

BIOAEROSOL COMPOSITION AT A FRUIT BEVERAGE BOTTLING FACILITY

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OUTLINE

- INTRODUCTION
- AIM
- MATERIALS AND METHODS
- RESULTS AND DISCUSSION
- CONCLUSIONS
- FUTURE RESEARCH



WHY THIS PROJECT



INTRODUCTION

- Pathogenic microorganisms in food
 - Linked to numerous foodborne illness outbreaks
 - Pasteurization, concentration or low-temperature storage
- South African legislation for consumption of fruit juices

Microorganisms	Legislation
Total viable colony count	10^4 CFU.ml ⁻¹
Coliform count	10^2 CFU.ml ⁻¹
Yeast and mould	10^3 CFU.ml ⁻¹
<i>E. coli</i>	Not detectable in 25 ml
<i>Salmonella spp.</i>	Not detectable in 25 ml

- No legislation for air quality

INTRODUCTION

- Bioaerosols and organic dust
- Bioaerosols are defined as
- Two phase system



- Various methods available for detecting viable microorganisms
- Air sampling most effective
- Various factors influence the airborne contamination
- The features of this specific fruit juice bottling facility

INTRODUCTION

Culturable organisms

- Viable and culturable
- Reproduce under controlled conditions
- Underestimate the total quantity of organisms
- Some bacteria, moulds and yeast

Non-culturable organisms

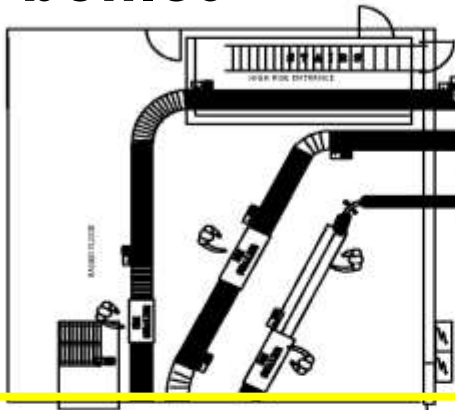
- Viable but non-culturable
- Not conducive to growth
- Difficult to estimate total quantity of organisms
- Some pathogenic bacteria, spores and allergens

AIM

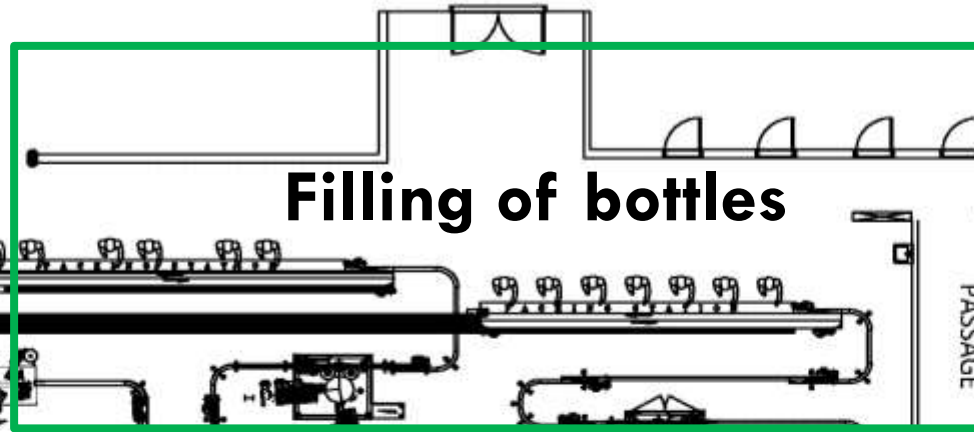
To enumerate and identify the culturable and non-culturable bioaerosol microbiota associated with a fruit juice bottling plant in Bloemfontein, South Africa.

