

Supplementary Information

A Cascade of Denitrification Bioreactor and Aerobic Biofilm Reactor for Heavy Oil Refinery Wastewater Treatment

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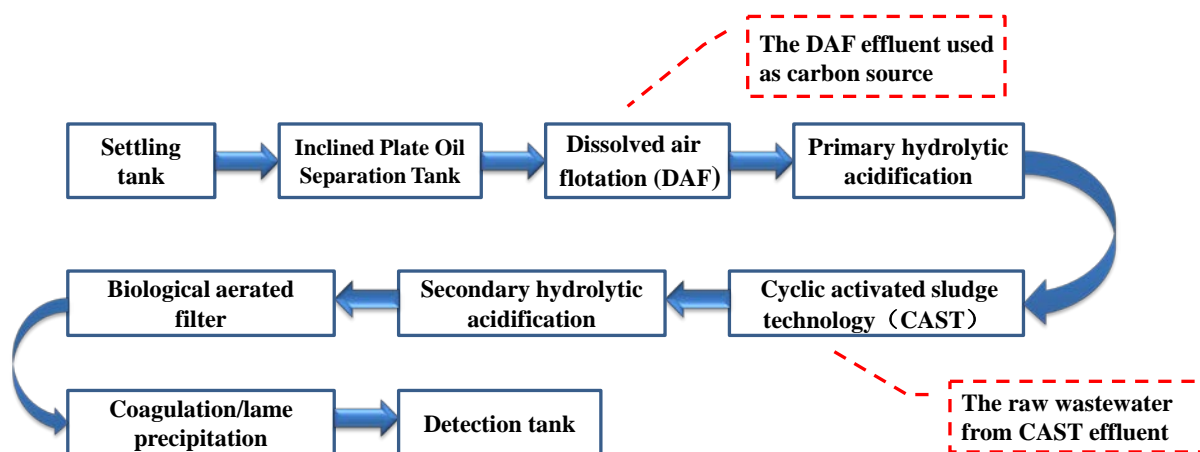


Fig. S1 The full process flow about the technological processes of Liaohé Petrochemical Branch Company include CAST and secondary DAF effluent.

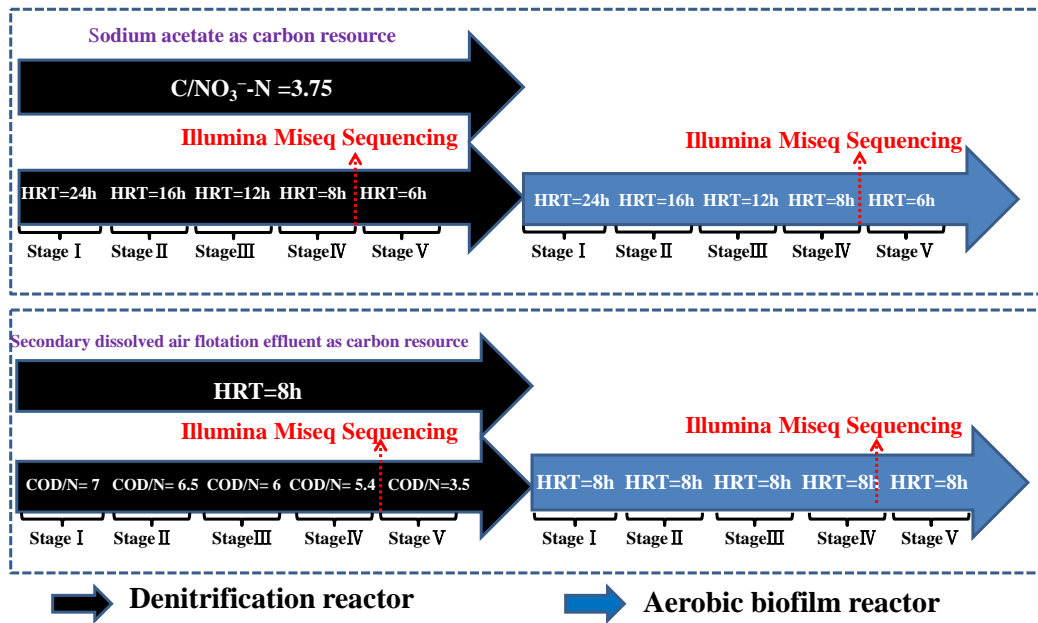


Fig. S2 A schematic flow of the whole experimental steps.

