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**Effects of hydraulic retention time on process performance of anaerobic side-stream reactor coupled membrane bioreactors: kinetic model, sludge reduction mechanism and microbial community structures**

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**Abstract:** An anoxic/oxic membrane bioreactor (AO-MBR) and three anaerobic side-stream reactor (ASSR) coupled MBRs (ASSR-MBR) were operated to investigate the effects of hydraulic retention time of ASSR ( $HRT_A$ ) and to elucidate sludge reduction mechanisms in ASSR-MBRs. Increasing  $HRT_A$  from 3.3 to 6.6 h improved nitrogen removal, and enhanced sludge reduction from 8.0% to 40.9% in ASSR-MBR. The sludge decay coefficient was  $0.0221\text{ d}^{-1}$  in MBRs, and  $0.0231\text{-}0.0345\text{ d}^{-1}$  in ASSRs. The measured lysis rate coefficient of heterotrophic biomass was  $0.083\text{-}0.112\text{ d}^{-1}$  in MBRs and  $0.079\text{-}0.111\text{ d}^{-1}$  in ASSRs. The hydrolysis rate coefficient of inactive particulate organic matters (POMs) in ASSRs significantly exceeded that in the MBR.

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