MATERIALS AND METHODS

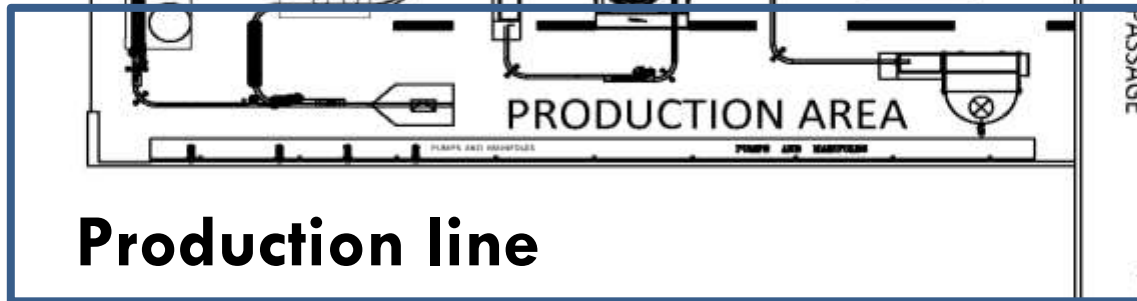
Dispersion of bottles



Filling of bottles



Production line



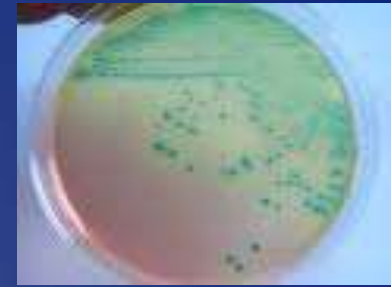
Mixing of materials



Sampling



Microbial enumeration

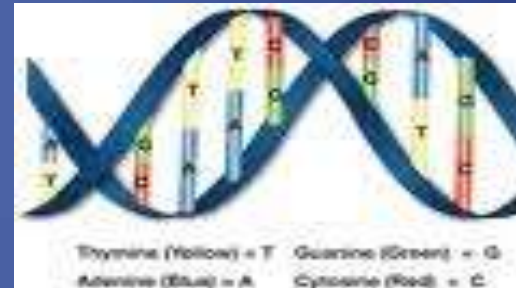


Concentration calculation

(#CFUs [after positive hole correction])

$$\frac{(\text{sampling time min}) \left(\frac{0.1 \text{m}^3}{\text{min}} \right)}{= \text{CFUs} \cdot \text{m}^{-3}}$$

