# PHYSICAL AGING of CARBOPOL

DIPTESH BISWAS

# CONTENTS

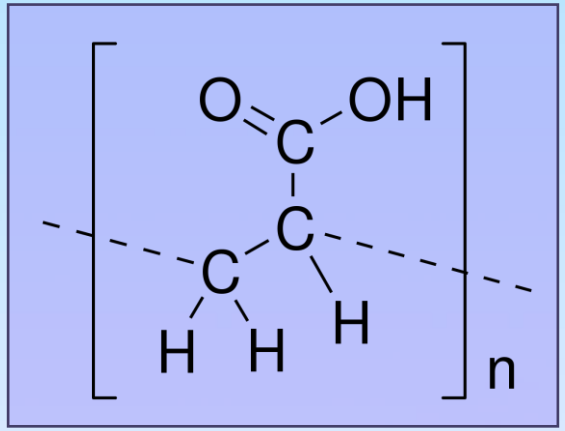
# OBJECTIVE

- To understand **physical aging** of **Carbopol**

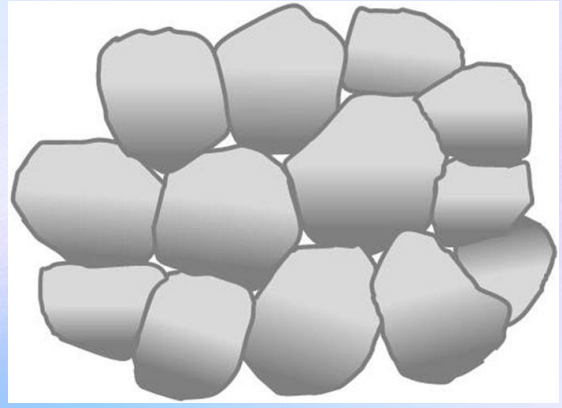
# INTRODUCTION

## What is Carbopol?

- Carbopol is a gel
- Gel is formed due to swollen of water and crosslinks between polyacrylic acid and dispersed particles
- Diameter 0.2-6μm, pH 3-5




Polyacrylic acid[1]



Schematic microstructure representation of Carbopol[2]



1. Wikipedia (https://en.wikipedia.org/wiki/Polyacrylic_acid)
2. M. Agarwal and Y. M. Joshi, "Signatures of physical aging and thixotropy in aqueous dispersion of Carbopol," *Phys. Fluids*, vol. 31, no. 6, 2019, doi: 10.1063/1.5097779.

# METHODOLOGY

## Material

- 0.2wt% of Carbopol gel made in 2020

## Rejuvenation

- Constant shear rate of $200s^{-1}$ for 80secs

## Aging Test

- Small amplitude oscillatory test
- $\dot{\gamma}_o = 0.01$, f = 0.1Hz for 10mins and 3mins

