

# COMBINING IN SILICO AND IN VITRO TOOLS FOR ASSESSING INHALATION HAZARD OF SODIUM DODCEYL SULPHATE EXPOSURE

Sreyoshee Sengupta\*, Hugh Barlow#, Maria Baltazar#, Jorid B.Sørli\*

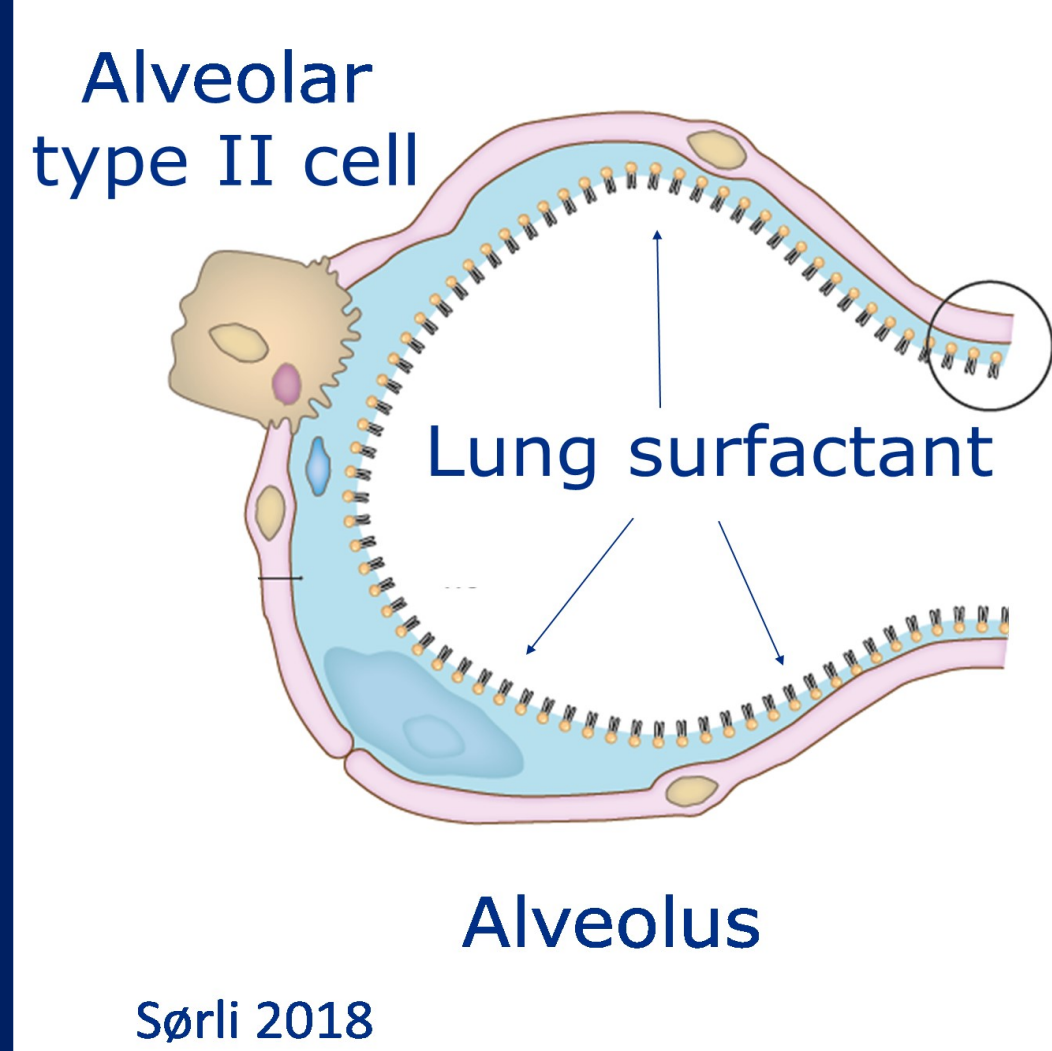
\*The National Research Centre for the Working Environment, Lersø Parkalle 105, 2100, Copenhagen, Denmark

#Unilever safety and Environmental Assurance Centre, Colworth Park, Sharnbrook, Bedfordshire, MK44 1LQ, United Kingdom

## Key Questions:

1. Can we study the effects of Sodium Dodecyl Sulphate (SDS) exposure on lung surfactant function *in vitro* ?
2. Can we study the effects of SDS on the visco-elastic properties of lung surfactant?
3. Can we use this information to address future inhalation hazard of SDS aerosols as an alternative to animal testing?

