Supplementary materials

Poly (vinyl alcohol)/modified porous starch gel beads for microbial preservation and reactivation: Preparation, characterization and its wastewater treatment performance

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Captions

Text S1 Microorganisms and cultivation

The inoculum sludge was obtained from the JiGuanShi Municipal Wastewater Plant of Chongqing (China), and its properties were as follows: mixed liquor suspended solid concentration (MLSS) 4000 ± 150 mg/L, the ratio of mixed liquor suspended solid concentration to mixed liquid volatile suspended solids (MLSS/MLVSS) 0.72. The algae (Chlorella, FACHB-1068, $1.24*10^7$ Cell/mL) was obtained from the Freshwater Algae Culture Collection at the Institute of Hydrobiology (China).

Text S2 Shock loading experiment of influent ammonia nitrogen concentration

The experiments were set up with influent ammonia nitrogen concentrations of 35 mg/L, 50 mg/L and 70 mg/L, and the influent ammonia nitrogen concentration was changed every 5 cycles, while the rest of the influent and experimental conditions remained the same as in the manuscript.

As shown in Figure S4, when the initial ammonia nitrogen concentration was 35mg/l, the ammonia nitrogen removal effect of PVA-MPS gel beads was gradually enhanced with the increase in the number of reaction cycles, and the ammonia nitrogen removal rate rapidly reached more than 95%. In the 6th cycle, the ammonia nitrogen concentration of the feed water was increased to 50mg/l, and the ammonia nitrogen removal effect of PVA-MPS gel beads was reduced under the impact load of this ammonia nitrogen concentration, but the ammonia nitrogen removal rate was basically maintained at more than 85%. And in the influent ammonia nitrogen concentration shock load increased to 70 mg/l, the ammonia nitrogen removal rate of

PVA-MPS gel beads decreased significantly, and the final ammonia nitrogen removal rate was 38%. The ammonia nitrogen removal of PVA-PS gel beads had a similar trend with PVA-MPS gel beads, but the ammonia nitrogen removal rate was always lower than that of PVA-MPS gel beads, and the final ammonia nitrogen removal rate was only 27%. In addition, at the end of the reaction, the morphology and elasticity of the PVA-MPS gel beads remained good, while partial breakage and microbial leakage occurred in the PVA-PS gel beads.

Table S1 The components of trace element.

Component	Concentration
EDTA-NA_2	23.01 g/L
$FeSO_4 \cdot 7H_2O$	5.00 g/L
$ZnSO_4 \cdot 7H_2O$	0.43 g/L
H_3BO_4	0.014 g/L
$CoCl_2 \cdot 6H_2O$	0.24 g/L
$MnCl \cdot 4H_2O$	0.99 g/L
$CuSO_4 \cdot 5H_2O$	0.25 g/L
$NaMoO_4 \cdot 4H_2O$	0.22 g/L
$NiCl_2 \cdot 6H_2O$	0.19 g/L
$NaSeO_4$	0.11 g/L

Table S2 Pore structure parameters of PVA-PS and PVA-MPS gel beads.

Samples	S_{BET}[a] （m^2/g）	V_{total}[b] （cm^3/g）	Average pore size （nm）
PVA-PS	4.424	0.021	11.790
PVA-MPS	5.413	0.040	12.387

[a] specific surface area; and [b] surface area of the micropores of the gel beads.

Cycle	Time (min)	5	355	300	55	3	2
1~50	Influent						
	Aeration						
	Sedimentation						
	Discharge						
51~60	Influent						
	Aeration						
	Anaerobic						
	Sedimentation						
	Discharge						

