

---

# *Chapter 8*

---

Overall  
Conclusion  
&  
*Future perspective*

---



## 8.1 Conclusion

This study represents a comprehensive and in-depth investigation into the field of microalgae-based wastewater treatment and harvesting mechanisms. One of the central findings of this research is the identification of *D. mucosa VSPA* as a superior microalgal strain when compared to *C. pyrenoidosa*. This discovery highlights the critical importance of strain selection in achieving optimal results in wastewater treatment processes, as *D. mucosa VSPA* exhibited higher biomass production and more efficient pollutant removal capabilities. Moreover, the study showcases the exceptional efficiency of microalgae in removing pollutants from wastewater. The results demonstrate significant reductions in ammonium nitrogen, phosphate phosphorus, COD, and color in the effluent, exceeding 85%, 70%, 75%, and 60%, respectively. This underscores the ecological benefits and potential cost-effectiveness of employing microalgae for the treatment of industrial effluents. The research also introduces the application of advanced computational techniques, such as Response Surface Methodology (RSM) and Artificial Neural Networks (ANN), for creating predictive models. The ANN-GA hybrid approach, in particular, stands out for its superior predictive accuracy and optimization capabilities. These models offer valuable tools for optimizing complex, multi-input/multi-objective wastewater treatment and harvesting processes. Looking ahead, the thesis emphasizes the importance of diversifying microalgae species in future research. This includes exploring lesser-studied microalgae strains that can thrive in extreme conditions or rapidly adapt to toxic industrial effluents. Such diversification is anticipated to enhance the overall efficiency and versatility of microalgae-based wastewater treatment processes. Additionally, the study delves into the potential of symbiotic co-cultivation of microalgae species, specifically *D.*

mucosa VSPA and *S. obliquus*, in a mixotrophic mode. This approach yielded higher biomass productivity and enhanced pollutant removal compared to traditional heterotrophic cultivation. These findings suggest that co-cultivation strategies, particularly with rare strains and for the treatment of toxic industrial effluents, warrant further exploration. Lastly, the thesis emphasizes the optimization of microalgae harvesting techniques through the dual flocculation coagulation (DFC) mechanism. The research revealed that the combination of alum and chitosan resulted in exceptionally high harvesting efficiency, with ANN-GA optimization achieving remarkable results. This advancement in harvesting techniques holds promise for improving the overall efficiency and feasibility of microalgae-based wastewater treatment systems.

### **8.1. Future Perspectives**

Looking ahead, the future perspective of microalgae-based wastewater treatment and harvesting holds tremendous promise and potential for addressing pressing environmental and resource challenges. Building on the insights garnered from this comprehensive study, one of the key avenues of future exploration lies in the continued diversification of microalgae species. This entails further research into strains capable of thriving in extreme conditions and rapidly adapting to toxic industrial effluents, ultimately expanding the applicability of microalgae-based systems.

Additionally, the integration of advanced computational techniques, such as the ANN-GA hybrid approach, will continue to play a pivotal role in optimizing and fine-tuning wastewater treatment processes. These predictive models can be refined to address an even wider range of multi-input/multi-objective challenges, enhancing system efficiency. The exploration of symbiotic co-cultivation strategies, as well as the innovative dual flocculation coagulation (DFC) harvesting mechanism, offers exciting avenues for improving both biomass productivity and pollutant removal, further establishing

microalgae-based systems as efficient and sustainable solutions for wastewater management. In conclusion, the future perspective for microalgae-based wastewater treatment and harvesting is characterized by ongoing innovation and refinement, with the potential to significantly mitigate environmental impacts and maximize resource recovery in the quest for sustainable wastewater management practices.