## Lung Surfactant



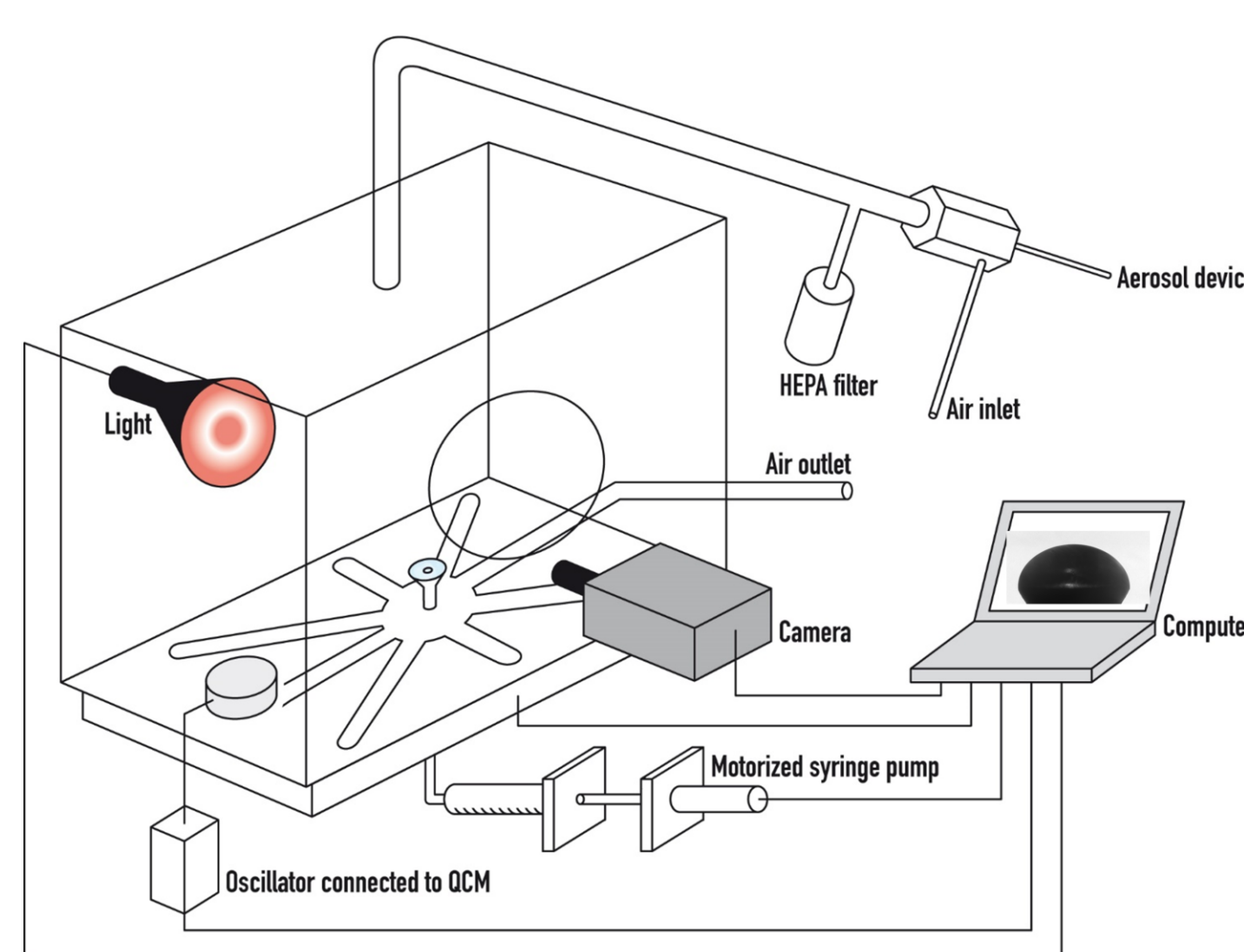
- Film at the air-liquid interface composed of 90% lipids + 10% proteins.

