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# *Inspiration to Application*

+ product development
+ process development
+ effective packaging
+ efficient manufacturing
+ sensory evaluation
+ analytical chemistry
+ winemaking
+ fermentation

# Economical Lees Management Strategies

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# Overview

Scope
- TEFF
- Aim of lees research

Lees
- What is it?
- Current Management Strategies
- Lees management issues

Viscosity
- Theory

Surfactants
- Types and Mode of action
- Tergitol L-62

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# Overview

Results

- Surfactant screening
- Settling
- Viscosity
- Sensory

Key outcomes

- Results summary

Benefits

- Lees Processing
- Environmental Impact

Recommendations

- Based on results

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# Scope

- Tarac's Environmental Future Fund (TEFF)
  - Established to help develop more sustainable ways of managing winery waste.
  - $20,000 scoping study

- Provisor successful applicant
  - Proposal to understand the flow properties of fermentation lees
  - Determine opportunities for improvement in lees management.

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# Lees

What is it?

- Residual yeast that aggregate/flocculate after fermentation
- Settles at the base of the wine tank
- Consistency of yoghurt, can contain up to 30% v/v solids
- Constitute between 2-4% v/v of wine volume

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# Lees

Current Management Strategies

- Dispose of lees to drain or to vineyard
- Ship lees directly from racking operations to Tarac (by-product extraction)
- Dilute lees and pump to RDV or lees press filter, solids sent to Tarac
- Pump lees directly to centrifuge or crossflow filter, solids sent to Tarac

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# Lees

Lees management issues

- Heavy/Viscous lees cause pipe blockages
- Difficulties in removing residual lees
- Stress on wastewater systems
- Wine loss and downgrade due to dilution and RDV filtration
- Centrifuge discharge disposal
  - Can be consistency of toothpaste

Residual lees

Tank cleaning

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# Viscosity

- Viscosity is a measure of a fluids consistency or resistance to flow

- Viscosity determined by the particle microstructure
- Viscosity increases as solids concentration increases
- Higher shear rates lower the viscosity due to micro-structure breakdown

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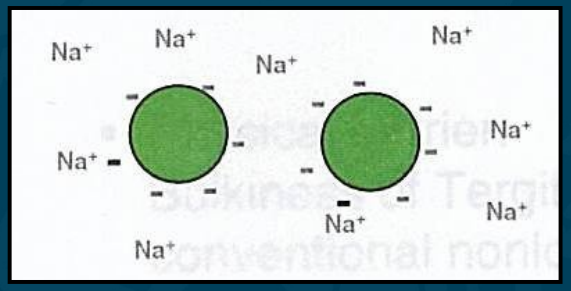
# Surfactants

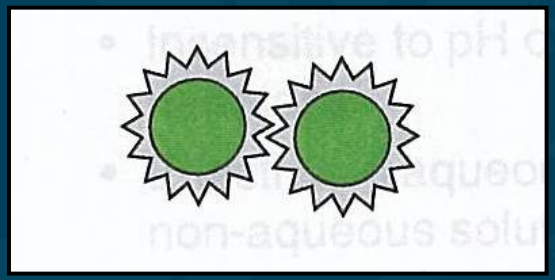
- Contain both hydrophobic (or non-polar) groups (their tails) and hydrophilic (or polar/ionic) groups (their heads)
- Classified by charge groups in its head
  - Non-ionic: no charge
  - Anionic: Positive charge
  - Cationic: Negative charge




Electrostatic Stabilisation

## Mode of Action

- Electrostatic stabilisation
  - Charge from an ionic surfactant causes repulsion between neighbouring particles.



Steric Stabilisation

- Steric stabilisation
  - Forms a layer surrounding the particle causing a physical barrier between partcles.

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# Results

## Surfactant screening

| Additive | Recommeded Dosage | Distance Travelled (cm) | | Average | Standard Error |
|---|---|---|---|---|---|
| | | Rep 1 | Rep 2 | | |
| Control (PRVD) | | 3.8 | 3.9 | 3.9 | 0.1 |
| **Surfactants** | | | | | |
| Gardiquat OB/ AU | 3% w/ w | **18.3** | **18.5** | **18.4** | 0.1 |
| Empicol LZ/ N powder | 1% w/ w | **15.0** | **14.0** | **14.5** | 0.5 |
| Tergitol L-62 | 0.5% w/ w | **8.0** | **8.0** | **8.0** | 0.0 |
| Hydrogen Peroxide 30% | 1% w/ w | 3.9 | 3.7 | 3.8 | 0.1 |
| Citrox | 1% w/ w | 3.8 | 4.0 | 3.9 | 0.1 |
| Polysorbate 20 | 1% w/ w | **10.7** | **11.2** | **11.0** | 0.2 |
| Vedesqa-mirenat N | 1% w/ w | 2.4 | 2.6 | 2.5 | 0.1 |

