


CHAPTER FIVE: CONCLUSIONS

This chapter concludes findings of the research and implies recommendations for future studied in mathematical modeling and simulations of anaerobic digestion in plug flow reactors.



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5. CONCLUSIONS

- Reactor model which was developed using advective diffusive reactor compartment in AQUASIM 2.1f has some deviation from actual plug flow reactor that has been used in anaerobic digestion.
- According to the simulation results in **first reactor model**, high gas flow rate observed under 60 days of HRT. Gas flow rate gradually decreased with increase of reactor HRT. A minimum gas flow rate observed under 480 days of HRT.
- Under every feed rate, a gradual reduction observed in methane composition of biogas until the reactor operating time reached the reactor HRT. After time passed the reactor HRT a rapid reduction noticed in methane in biogas.
- pH drop at the reactor front under high feed rates that it can be seen even in actual plug flow reactors under high feed rates.
- The TVFA variation caused to pH drop in plug flow reactor. Accumulation of VFA drops the pH at reactor front, middle and the end.
- pH reduction along the plug flow caused to inhibit the acetate degrading bacteria, hydrogen degrading bacteria and acidogens and acetogenesis.
- According to the  variation of inhibition function microorganisms get inhibited and methane production stopped.
- In **second reactor model**, maximum biogas production rate was observed in CSTR series with 480 days HRT. With the increase of feed rate biogas production rate decreased. Finally the gas rate came to zero at every feed rate.
- The pH significantly dropped at the first CSTR reactor and owing to the high pH reduction microorganisms get inhibited and the variation of inhibition function revealed a rapid inhibition under low reactor HRT.
- Rate of pH drop minimized at 60 days HRT in first reactor and it reduced with increase of HRT.

Recommendation for the future works

- It is recommended to proceed with plug flow reactor simulation in MATLAB environment as plug flow reactor can be more accurately modeled and simulated rather than in AQUASIM environment.
- It is suggested to perform plug flow reactor simulation in AQUASIM with new plug flow reactor model which can mimic an actual plug flow reactor.
- It is suggested to perform plug flow reactor simulation with recycling of biomass in to the reactor.
- It is suggested to perform co-digestion in plug flow reactor and find the optimum conditions.

