

Assessment of pathogenic bacteria in microalgae-based wastewater treatment using pig slurry as the nutrient source

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INTRODUCTION AND OBJECTIVE

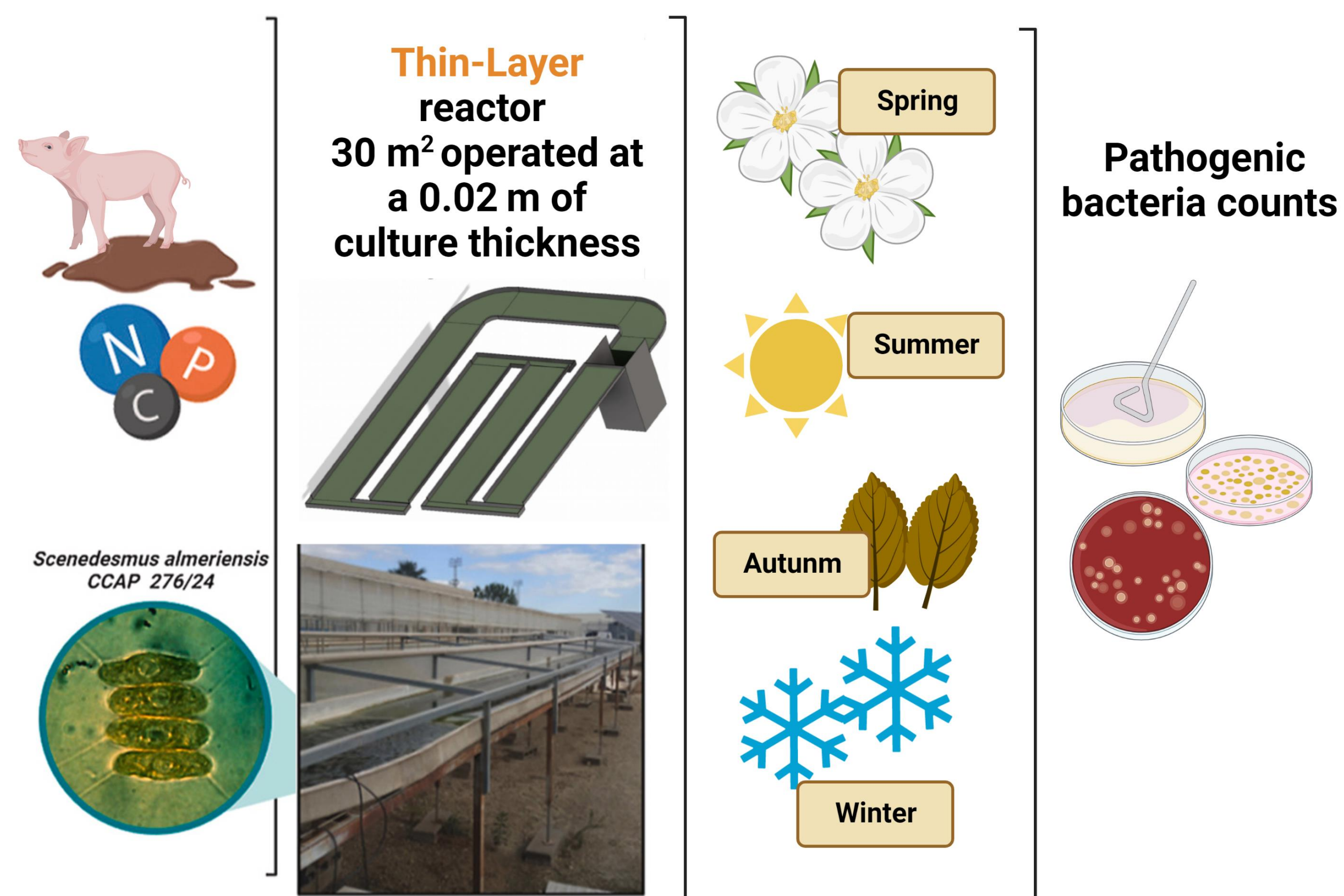
Microalgae are photosynthetic microorganisms with simple nutritional requirements that allow using wastewater as a culture media. The utilization of pig slurry has been suggested as a potential strategy to (i) reduce nutrient costs, (ii) minimize their environmental impact and (iii) produce valuable biomass to obtain products such as biostimulants or biopesticides. However, this technology faces two major challenges: (i) managing to reduce the levels of nutrient (such as nitrogen and phosphorus) present in these waters to comply with current EU legislation, (ii) reducing/eliminating the presence of pathogenic microorganisms in the waters once treated in an economical and sustainable way. The first has been extensively studied in the literature, while few studies have focused on evaluating the presence of pathogenic microorganisms in microalgae wastewater treatment systems. **Therefore, to the aim of the present work is to assess the influence of the microalgae-based wastewater treatment in the removal of the main pathogenic bacteria (*E. coli* and *Clostridium perfringens*) present in piggery wastewater.**