## Creep Test

- Oscillatory stress sweep test for 60secs
- Stress amplitude of 5Pa at 1Hz

# RESULTS

## Storage Modulus

- Weakly aging
- No distinguishing features in the storage modulus

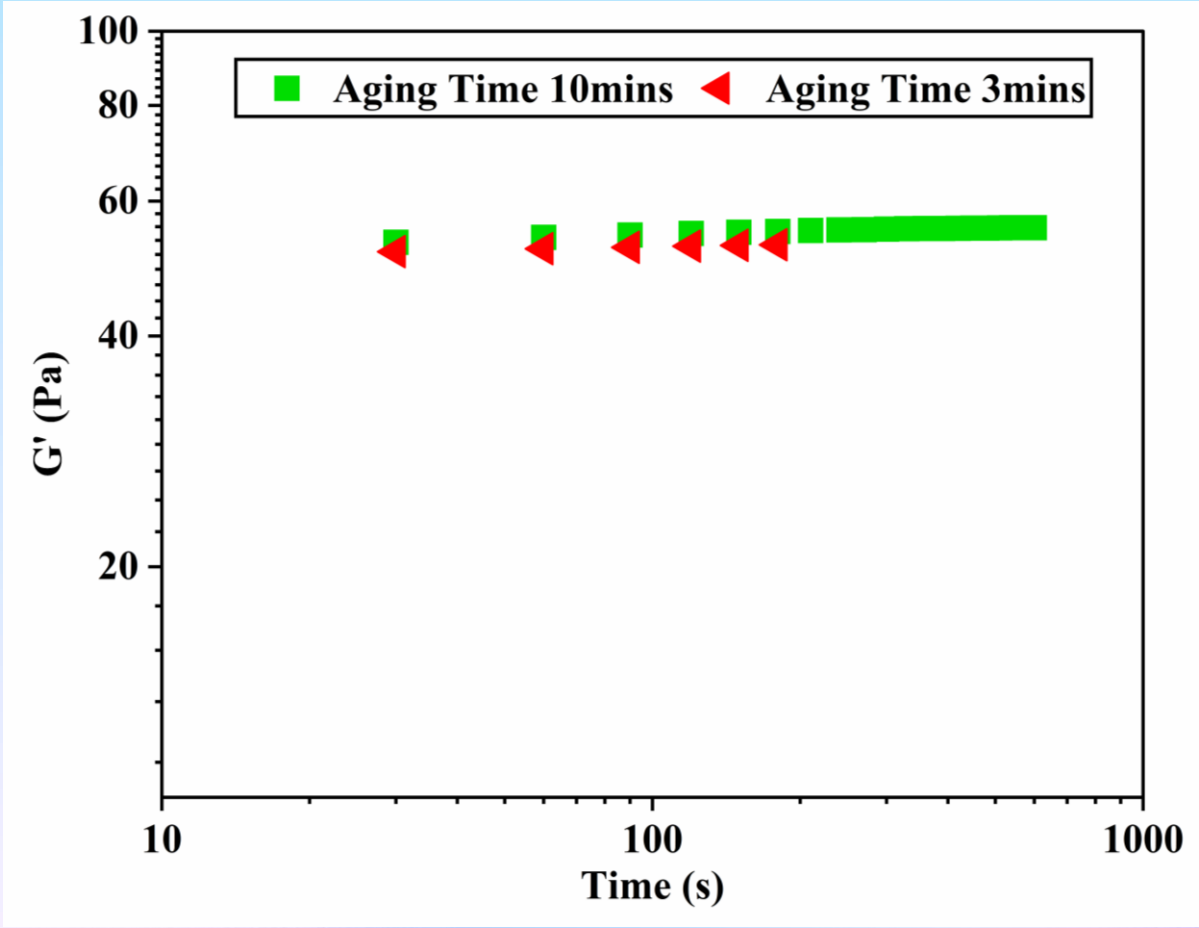



Figure: Storage modulus vs time

# RESULTS

## Creep Test

- Comparatively strong increase in Creep behavior

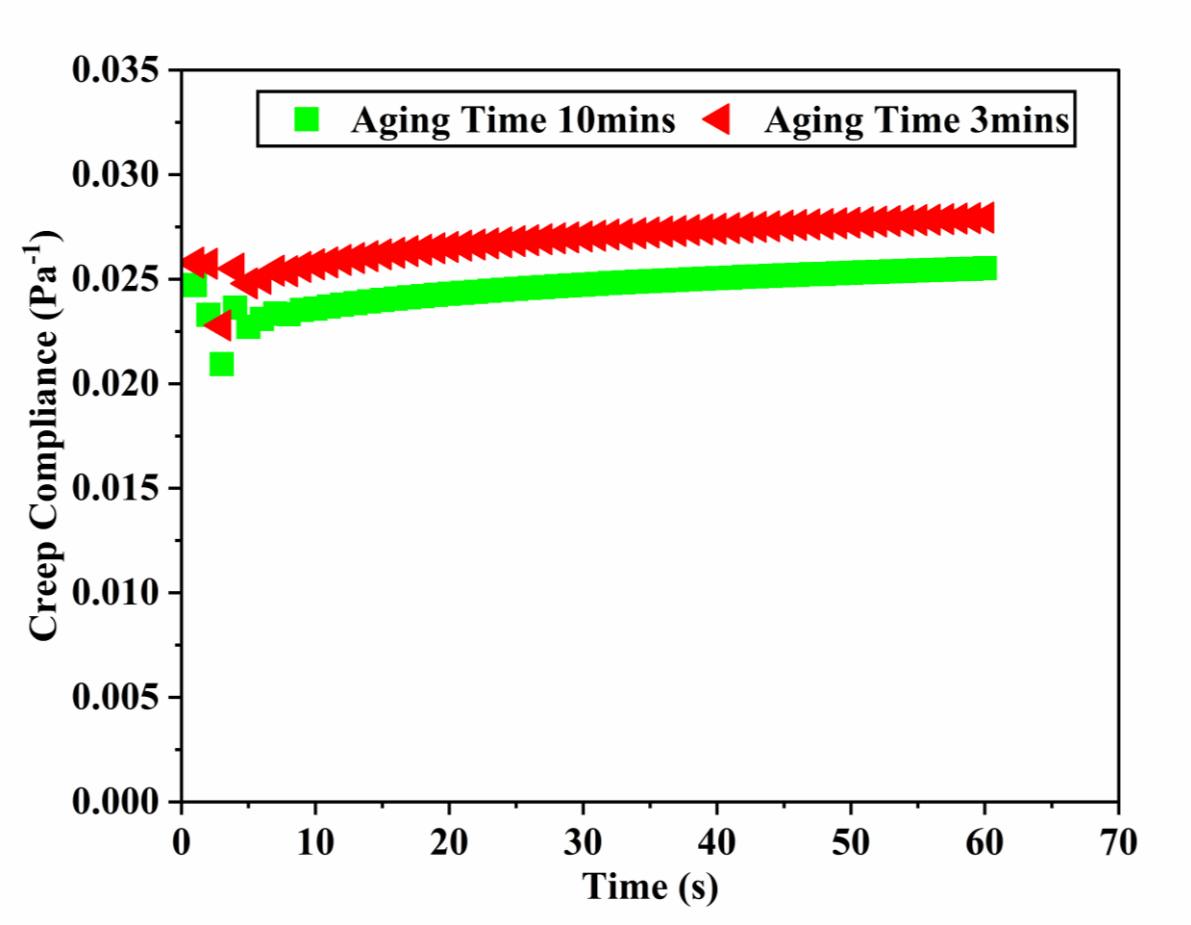



Figure: Creep compliance vs time

# CONCLUSION

- **Storage modulus shows a weak change as a function of time**
- **Creep test shows a strong change in behavior to give the assurance of physical aging**

# REFERENCES

1. M. Agarwal and Y. M. Joshi, “Signatures of physical aging and thixotropy in aqueous dispersion of Carbopol,” *Phys. Fluids*, vol. 31, no. 6, 2019, doi: 10.1063/1.5097779.

# THANK YOU