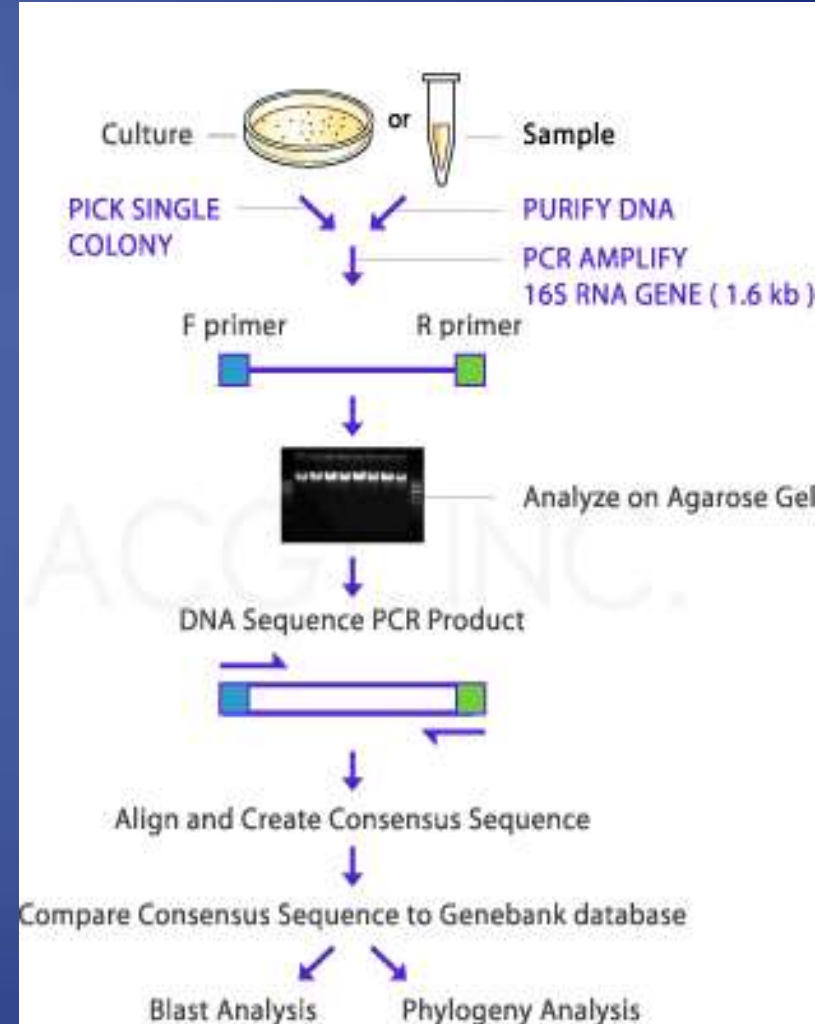
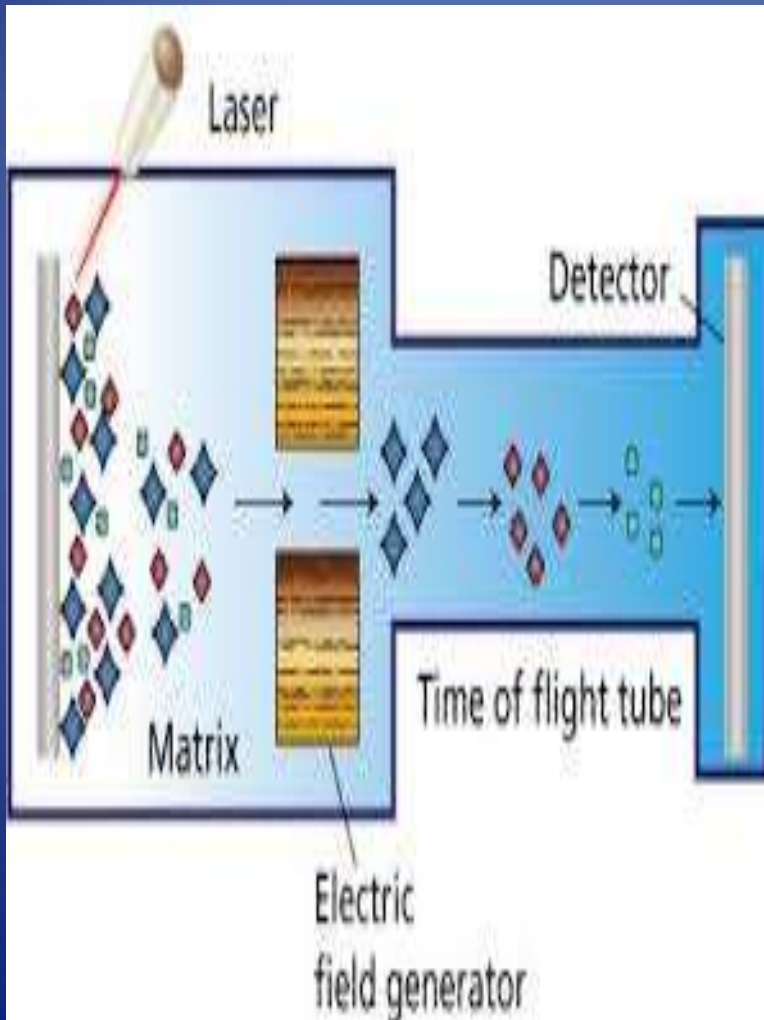
**Yeast and mould were identification by
D1/D2 domain sequencing and
ITS1/ITS4 respectively**