MATERIAL AND METHODS

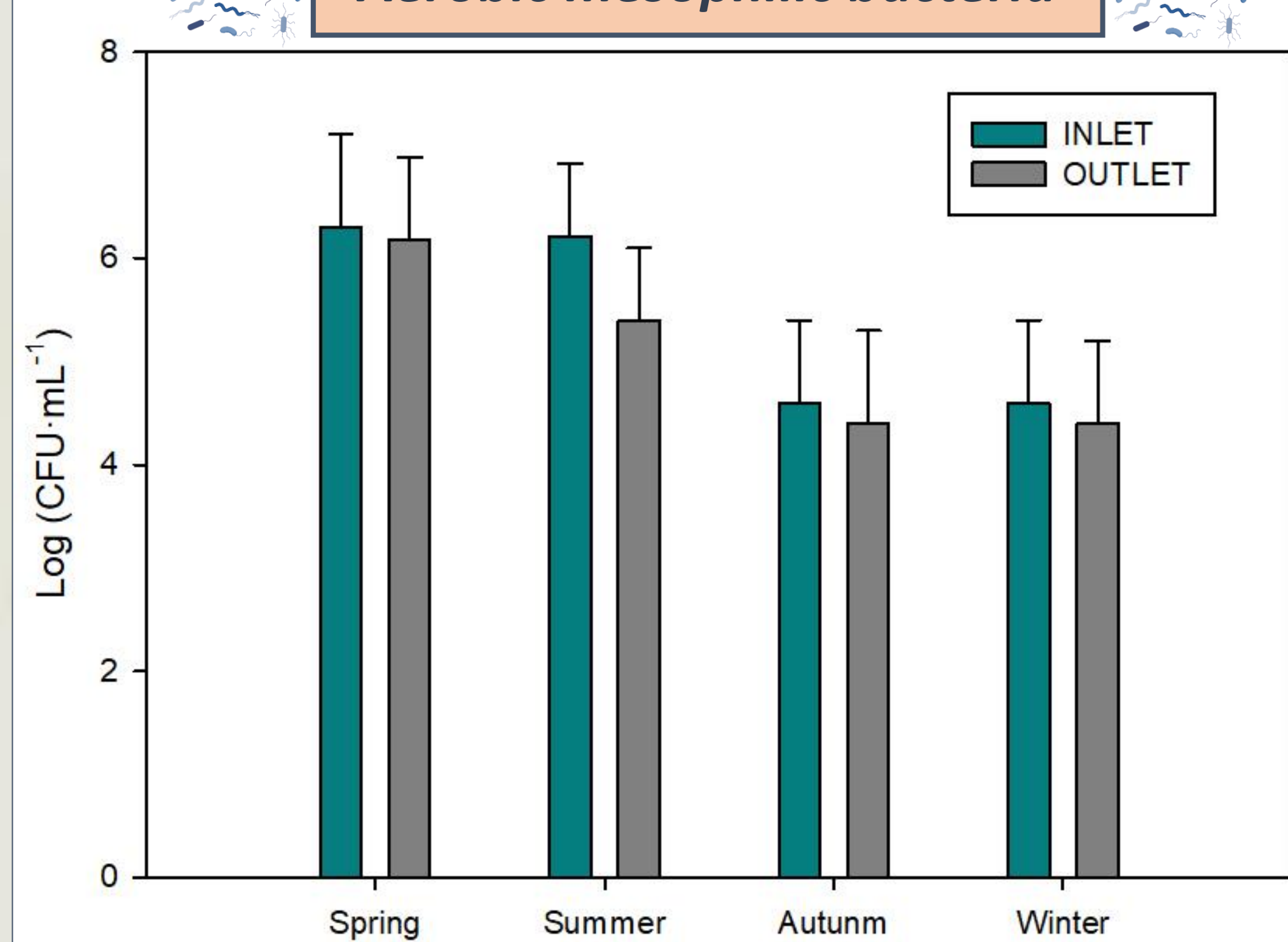
Scenedemus almeriensis (CCAP 276/24) was used as an inoculum to treat diluted pig slurry using a 30 m² thin-layer cascade reactor with a working volume of 1200 L. The reactor was operated in semi-continuous mode at 0.2 day⁻¹. Once the steady-state was achieved microbiological and analytical analyses were performed. Mesophilic aerobic microbiota was determined by plate count using Nutritive Agar. Also, total coliforms and *E. coli* were determined using Endo Agar (Merck, Madrid, Spain) as a differential culture media. SPS Agar was used as a solid medium for detection and enumeration of *Clostridium perfringens*. Results were expressed as log CFU·mL⁻¹.