Fig. S1 Cycle time distribution of reactor

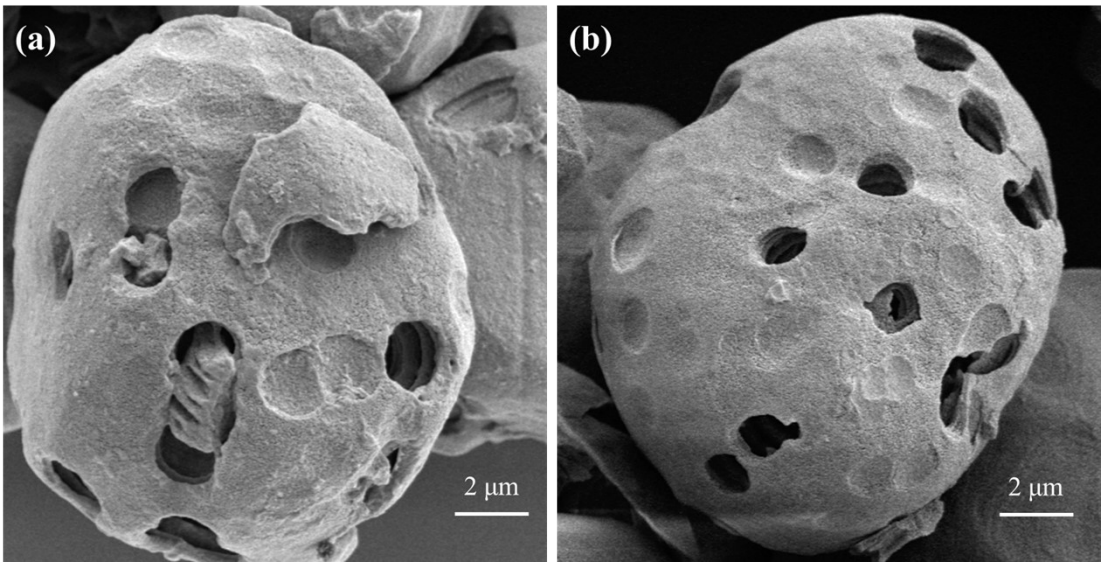

Fig. S2 SEM image of (a) PS and (b) MPS

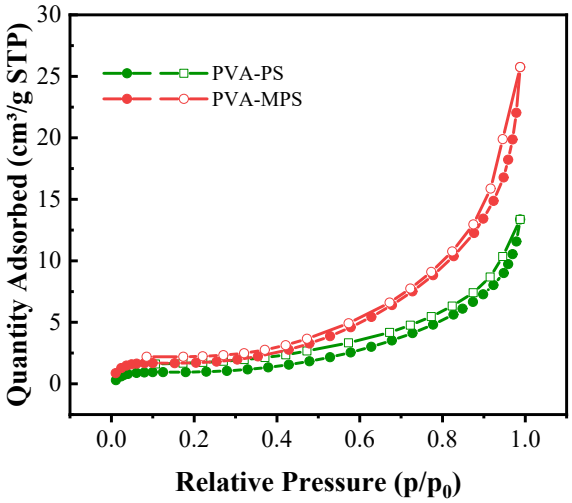

Fig. S3 Adsorption and desorption isotherms for PVA-PS and PVA-MPS gel beads

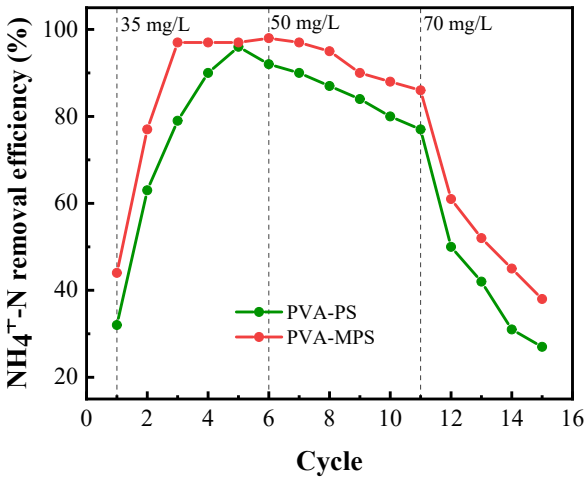

Fig. S4 Performance of microbial gel beads against ammonia shock loading

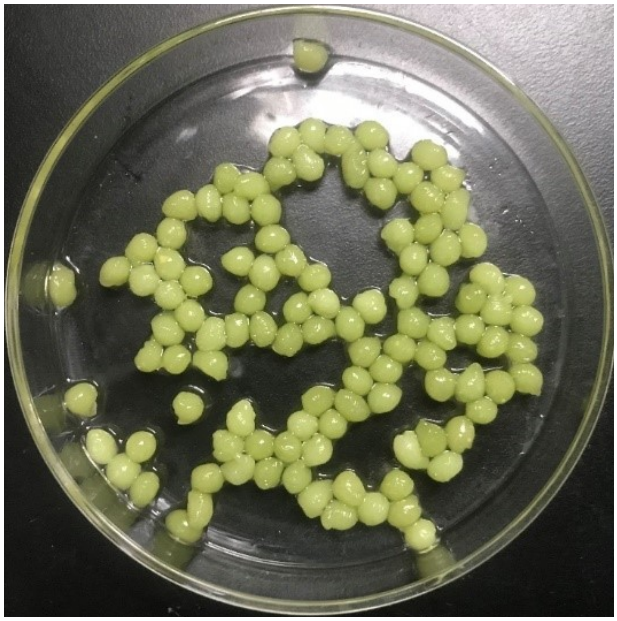

Fig. S5 Digital image of PVA-MPS gel beads before preservation

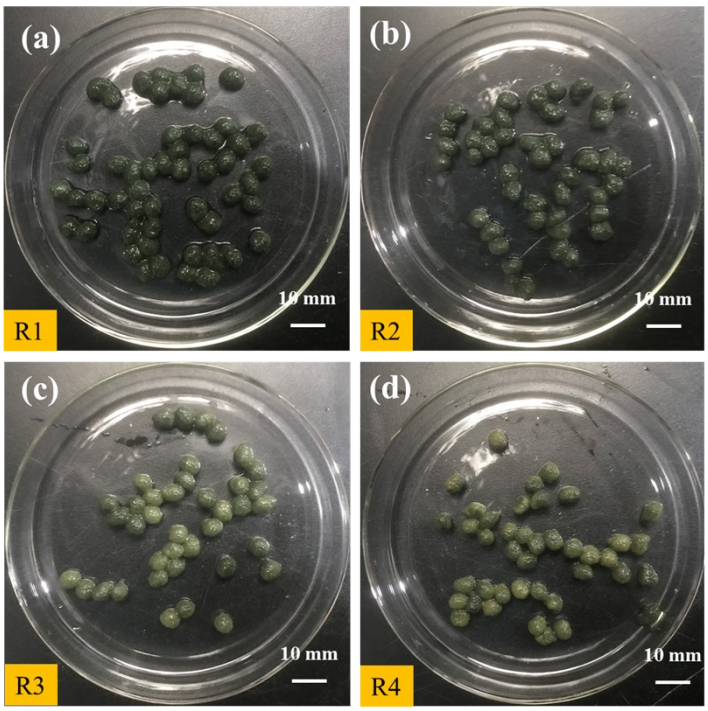

Fig. S6 Digital image of PVA-MPS gel beads collected from (a) R1, (b) R2, (c) R3, and (d) R4 were reactivated in separate reactors.