**Function: surface tension regulation** allowing effortless breathing and prevent lung collapse.

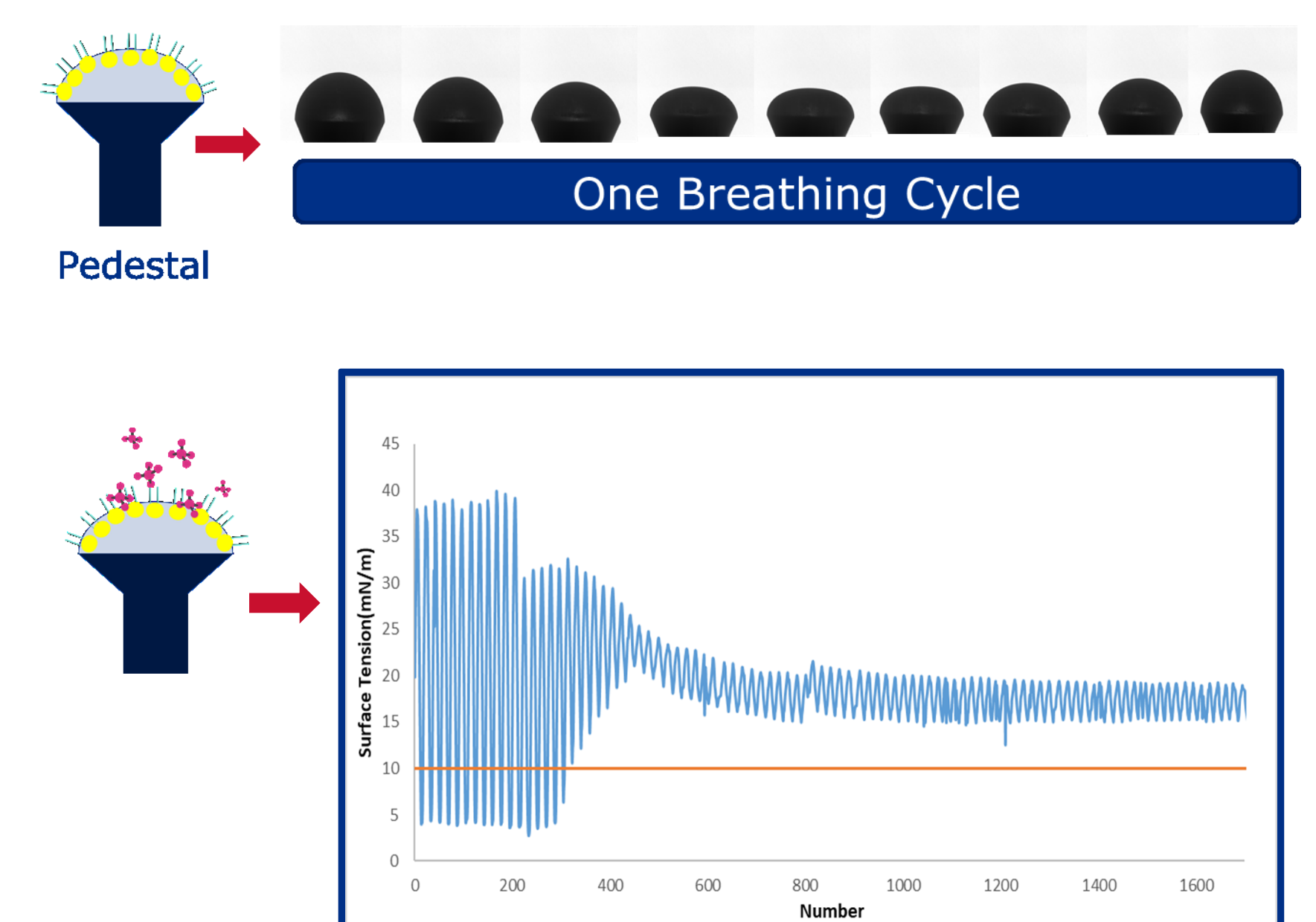
Lung surfactant function inhibition leads to alveolar collapse resulting in difficulty in breathing.