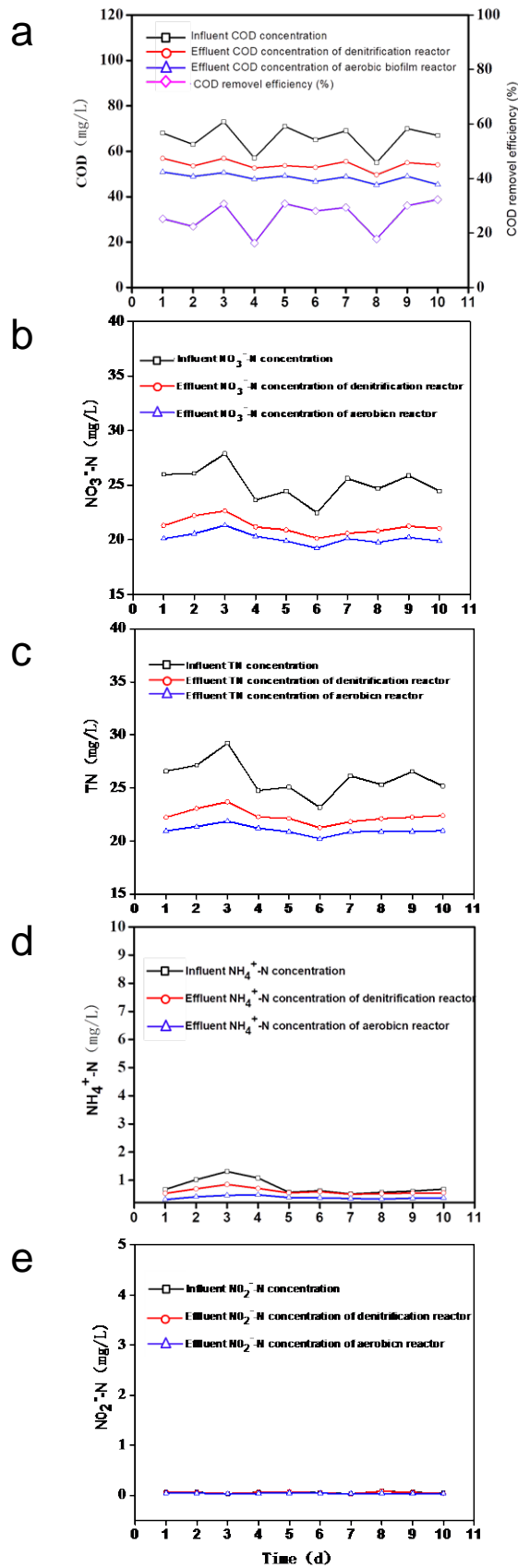


Fig. S3 Operational performance of bioreactors: the variations in COD (a), nitrate nitrogen (b), total nitrogen (c), ammonium nitrogen (d), and nitrite nitrogen concentration (e) under HRT of 25h without adding carbon at the start phase of laboratory-scale experiment.

Table S1 the original wastewater characterization

Parameter	Concentration (mg/L)
COD	875.6±5.6
BOD ₅	306.4±3.1
Oil	85.1±0.6
TN	42.5±0.2
NH ₃ -N	37.2±0.2
NO ₃ ⁻ -N	0.801±0.002
Sulfide	3.3±0.01
Volatile phenol	24.1±0.21
SS	86.2±0.4
pH	8.22±0.05