Bacteria

MALDI-TOF Mass spectrometer

16S rRNA Gene Sequencing



RESULTS AND DISCUSSION

Total microbes - 52 to 1269 (CFUs).m⁻³

Presumptive positive *Staphylococcus aureus* - 11 to 138 (CFUs).m⁻³



Presumptive positive *Salmonella* spp. - 2 to 6 (CFUs).m⁻³



Coliforms - 1 to 18 (CFUs).m⁻³



Presumptive positive *Escherichia coli* - 1 to 5 (CFUs).m⁻³



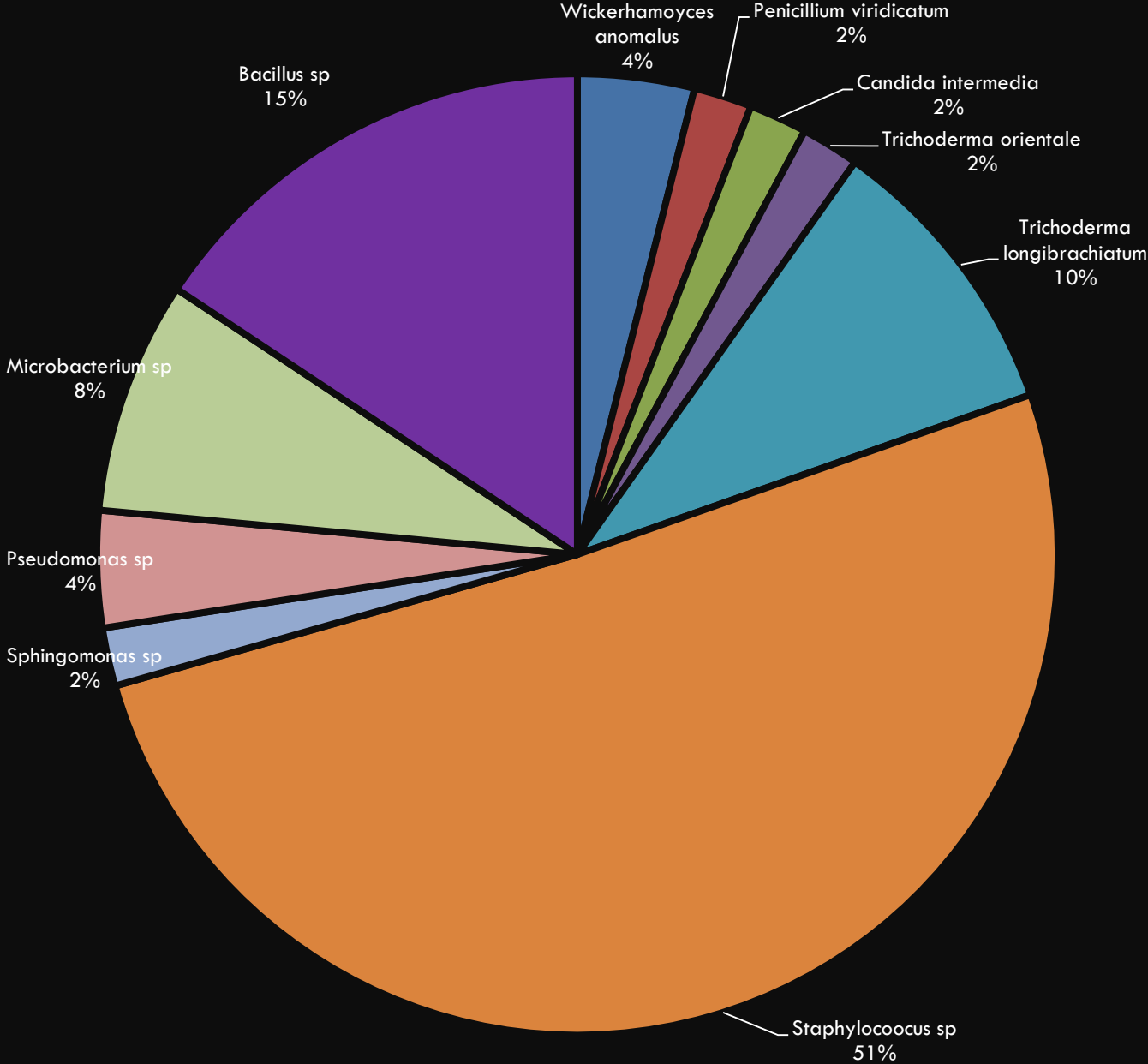
Mould - 11 to 33 (CFUs).m⁻³