## Methodology

a) *In vitro* LS bioassay : based on the constrained drop surfactometer



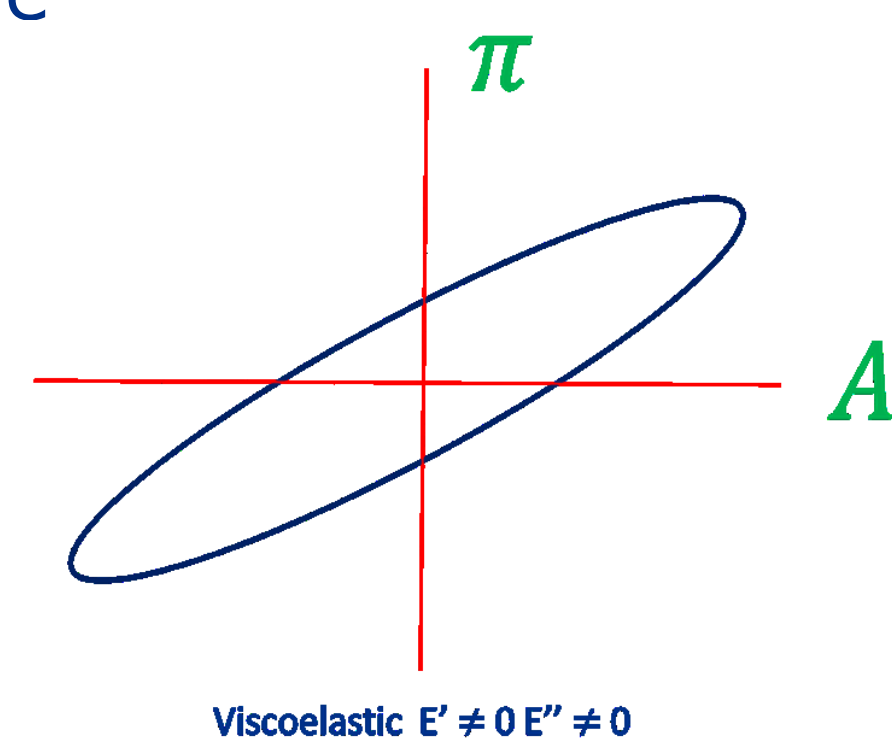
b) Measurement of LS function



LS inhibition

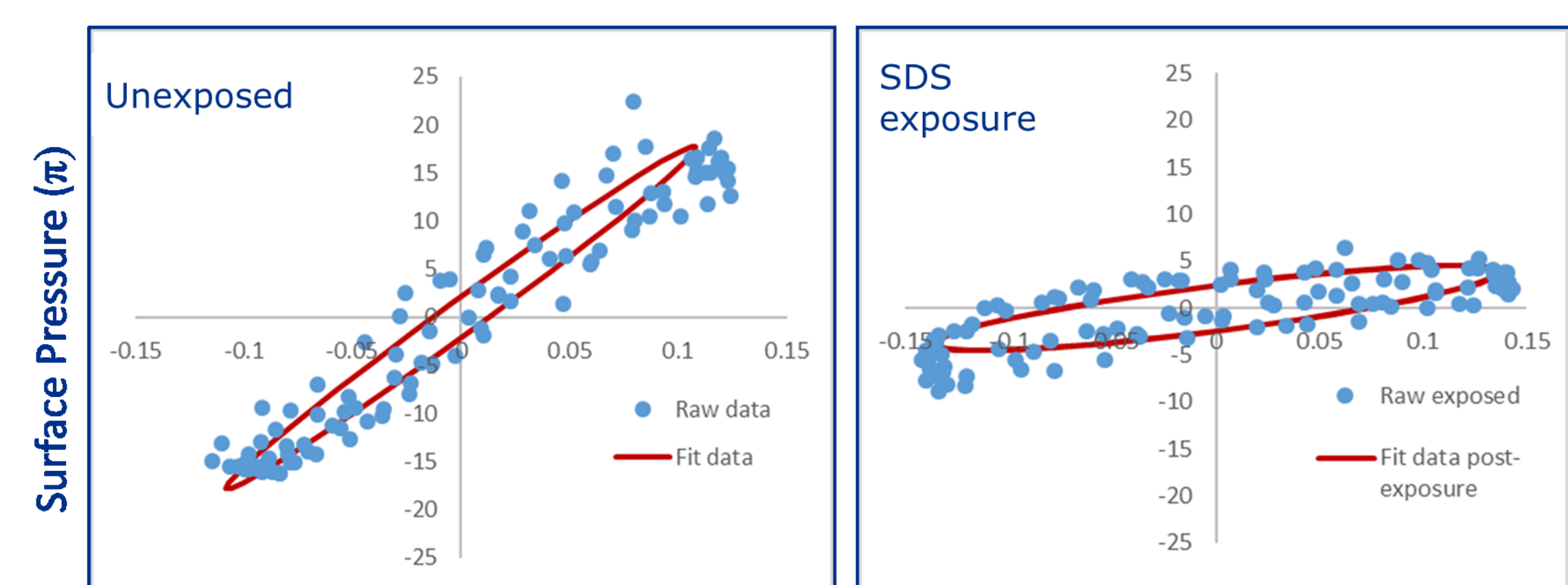
## Investigating viscoelastic properties of lung surfactant

- Lung surfactant is viscoelastic in nature
- The Fourier Transform Tensiometry method : periodic oscillation of lung surfactant drop
- Area :  $A(t) = A_0 \sin \omega t$
- Surface pressure :  $\pi(t) = E' A_0 \sin \omega t + E'' A_0 \cos \omega t$ ,  $\omega$  mode of oscillation of the droplet size
- Viscoelastic properties determined by  $E' =$  storage moduli,  $E'' =$  loss moduli.