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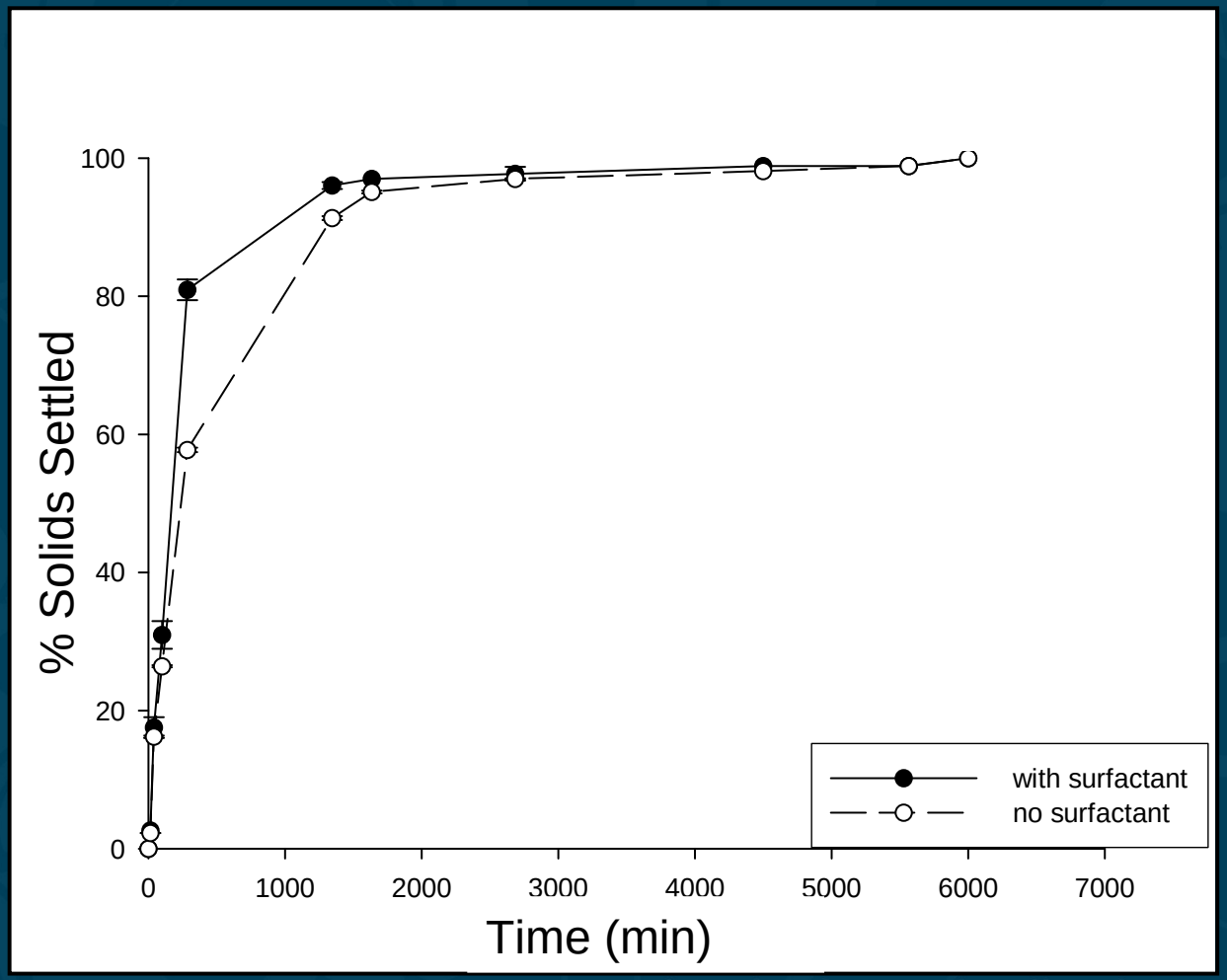
# Results

## Settling Rate

- Rate was increased after Tergitol L-62 addition
- Final compaction constant, with and without surfactant