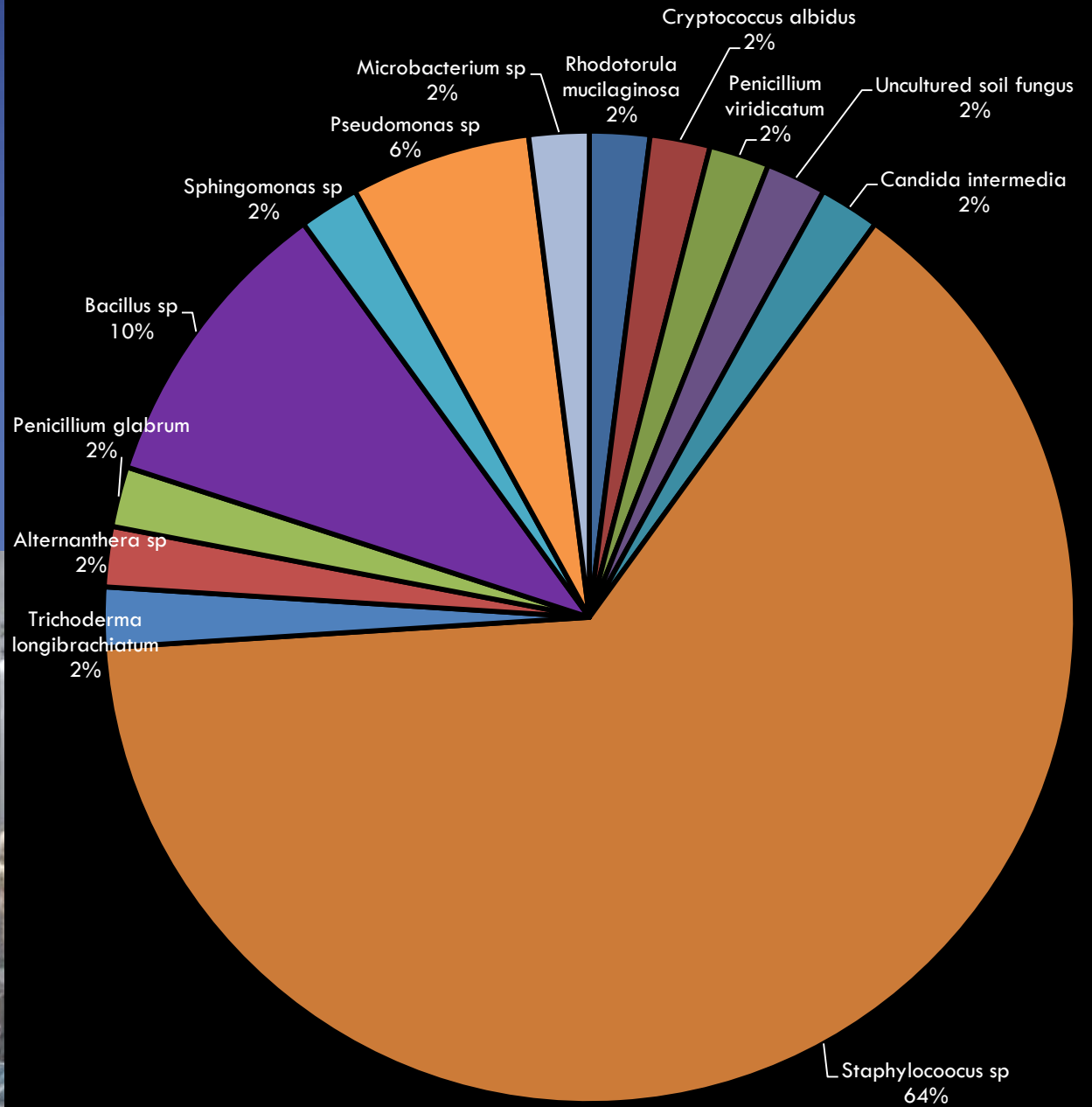
Yeasts - 23 to 120 (CFUs).m⁻³



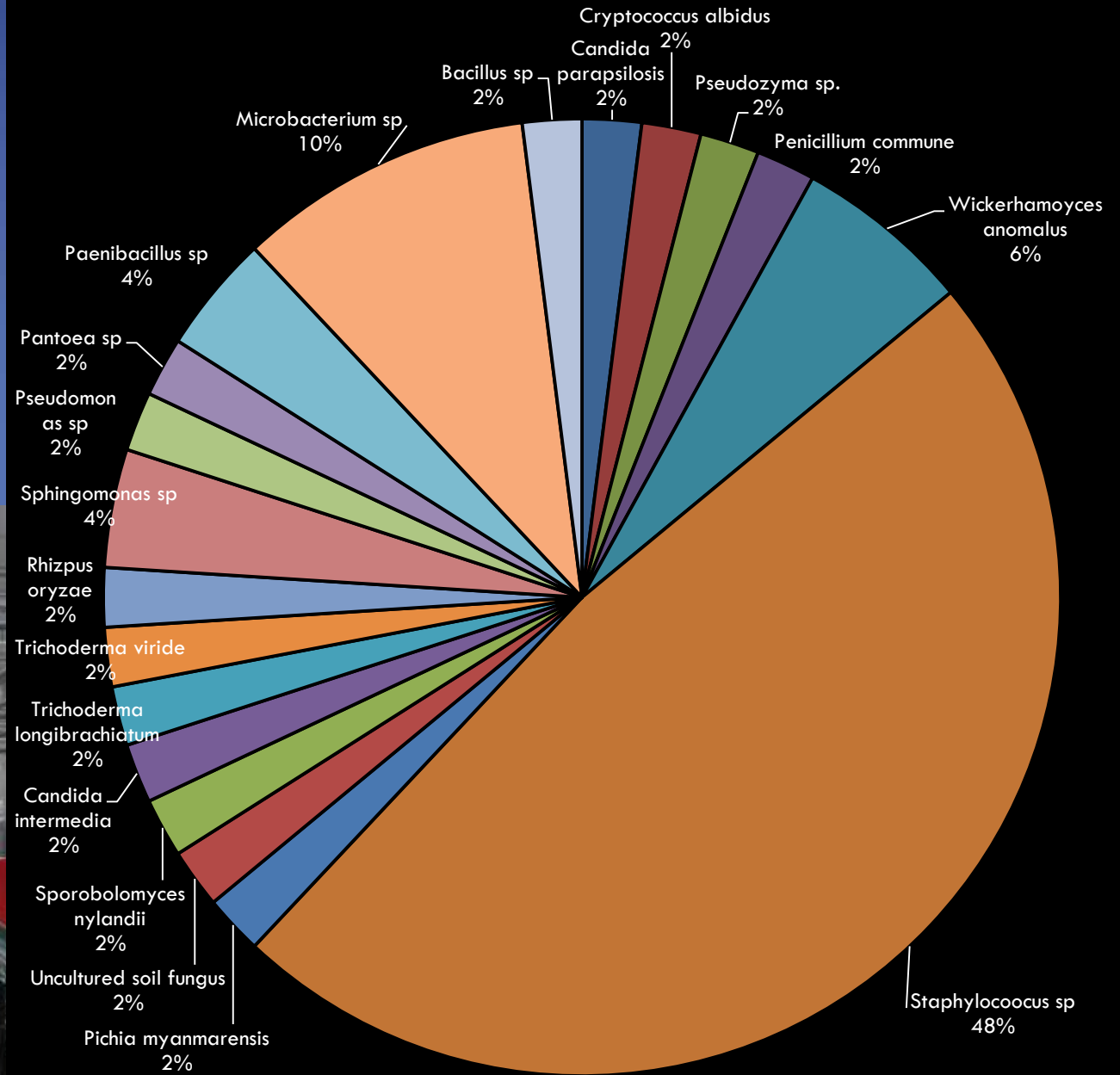
Mixing of materials



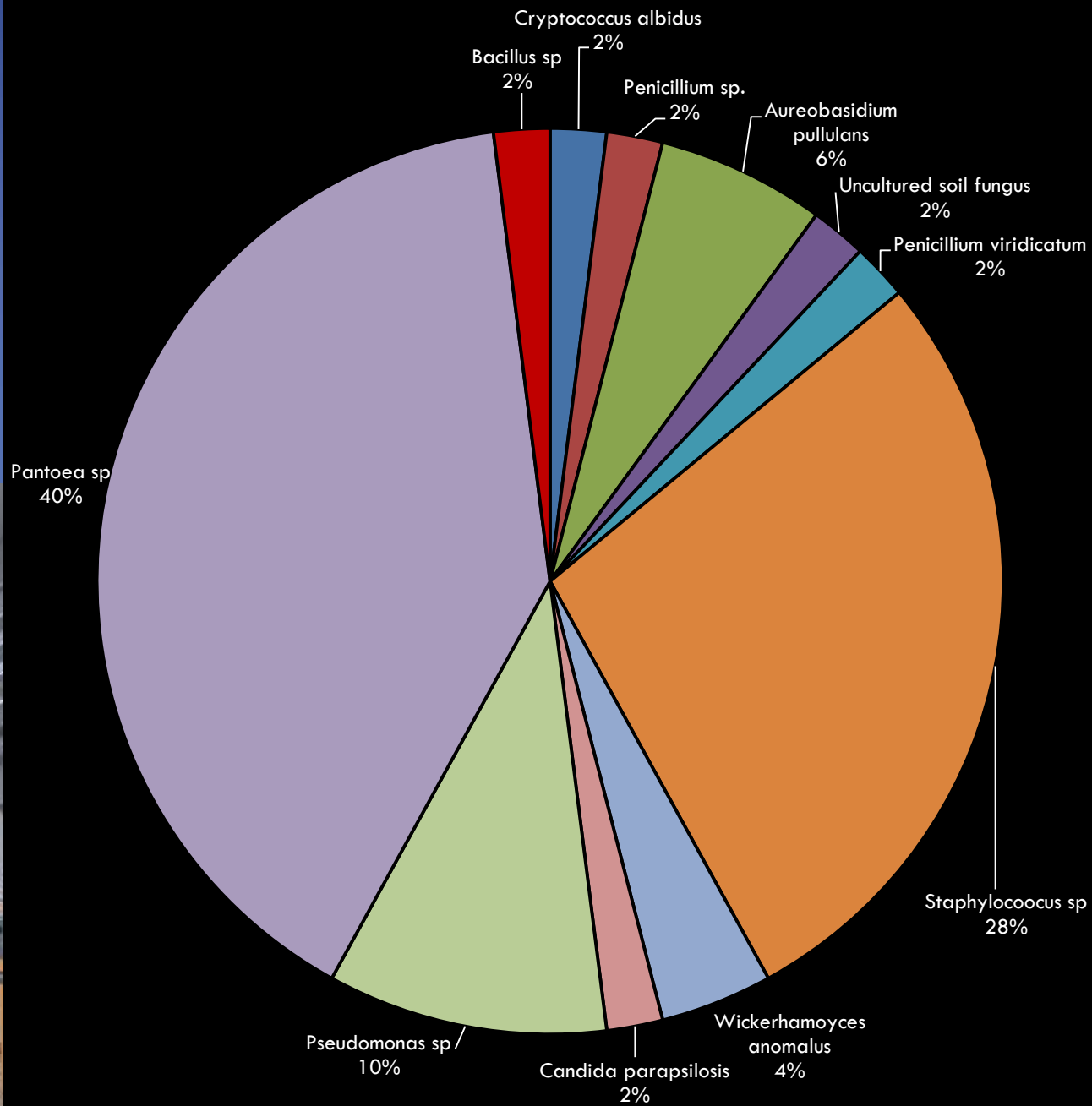
Production line

