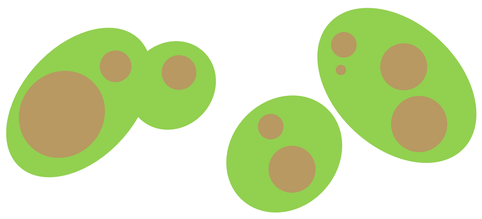
The Development of Engineering Strategies for Enhanced Oil Accumulation and Fatty Acid Modification in Oleaginous Microorganisms

DD Nunes, Prof E Van Rensburg, Prof VL Pillay & Prof RWM Pott

Background

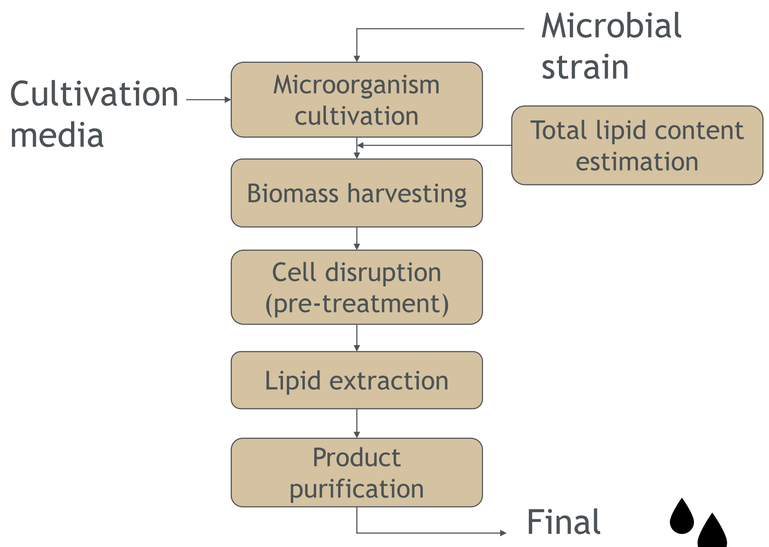
Microbial oils

- Lipids stored as excess energy source
- Intracellular accumulation
  - De novo lipid pathway



- Multiple applications
  - Based on fatty acid (FA) profile

Microbial oil production



Strategies to reduce production cost

- Low-cost substrates (industrial by-products/wastes)
- Genetic mutation
- Target oil production

} Oil accumulation & FA modification

Aims and objectives

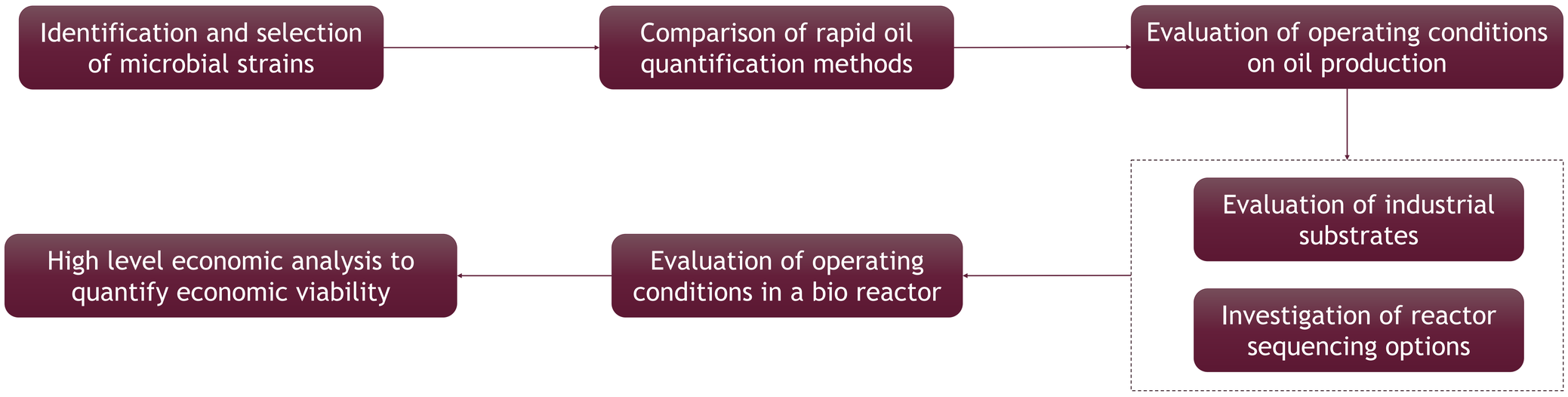
Aim

Investigate oil production in oleaginous microbes and to devise production strategies to control the quantity and quality of the oils being produced

