

# Flavonoid loaded solid lipid nanoparticles in Pluronic gel for combating dry eye disease

<sup>1</sup>Samiullah Khan, <sup>1,2</sup>Chi Wai Do, <sup>1,3</sup>KaHing Wong, <sup>1,4,5</sup>Emmanuel A. Ho

<sup>1</sup>Centre for Eye and Vision Research (CEVR), 17W Hong Kong Science Park, Hong Kong; <sup>2</sup>School of Optometry, The Hong Kong Polytechnic University, Hong Kong;

<sup>3</sup>Department of Food Science and Nutrition, The HK Polytechnic University, <sup>4</sup>School of Pharmacy, University of Waterloo, Waterloo, Canada; <sup>5</sup>Waterloo Institute for

## Background

Dry eye disease (DED) is a dynamic multifactorial ocular disease accompanied by increased tear osmolarity, oxidative stress and ocular surface inflammation. Current effective therapies for DED are very limited. Flavonoids (Flav), class of secondary metabolites are natural phenolic compounds widely present in different plants reported to possess potent anti-inflammatory, anti-apoptotic and anti-oxidative properties.

## Objectives

To explore the therapeutic potential of flavonoid loaded lipid nanoparticles in pluronic gel in dry eye conditions by investigating their

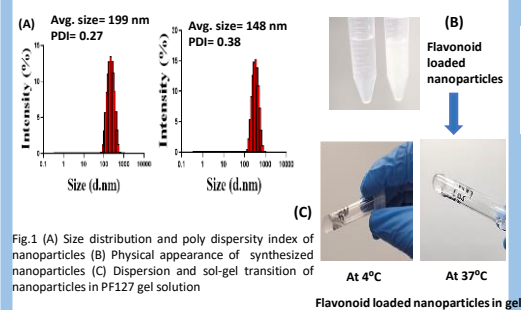
- Anti-inflammatory effect
- Anti-apoptotic effect
- Anti-oxidative effect
- Regulation of Mitochondrial membrane potential (MMP)

## Methods

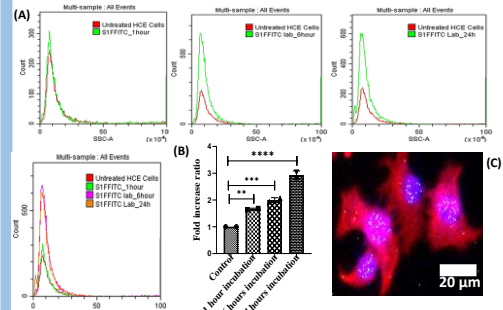
Flavonoid loaded lipid nanoparticles (Flav Nanoparticles) were fabricated by oil in water emulsification-ultrasonication technique. While lipid nanoparticles in Pluronic gel were prepared by cold method. Cellular uptake of nanoparticles by human corneal epithelial cells (HCECs) were checked by flow cytometry and confocal microscopic analysis. HCE cells based DED model was established by increasing the osmolarity of the medium from 312 mOsm (control) to 450 mOsm (DED) *via* addition of sodium chloride. Anti-inflammatory effect of flavonoid loaded formulations was investigated by qPCR analysis under DED conditions. Anti-oxidative effect was conducted by DCFH-DA assay under DED conditions. Anti-apoptotic effect was investigated by Annexin V-FITC apoptosis assay under DED conditions. Effect of flavonoid loaded formulations under DED conditions on MMP regulation was checked by JC-1 assay.

## Experimental Results

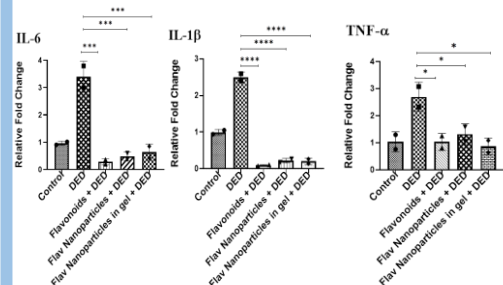
### 1. Flavonoid loaded nanoparticles and gel fabrication



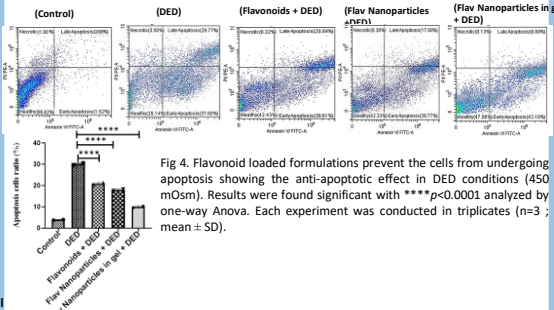
### 2. HCE Cellular uptake of nanoparticles



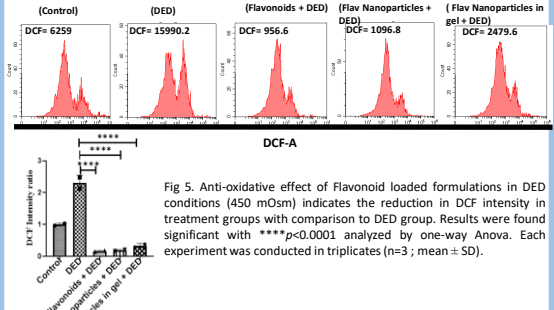
### 3. Anti-inflammatory effect of formulations in DED conditions



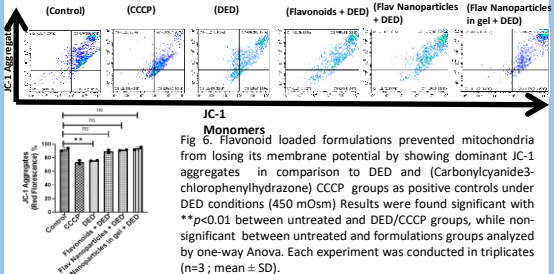
### 4. Anti-apoptotic effect of formulations in DED conditions



### 5. Anti-oxidative effect of formulations in DED conditions



### 6. Effect of formulations on MMP regulation in DED conditions



## Conclusion

We believe that flavonoid loaded formulations has the potential to be used as alternate therapy in treating DED.