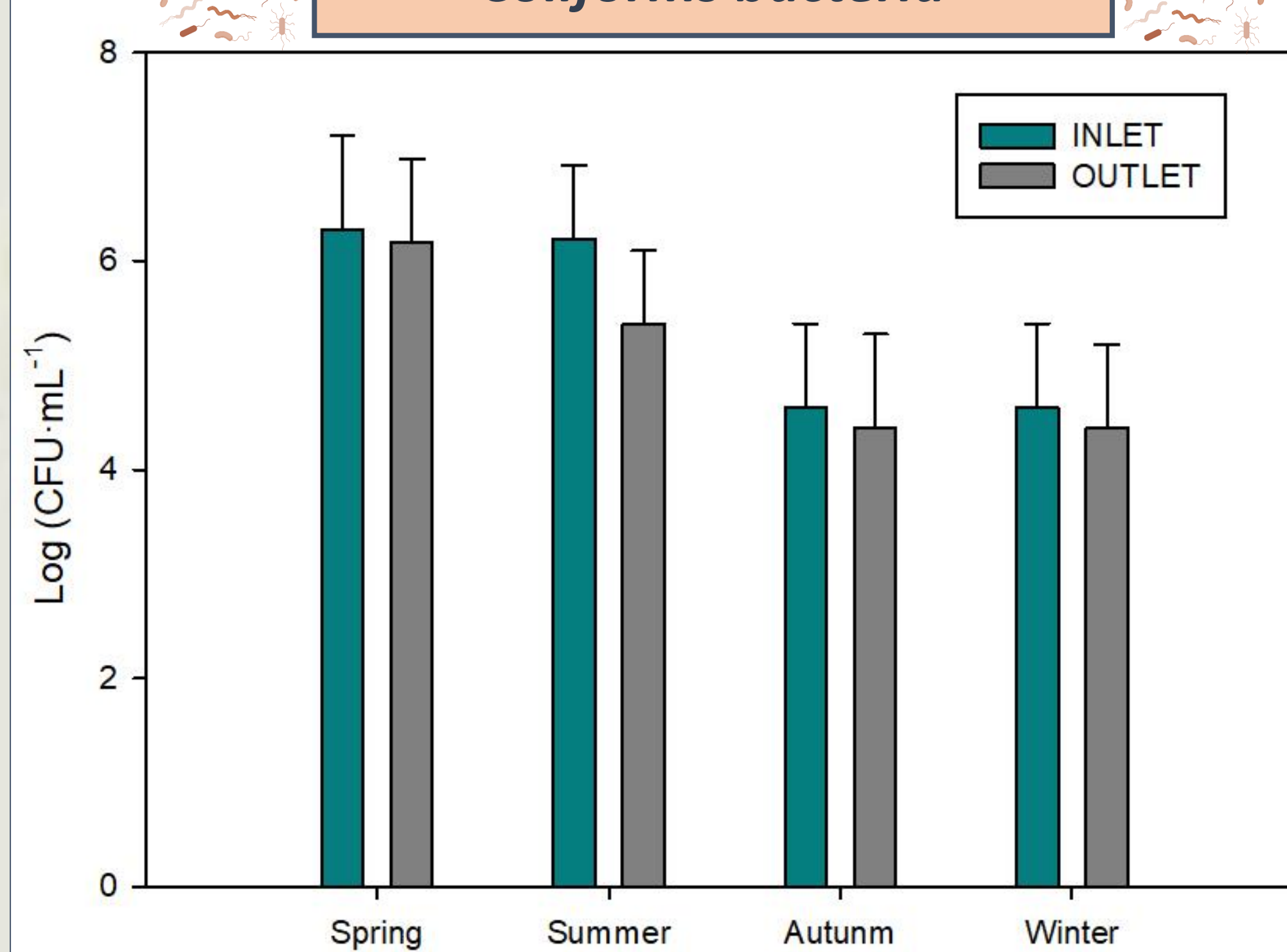
Season	N-NH ₄ ⁺ (mg·L ⁻¹)	N-NO ₃ ⁻ (mg·L ⁻¹)	P-PO ₄ ²⁻ (mg·L ⁻¹)	COD (mg·L ⁻¹)
Spring	60.6	9.4	10.6	220
Summer	98.5	2.6	7.2	195.4
Autumn	50.7	11.5	3.7	194
Winter	50.3	11.5	3.8	193.8