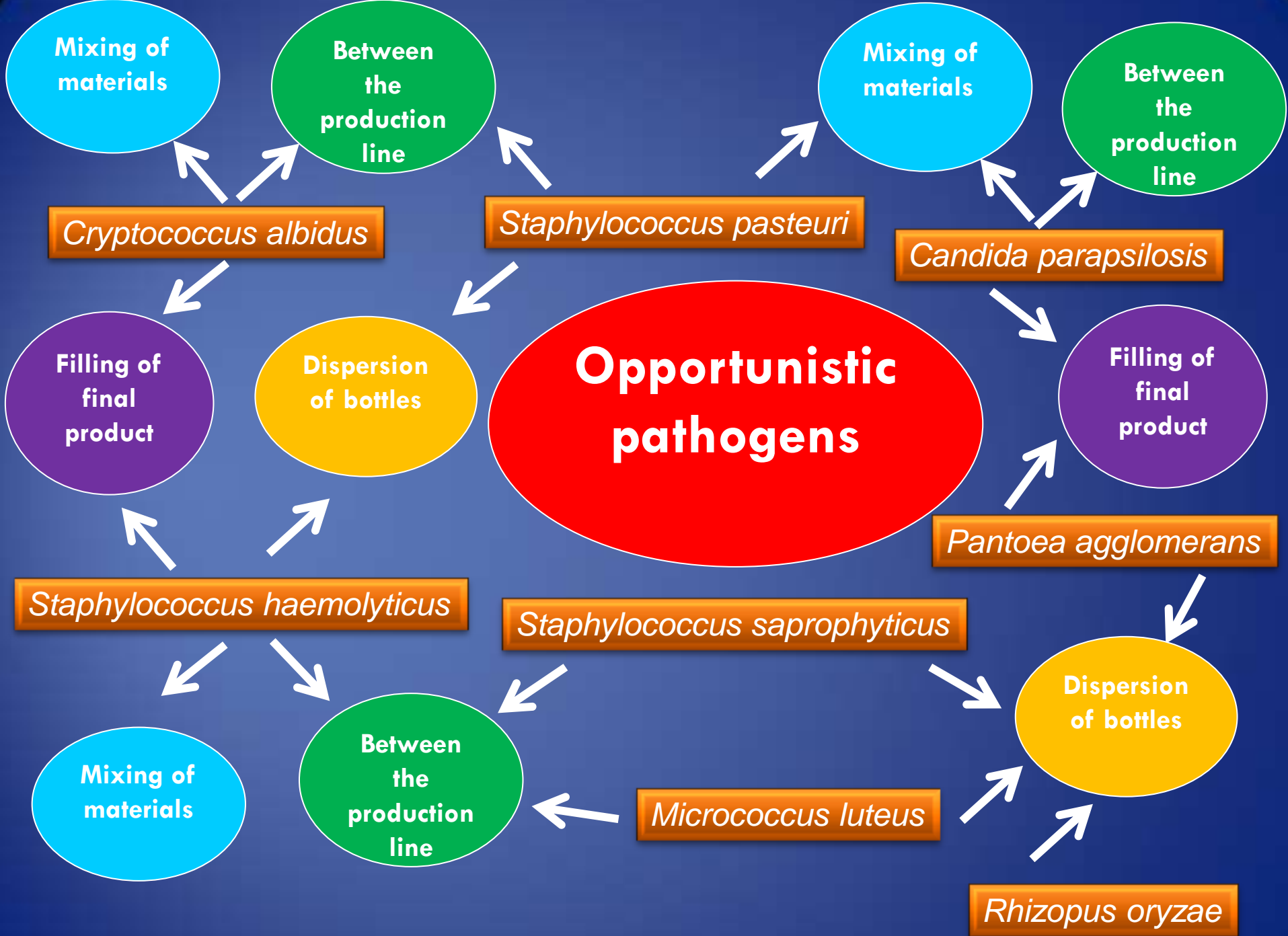


Dispersion of bottles



Filling of final product





CONCLUSION

- 15 Different yeast species, 6 different mould species and 63 different bacteria species were identified
- There is a need for control of bioaerosols
- IDEAL – to collect all viable microorganisms
- Culture independent method



FUTURE RESEARCH

- Compare MALDI-TOF against 16S rRNA gene sequencing
- Culture independent analysis



THANK YOU