Main objectives

1. Identification and selection of strains suitable for large-scale production
2. Evaluate effect of operating conditions, industrial substrates & cultivation modes on oil production
3. Upscale to a bioreactor

Methodology



Results to date – Variation in operating conditions

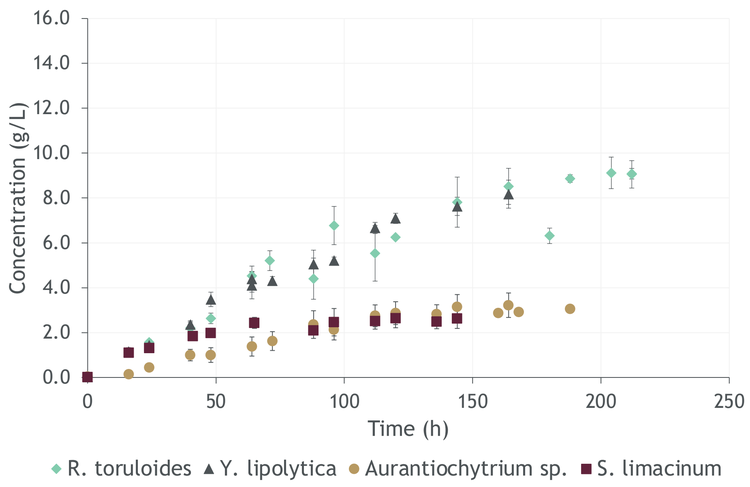


Figure 1: Growth curves produced for strains at 30ºC in a water bath (insufficient oxygen saturation)

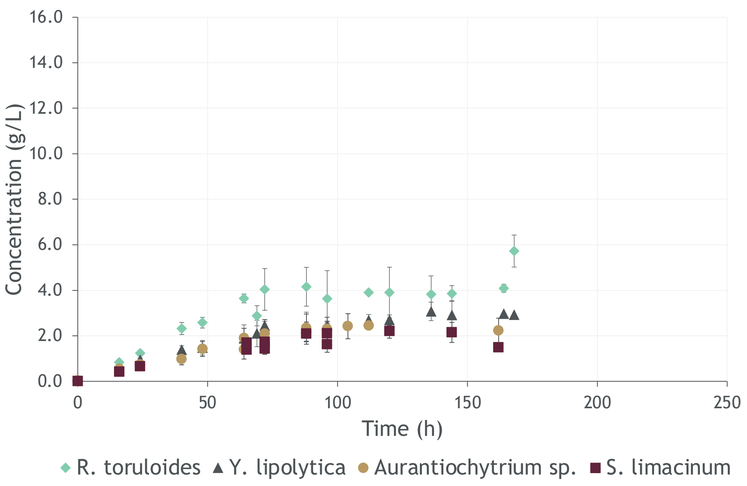


Figure 2: Growth curves produced for strains at 20ºC in a water bath (insufficient oxygen saturation)

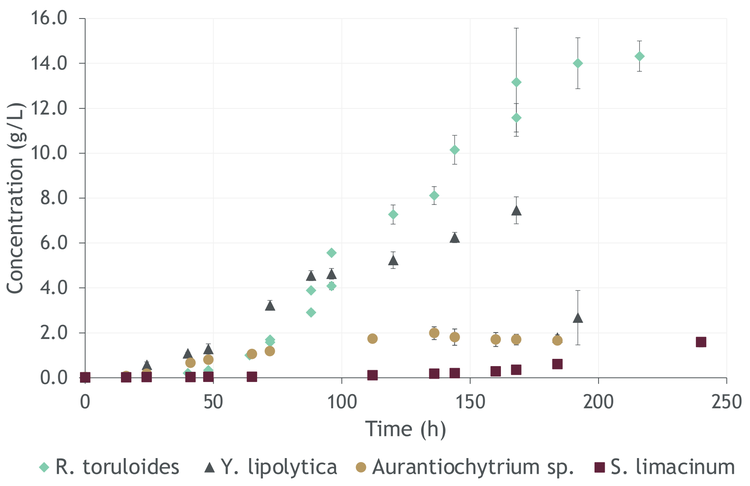


Figure 3: Growth curves produced for strains at 10ºC in a water bath (insufficient oxygen saturation)