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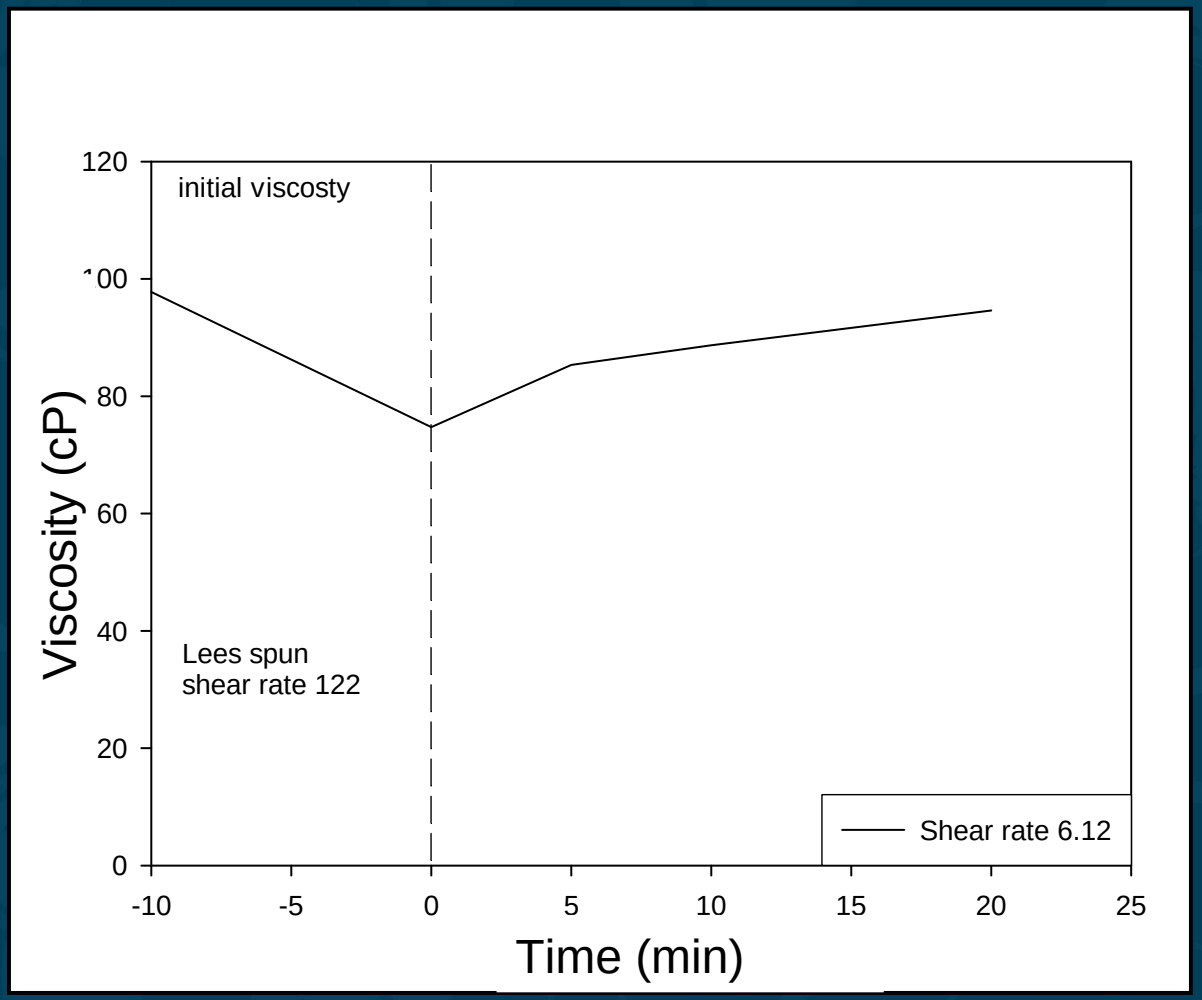
# Results
## Viscosity

- Viscosity drops with the application of high shear rates
- Lees viscosity recovers after approximately 20 minutes