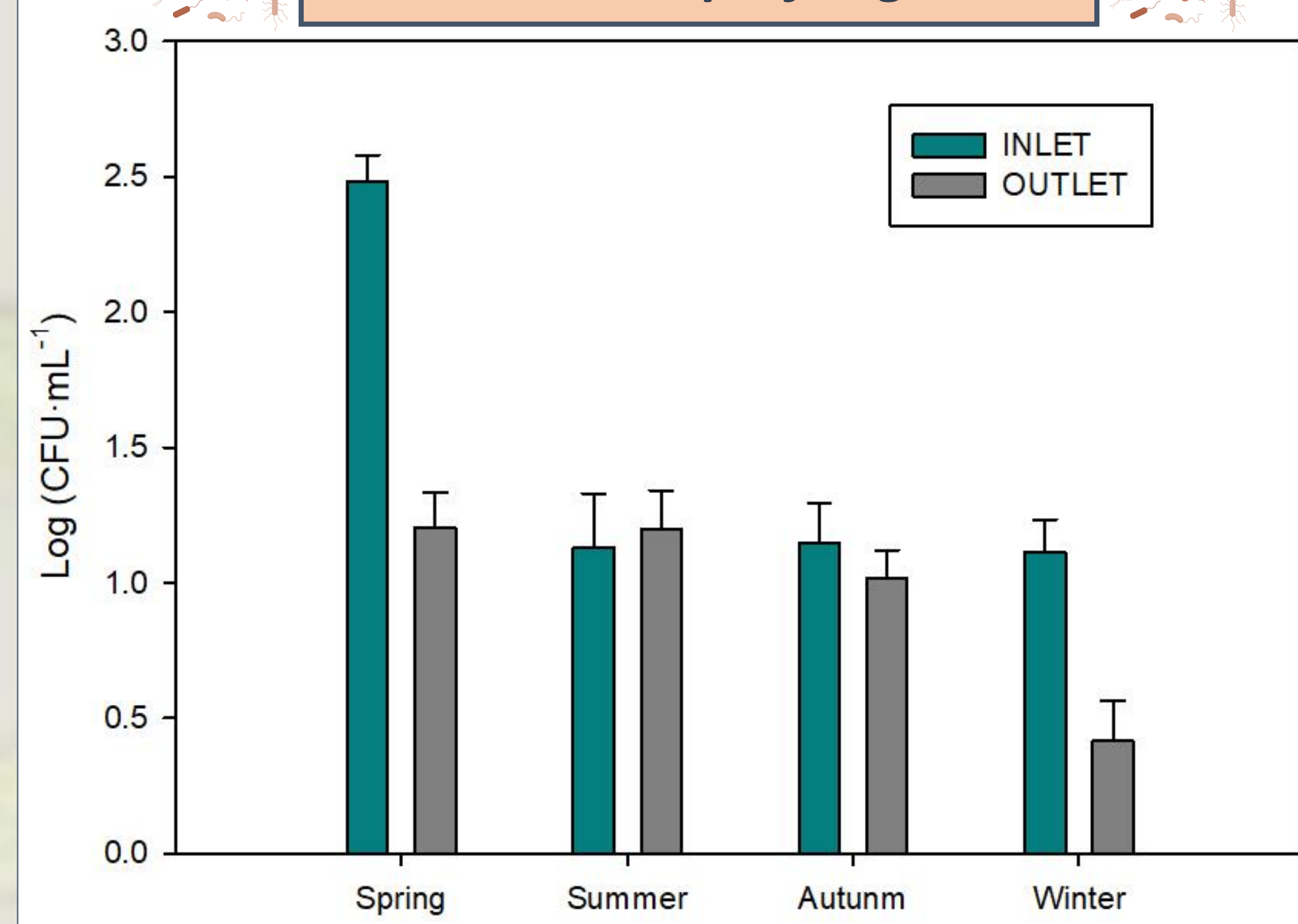
Aerobic mesophilic bacteria



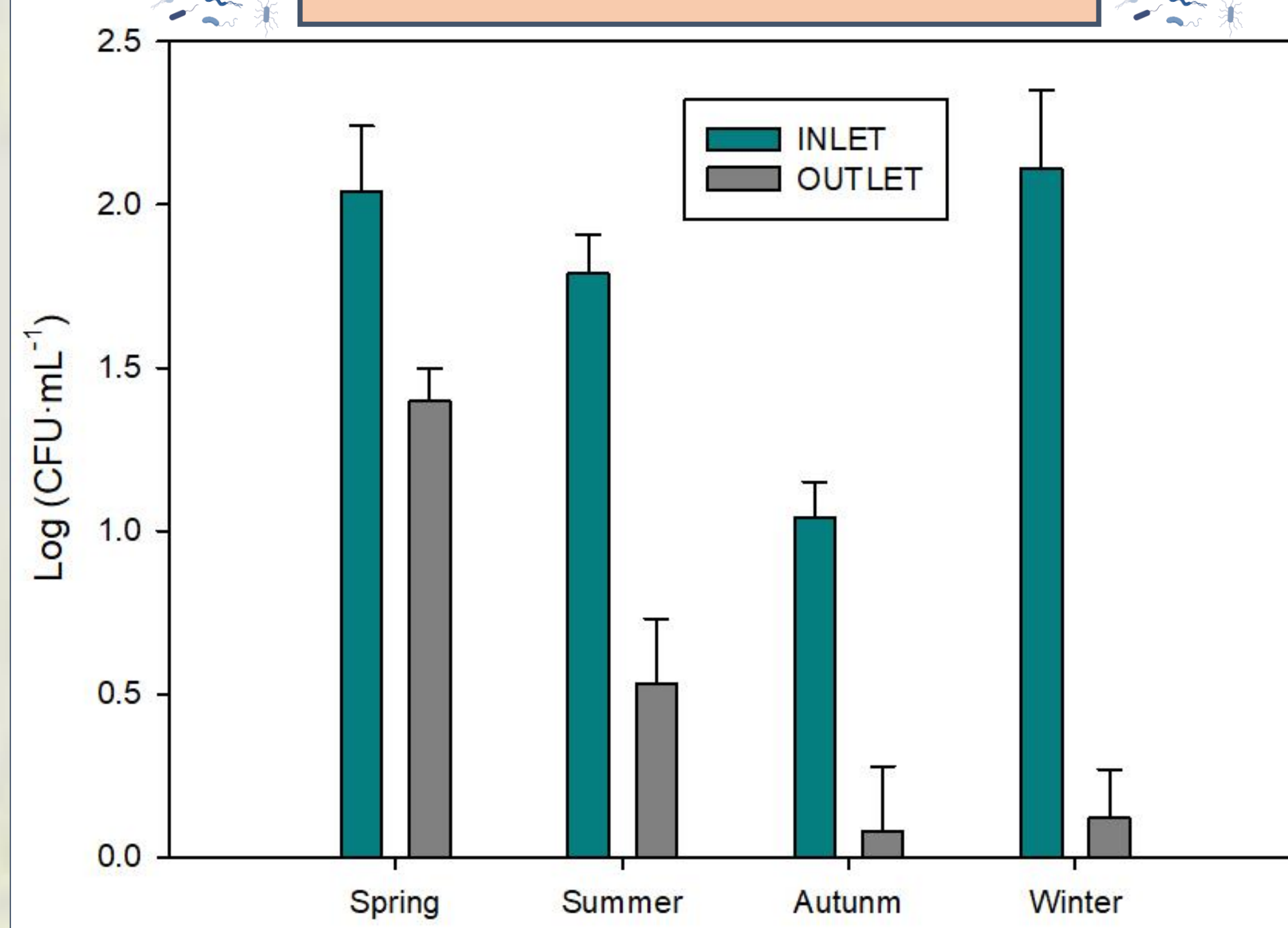
Coliforms bacteria



Clostridium perfringens



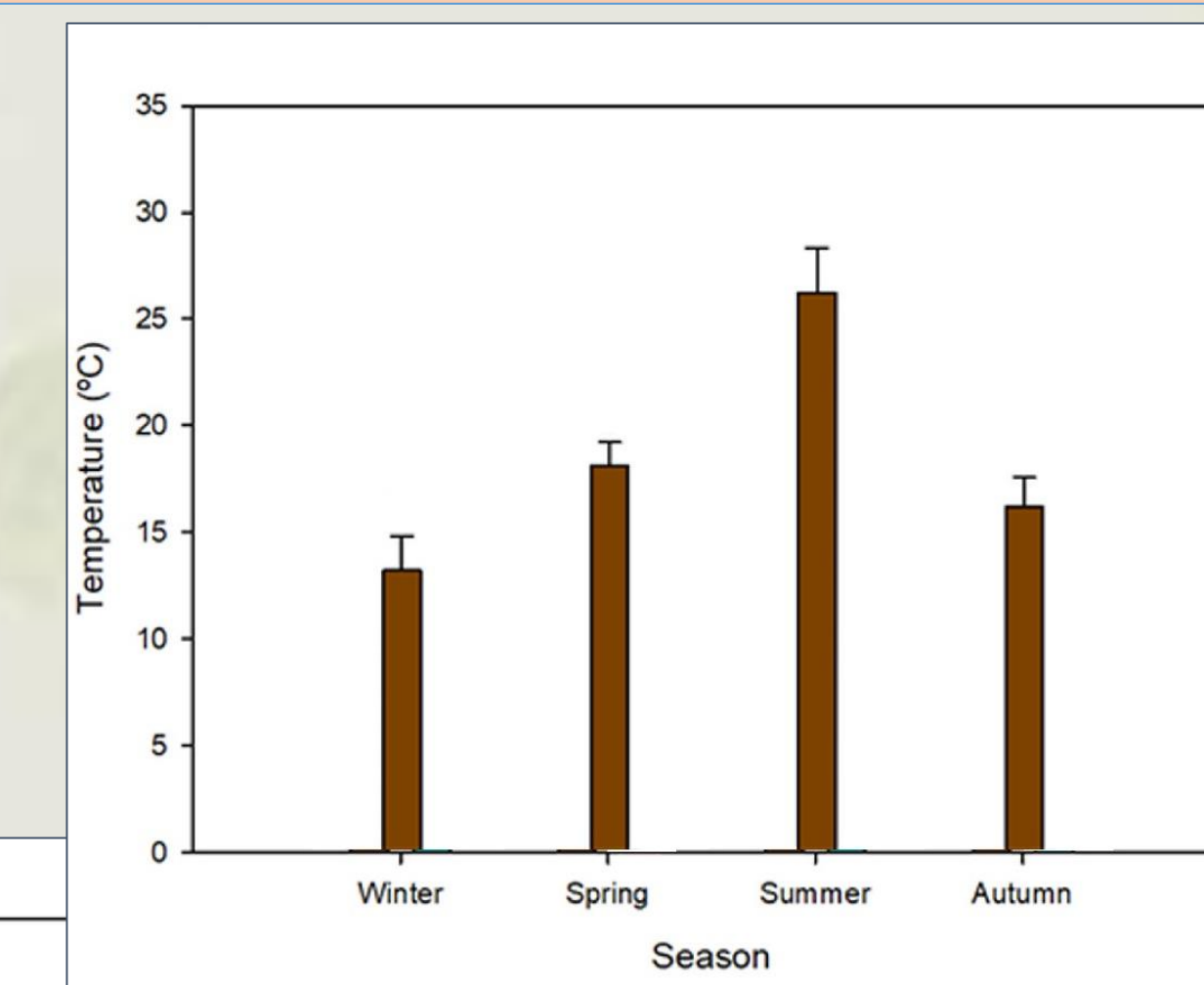
Escherichia coli



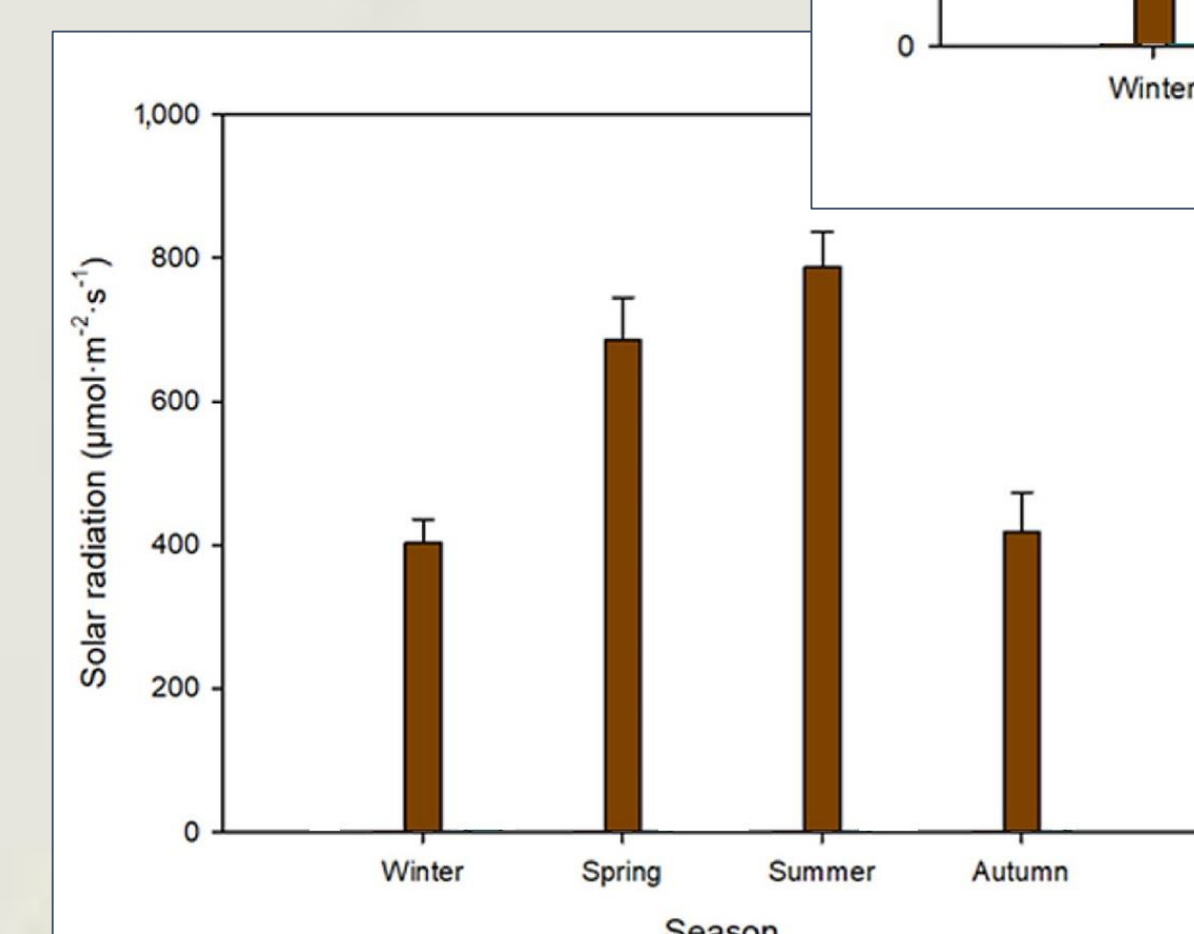
RESULTS AND DISCUSSION

The reduction observed after the microalgae-based treatment might be explained by various mechanisms as competition of nutrients, elevation of pH and dissolved oxygen, presence of algal toxins or the adhesion and sedimentation of pathogens. Specifically, the removal of *Clostridium perfringens*, widely described as obligate anaerobic bacteria, is largely influenced by the high dissolved oxygen concentration reached by photosynthesis in microalgal cultures, also other pathogenic bacteria such as *E.coli* showed enhanced removal in the microalga-based wastewater treatment highly susceptible to high solar irradiance and low temperatures.

Temperature



Irradiance



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CONCLUSIONS

The concentration of microbial populations varied in the inlet and outlet during the trials, as well as some environmental and operational conditions such as light, temperature and main nutrients concentration. Results demonstrated that microalgae-based wastewater treatment is a promising technology both to reduce the nutrients present in the pig slurry and the main pathogens present