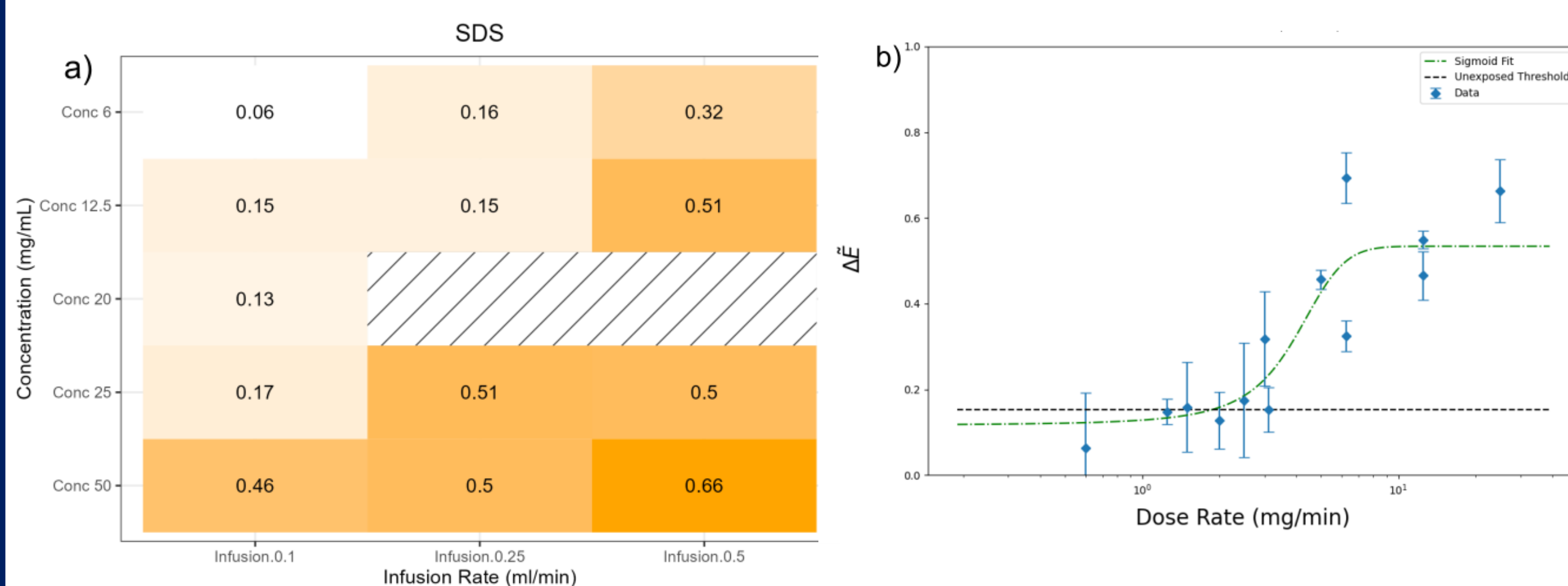


- Complex modulus  $E^* = E' + i E''$

## c) The Fourier Transform Tensiometry Method



## Results



a) Surfactant inhibition is determined by the normalized changes of the complex modulus.

b) Inhibition of lung surfactant is correlated to the dose rate.

## Conclusions

- The effects of SDS exposure on lung surfactant function *in vitro* is inhibitory at increasing concentrations and infusion rates.
- The Fourier Transform Tensiometry method allows to study the changes in the viscoelastic properties of lung surfactant when exposed to aerosolised SDS.
- Furthermore, the complex modulus from the method can be used to quantify lung surfactant function inhibition
- Inhibition of lung surfactant function on interaction with SDS aerosols in dose rate dependent.

## References :

Da Silva et al., *Curr. Res. in Tox.*, 2021  
Sørli et al., *Am. J. Respir. Cell Mol. Biol.* 2016  
Sørli et al., *Int. J. Pharm.* 2018

