralization.**

### Chitosan antioxidant activity on human cardiac fibroblasts




Under oxidative conditions mimicking cardiac stress, HCFs showed **fibrotic activation**. However, their culture with chitosan hydrogels preserved **decreased α-SMA expression.**

## CONCLUSION AND FUTURE PERSPECTIVES

- It is possible to generate a **tunable amount and type of ROS** in media within **short treatments time.**
- **Chitosan hydrogels** could be considered as a potential regulatory $H_2O_2$ system.
- **Chitosan hydrogels** $H_2O_2$ scavenging capacity is able to **prevent fibrotic gene expression** in HCFs subjected to **oxidative stress.**
- Supporting qualitative immunofluorescence analyses with **quantitative techniques** such as qPCR and Western Blot.
- In vitro experiments to study chitosan hydrogels **anti-inflammatory** capacity on **macrophages** in an under induced inflammatory conditions.

## REFERENCES

1. Y. E. Kim and J. Kim. ACS. 2022.
2. J. Zhang et al., Adv. Mater. Interfaces. 2020.
3. S. Kim. Int J Polym Sci. 2018.
4. I. Younes and M. Rinaudo. Mar. Drugs. 2015.

## ACKNOWLEDGMENTS

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let's connect!