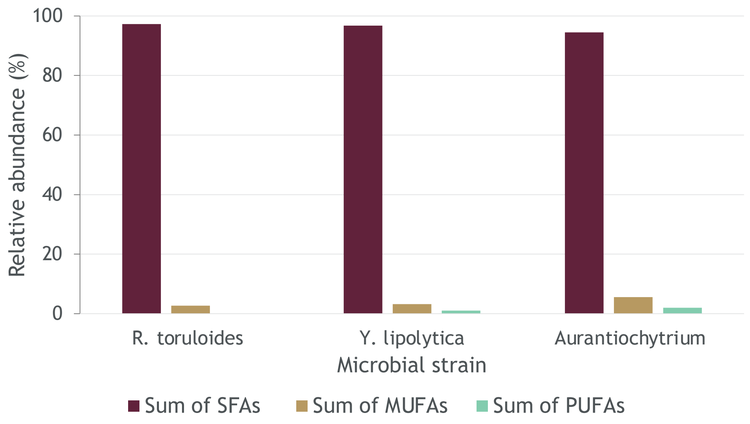


Figure 4: Sum of fatty acids in microbial oil produced at 30ºC in a water bath (insufficient oxygen saturation)

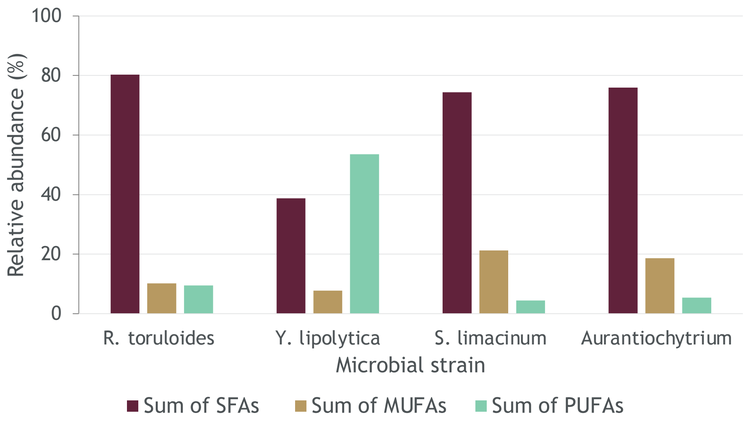


Figure 5: Sum of fatty acids in microbial oil produced at 30ºC in an incubator (moderate oxygen saturation)

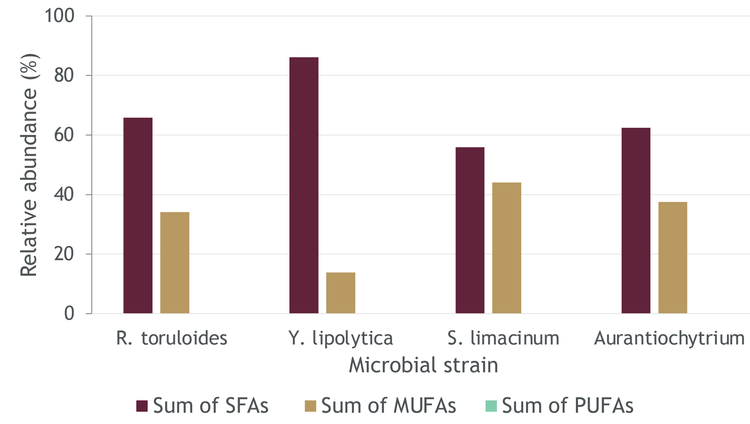


Figure 6: Sum of fatty acids in microbial oil produced at 10ºC in a water bath (insufficient oxygen saturation)