Critical design factors for polyvinyl alcohol hydrogel entrapping ammonia-oxidizing bacteria: biomass loading, distribution of dissolved oxygen, and bacterial liability

**Fig. S1.** The location and function of AOB and AMX bacteria in the outer and inner layers of the PVA/alginate gel bead.
Fig. S2. The effect of PVA concentration on the thickness of the outer layer.

Fig. S3. The nitrogen composition of the influent and effluent during the AOB enrichment.
Fig. S4. The CLSM observation on the cell density of the nitrifying bacterial community in the outer layer according to depth.

Fig. S5. A cross-section view of the live and dead cell distributions of the nitrifying bacterial community in the outer layer.