Effects of Nano-bubbles on Stationary Growth of Fungi and Bacteria

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ABSTRACT

In this study, fungi and Gram-negative bacteria were grown in selected media with different concentrations of nano-bubbles. Fungi *Trichoderma spp.* (KBM_1Δ) and *Purpureocillium lilacium* (KBM_3Δ) and bacteria *Escherichia coli* and, *Salmonella spp*. were inoculated in a minimal defined medium containing dextrose as the sole carbon source and grown at room temperature. Dried fungal biomass was recorded after filtration, oven drying at 60°C and weighing the samples after 7 days of growth. Bacterial growth was determined by optical density after 24 hours. Effects on microbial growth of different nano-bubbles concentrations in fungi (E11, E10, E9) and in bacteria (E11, E9) were compared between treatments and a study control with a minimum medium prepared with distilled water. Data were analysed using graphics and ANOVA. The ANOVA results showed that the growth of nano-bubbles on fungi are not statistically significative (p>0.05). In the case of bacteria, both, *E. coli* and *Salmonella* showed not significant growth medium with distilled water. Fungi and bacteria, in general, showed no effects in cultures supplemented with nano-bubbles.

INTRODUCTION

- Nano-bubbles are small bubbles of approximately 100 to 200 nm that help oxygen distribution in solutions(Marui, 2013).
- They remain in water for several months essentially preventing the loss of oxygen from the medium (Khan et. al., 2020).
- The properties of nano-bubbles include long term stability, negative zeta potential and generation of free radicals (Guo et. al., 2019).
- Growth of 2 fungi (*Trichoderma sp., Purpureocillium lilacinum*) and of bacteria (*Salmonella, E. coli*) were evaluated in different nano-bubbles concentration and minimum medium.

OBJECTIVE

- Compare the growth of bacteria and fungi in a culture medium with nano-bubbles and a control medium
- Evaluate differences based in statistical significance analysis

METHODOLOGY

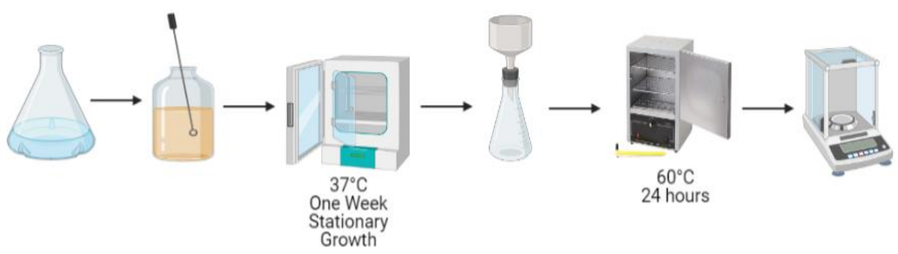


Figure 1: Protocol for fungi growth.

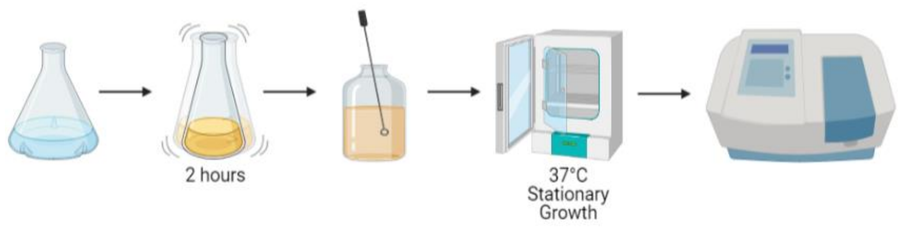


Figure 2: Protocol for bacteria growth.

