



Assessing the Ecotoxicological Impact of Antibiotics on Aquatic Organisms

Anna Bilida¹, Maria Antonopoulou*

¹ Department of Sustainable Agriculture, University of Patras, GR-30131 Agrinio, Greece

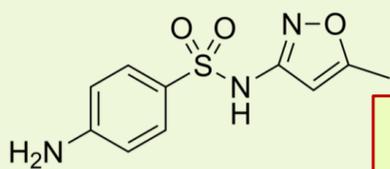
*Corresponding author E-mail: mantonop@upatras.gr

1. INTRODUCTION

- ✓ The commercial aquaculture industry has undergone rapid expansion since the 1980s, which has resulted in a substantial reliance on antibiotic treatments to combat disease outbreaks [1].
- ✓ The frequent utilization of Sulfamethoxazole (SMX), Trimethoprim (TMP), Oxytetracycline (OTC), and Florfenicol (FLO) has been demonstrated to result in the persistence of 70–80% of residues within aquatic ecosystems, posing significant public health risks and environmental issues [2].
- ✓ As vital primary producers, microalgae are extremely susceptible to antibiotic stress. Co-exposure to SMX and TMP increases the risk of concomitant metabolic and ecological disturbance in systems for aquaculture [3].

2. METHODS

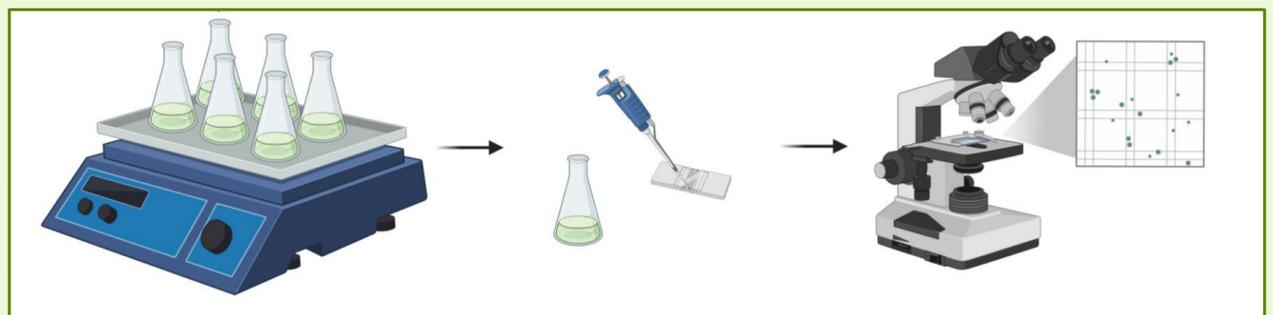
Concentration range: 1 -10 $\mu\text{g L}^{-1}$



Sulfamethoxazole (SMX)



Trimethoprim (TMP)



$$\mu_{av} = \frac{\ln X_L - \ln X_0}{t_L - t_0}$$

μ_{av} (Specific Growth Rate): Calculates the average growth of *Chlorococcum* sp. based on the change in biomass (X) over the exposure duration (t).

$$I = \frac{\mu_C - \mu_X}{\mu_C} \times 100$$

I (Inhibition %): Quantifies growth suppression by comparing the growth rate of treated samples (μ_X) against the antibiotic-free control (μ_C)

3. RESULTS

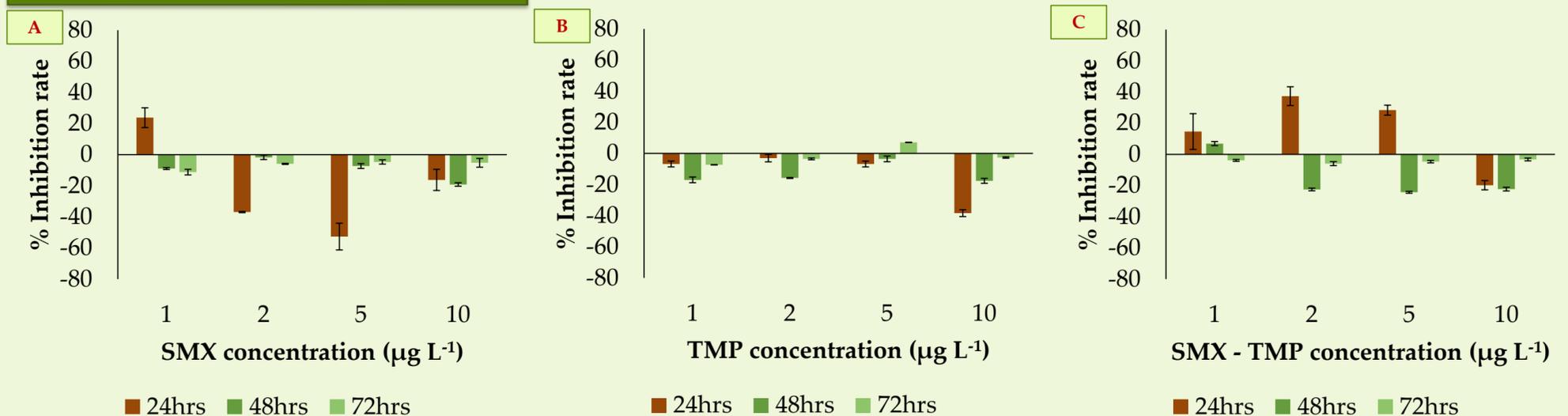


Figure 1. Percentage of inhibition rate (%I) in *Chlorococcum* sp. following treatment with varying concentrations of (A) SMX, (B) TMP and (C) SMX-TMP mixture for 24–72 hours.

4. CONCLUSION

- ✓ In the case of extended exposure intervals (48–72 hours), a tendency towards a shift from initial suppression to growth stimulation was observed for all treatments (SMX, TMP, and combination).
- ✓ SMX exhibits short-term early inhibition, which gradually returns to growth stimulation.
- ✓ In all the concentrations and time periods that were examined, TMP primarily functions as a growth stimulant.
- ✓ Following a 48-hour period, the acute initial inhibition brought on by the mixture rapidly reverts to activation.

References

1. Bondad-Reantaso, M. G., MacKinnon, B., Karunasagar, I., Fridman, S., Alday-Sanz, V., Brun, E., ... & Caputo, A. (2023). Review of alternatives to antibiotic use in aquaculture. *Reviews in aquaculture*, 15(4), 1421-1451.
2. Divya, V., Battula, P., Pulipati, S., Veena, M. R., Rasool, A., Bhuvanesh, G., ... & Puttaiah, S. H. (2025). Ecotoxicity assessment and detection of antimicrobial compounds in urban environments and AMR hotspots. *Scientific Reports*, 15(1), 38274.
3. Li, D., Wang, P., Sun, M., Yin, J., Li, D., Ma, J., & Yang, S. (2024). Effects of sulfamonomethoxine and trimethoprim co-exposures at different environmentally relevant concentrations on microalgal growth and nutrient assimilation. *Aquatic Toxicology*, 271, 106937.

Acknowledgements

The research project is implemented in the framework of H.F.R.I. call "3rd Call for H.F.R.I.'s Research Projects to Support Faculty Members & Researchers" (H.F.R.I. Project Number: 26141).