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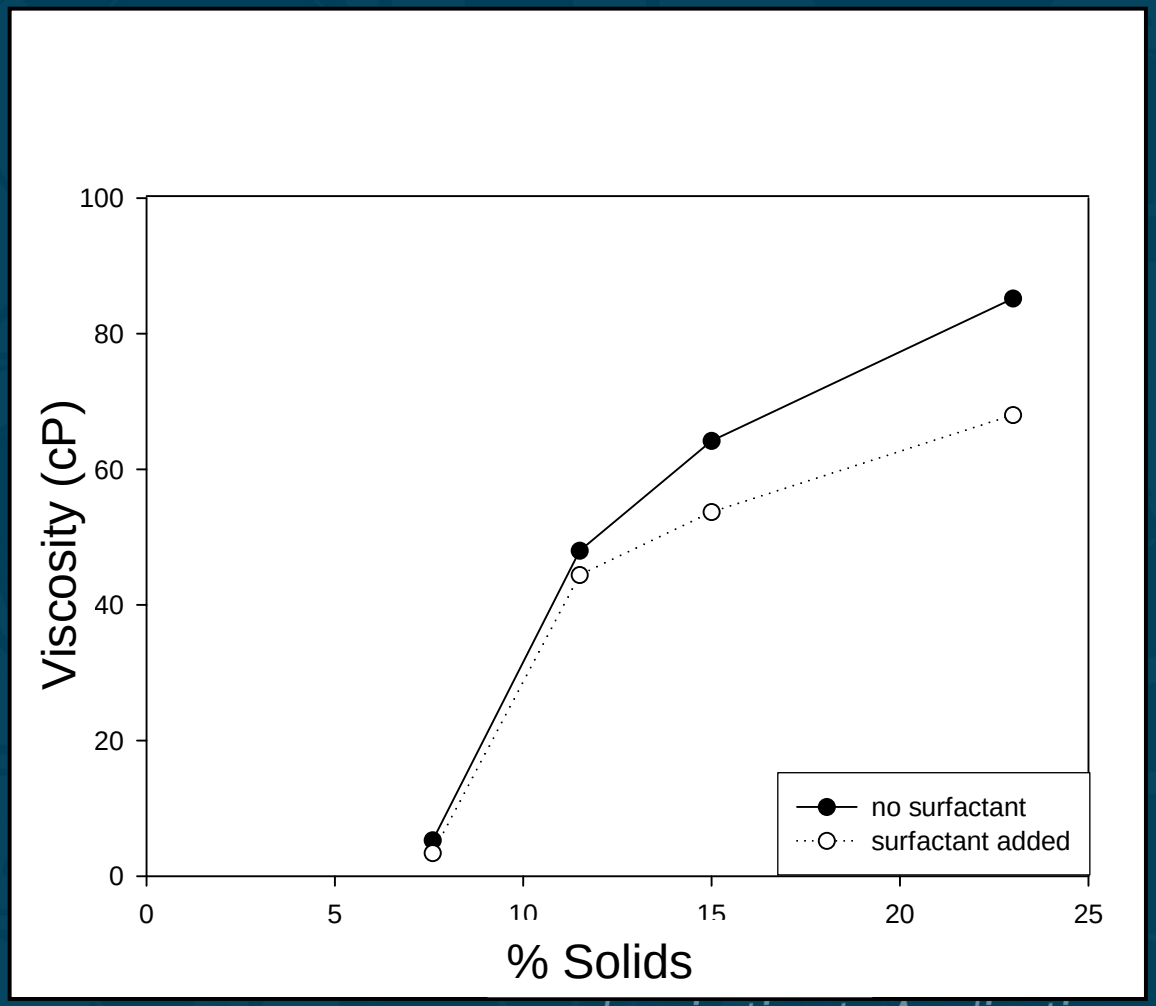
# Results
## Surfactant addition

- Increase in viscosity as solids concentration increases
- 20% decrease in viscosity after surfactant addition

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# Sensory

- Tergitol L-62 slight detrimental sensory characteristics to recovered wine
  - Not used for wine recovery processing
  - Disposal and Cleaning applications
- Informal screening of Empicol LZ/N
  - Characteristics associated with Tergitol not observed
- Further study required on food grade surfactants and subsequent wine quality

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# Key Outcomes

- Decrease in viscosity by 20% through agitation
- Recover lees consistency after 20 minutes
- A range of surfactants anionic, cationic and non-ionic increased the flow rate of lees
- Reduce viscosity with the addition of Tergitol L-62 by 20%
- Lees settles faster with the addition of Tergitol L-62
- Tergitol L-62 has detrimental sensory characteristics

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# Benefits

## Lees Processing

- Maximise lees recovery by reducing residual lees
- Maximise wine recovery, racking off larger quantities of wine
- Potential for mobilising centrifuge desludge
- Reduced labour costs

## Environmental Impact

- Reduced wastewater load
- Reduced water use
- Surfactant biodegradable

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# Recommendations

Future Research

- Field trials
- Optimisation of surfactants for this application
- Quantification of benefits

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