CHAPTER V

CONCLUSION AND SUGGESTIONS

5.1 Conclusion

Based on the results of the research that has been conducted and the analysis in the discussion chapter, several conclusions can be drawn, namely:

1. The maximum mass of organic compounds during desorption occurred with the NaOH regenerant, the RIP TiO_2 material yielded a maximum mass of organic compounds of 7.53 mg, while the maximum mass of organic compounds on the resin was 6.87 mg. These results were obtained at a desorption contact time of 250 minutes for RIP TiO_2 and 150 minutes for the resin. Meanwhile, for RIP TiO_2 regenerated with deionized water, the optimum time was 150 minutes, and for the resin, it was 250 minutes. These results indicate that the duration of desorption does not always correlate with the mass of organic compounds successfully desorbed.
2. The results of the photocatalytic process over 5 cycles without desorption showed a decrease in the mass of successfully adsorbed organic compounds in each cycle, whereas the results of the photocatalytic process over 5 cycles with additional desorption showed that the mass of successfully adsorbed organic compounds was much more stable, particularly when using deionized water as the regenerant. This is supported by the amounts of organic compounds removed by the resin (9.11 mg) and the TiO_2 RIP (9.32 mg) when deionized water is used as the regenerant.
3. Analysis of the morphology of TiO_2 after regeneration revealed that the carbon concentration had decreased to less than half its original value, and cracks were observed on the material's surface, indicating a deterioration in the condition of the TiO_2 due to exposure to NaOH. Furthermore, FTIR analysis showed that NaOH regeneration did not completely eliminate the material's structure but altered the absorption intensity of the original functional groups.

5.2 Research Limitations

This study has several limitations in interpreting the results. The use of a NaOH solution as a regenerant to analyze the desorption results is one of the main limitations. After the desorption process using NaOH, the measured concentrations of organic compounds were significantly higher than the initial concentrations of organic compounds in the river water. These results cannot yet be directly interpreted as the actual amount of organic compounds desorbed from the RIP TiO_2 material. This is because the basic conditions created by the NaOH solution are suspected to affect the optical characteristics of the dissolved organic compounds, increasing their absorbance. Consequently, the concentration values obtained may not accurately reflect the amount of organic compounds released during the desorption process.

In addition, in this study, organic compounds were also identified using UV-Vis spectrophotometry at a wavelength of 254 nm (UV_{254}). This parameter is an indirect (surrogate) parameter used to indicate the amount of organic compounds, particularly the organic fraction containing aromatic groups. Consequently, this technique cannot determine the types and amounts of organic compounds released during the desorption process, particularly in solutions with high pH. Due to this limitation, the interpretation of desorption results especially when using NaOH was conducted with caution and was not used as the sole basis for evaluating the success of RIP TiO_2 regeneration. Tests of photocatalytic performance under repeated use, as well as material characterization using FTIR and SEM-EDX, were also considered in the evaluation of regeneration effectiveness in this study.

5.3 Suggestion

Suggestions that need to be considered by researchers for further research are as follows:

1. Further research is expected to characterize the material at each regeneration cycle, particularly using FTIR, SEM-EDX, XRD, and BET analysis. This is necessary to determine changes in the material's chemical structure,

morphology, atomic content, and active site area of the RIP TiO_2 and resin materials.

2. It is necessary to evaluate variations across a wider range of regenerant types and concentrations to identify the best regeneration method that maintains the material's capacity and effectiveness consistently during repeated use.
3. Testing with a greater number of cycles is necessary to determine the service life of the resin and RIP TiO_2 materials and to determine the most saturated point of the material used for photocatalysis.