RESULTS

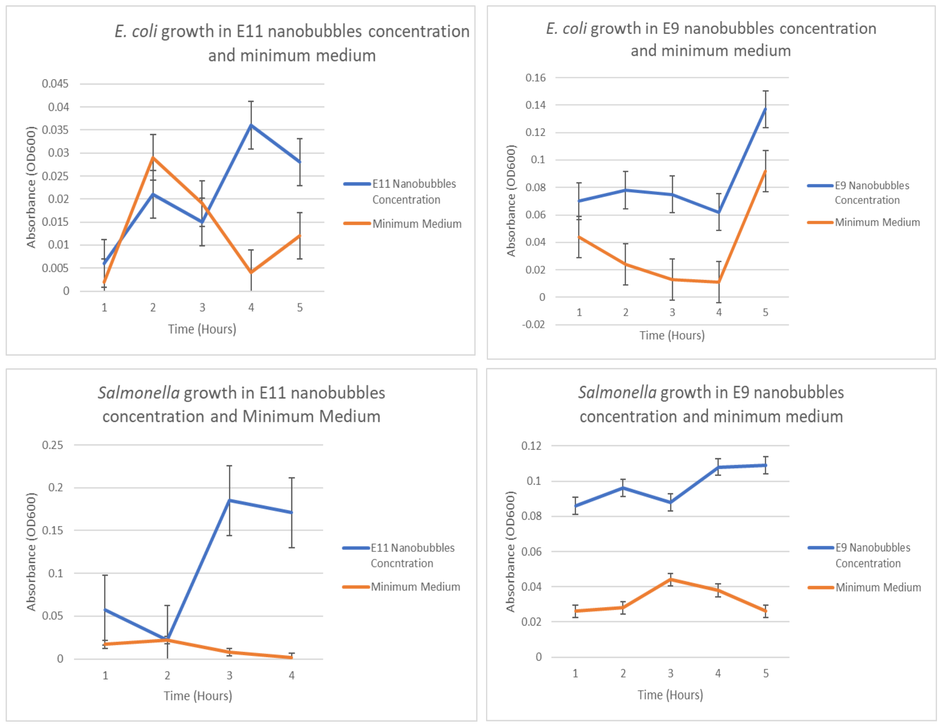
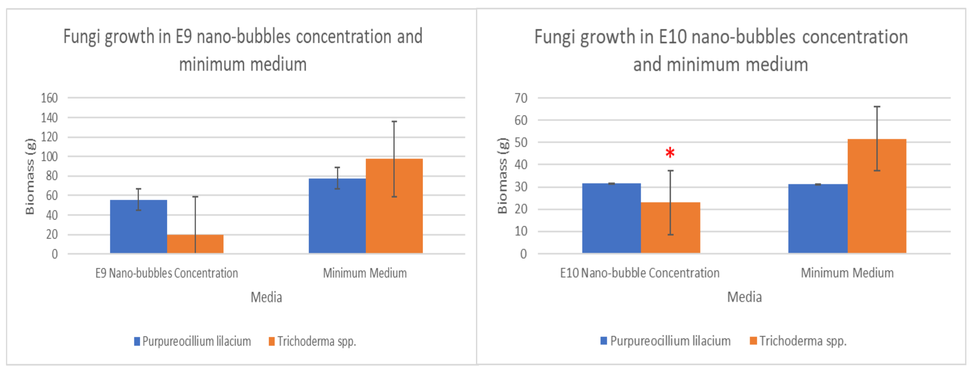


Figure 3: Growth of *Salmonella* and *E. coli* in E11 and E9 nano-bubles concentration and mínimum médium (p-value <0.05).



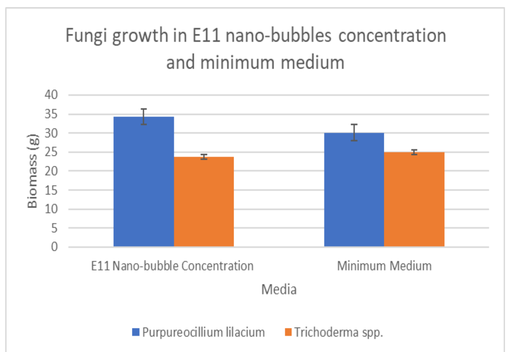


Figure 4: Growth of *Purpureocillium lilacium* and *Trichoderma spp.* in E11, E10 and E9 nano-bubles concentration and mínimum médium (p>0.05).

DISCUSSION

The results of this study presented that the growth of *Salmonella* in different concentrations of nano-bubbles and the minimum medium control was different. The p-value calculated for the E11 and E9 nano-bubbles concentration of *Salmonella* was 0.0566 and 5.02E-06. The collected data of *E. coli* presented a p-value of 0.297227 in E11 and 0.045582 in E9 nano-bubbles concentration. These data of the p-values has showed statistically significative differences (p-value<0.05) in nano-bubbles and control growth. On the other hand, the results presented of the fungi has showed a p-values in the E9, E10 and E11 nano-bubbles concentration not statistically significative (p>0.05).

CONCLUSIONS

- The growth of bacteria in different concentrations of nano-bubles was statistically significative.
- The growth of fungi in different concentrations of nano-bubles was not statistically significative.

FUTURE DIRECTIONS

- Gram positive bacteria
- Variation with another nano-bubbles concentration
- Use different fungi and yeast.

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