Supporting Material

Supplementary Texts

Text S1. The activation of inoculum

To increase the volume loading rate (VLR), the inoculum was acclimated by the activated wastewater for a short time. The VLR of the activated sludge reactor was set at 2 kgCOD·(m^3·d)$^{-1}$ at first, and it was raised even more by adding more wastewater. The VLR increases by 2 kgCOD·(m^3·d)$^{-1}$ every three days to 8 kgCOD·(m^3·d)$^{-1}$ at the end. When the removal of COD by the reactor of AnGS reached 85%, the inoculum was used in formal anaerobic digestion experiments. The activated wastewater, using sodium acetate and glucose together as carbon sources, has an equivalent COD value of 8000 mg·L^{-1}. Among them, the equivalent COD values of sodium acetate and glucose both are 4000 mg·L^{-1}. Other coexisting substrates are described in the section "Inoculum and substrates".

Text S2. Detailed description of the conventional analysis methods

1. The analysis of VFAs

After the anaerobic effluent was filtered through a 0.45 µm cellulose acetate filter, 3% formic acid was added, and the sample was refrigerated at 4°C. Referring to previous methodologies [22], 1 mL of the prepared sample was analyzed using an Agilent gas chromatograph GC-8890 equipped with an HP-INNOWAX column (30 m × 0.25 mm × 0.25 µm). The gas chromatograph was coupled with a split/non-split injection port (SSL) and a flame ionization detector (FID), both set at a stable temperature of 250°C. Nitrogen was used as the carrier gas, with a flow rate precisely controlled at 25 mL/min. The split ratio was set at 1:1 during injection to ensure a uniform sample distribution. The temperature program was as follows: the column oven started at 80°C and ramped up at 20°C/min to 110°C, followed by a ramp rate adjustment to 10°C/min until reaching 220°C. The final temperature was held for 2 min to ensure thermal equilibrium and detection accuracy. The elution order of volatile fatty acids was acetic acid, propionic acid, isobutyric acid, butyric acid, isovaleric acid, and valeric acid. It is worth noting that the addition of formic acid resulted in sodium acetate being detected as "acetic acid".

2. The analysis of SAM

During the period of maximal anaerobic methanogenesis rate, the Specific Methane Activity (SMA) value can be computed using Eqs (1):

$$SMA = \frac{k}{X \cdot V} \qquad (1)$$

Where SMA denotes specific methanogenic activity, mLCH$_4$·(gVSS·h)$^{-1}$; k denotes the slope, mL·h^{-1}; X denotes the average concentration of the sludge in the culture flask, gvss·L^{-1}; and V denotes the volume of the reaction region, L.

3. The particle size analysis of AnGS

The particle size distribution of anaerobic granular sludge (AnGS) was determined using a laser particle size analyzer (Bettersize 2600) through wet method testing. The specific operating steps were as follows: after cleaning the disperser with water, the hydraulic circulation flow rate was set to 600, with measurements taken three times. A suitable amount of wet AnGS (approximately $1 \sim 2$ g) was added to the hydraulic disperser to ensure a light transmittance of about 15%, and the average of three measurements was analyzed.

Text S3. Detailed description of statistical analysis

The Pearson coefficient is between 1 and -1, where 1 represents a perfectly positive correlation, -1 indicates a perfectly negative correlation, and 0 means no relationship. The correlation was considered statistically significant at 95% confidence intervals ($p < 0.05$).
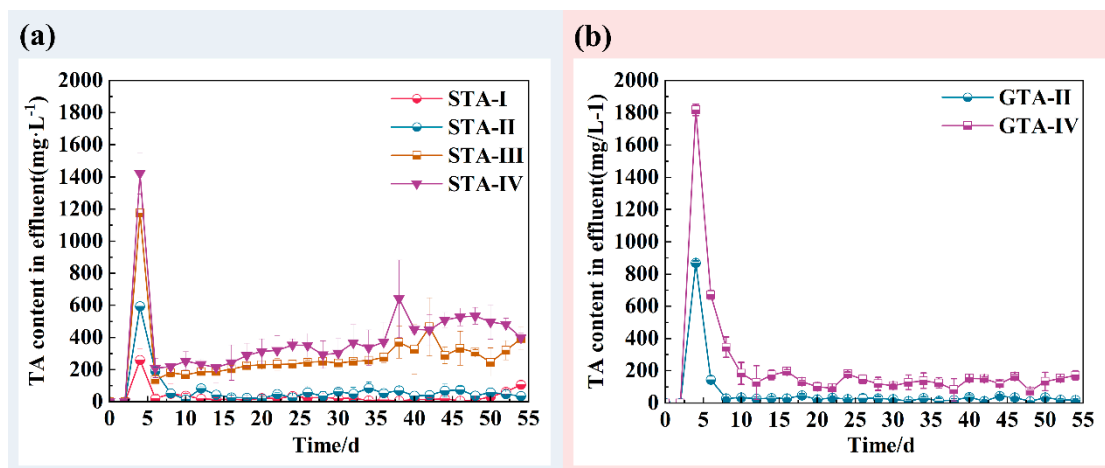
Supplementary Figures

Figure. S1 The content of TA in anaerobic effluent under TA stress (a: sodium acetate group; b: glucose group).
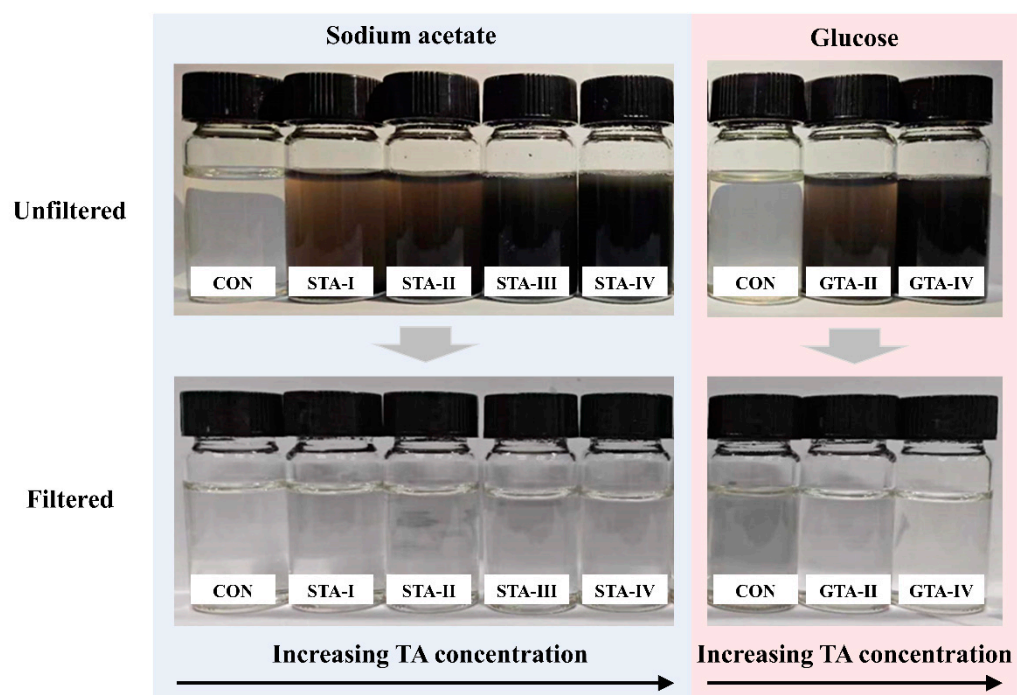
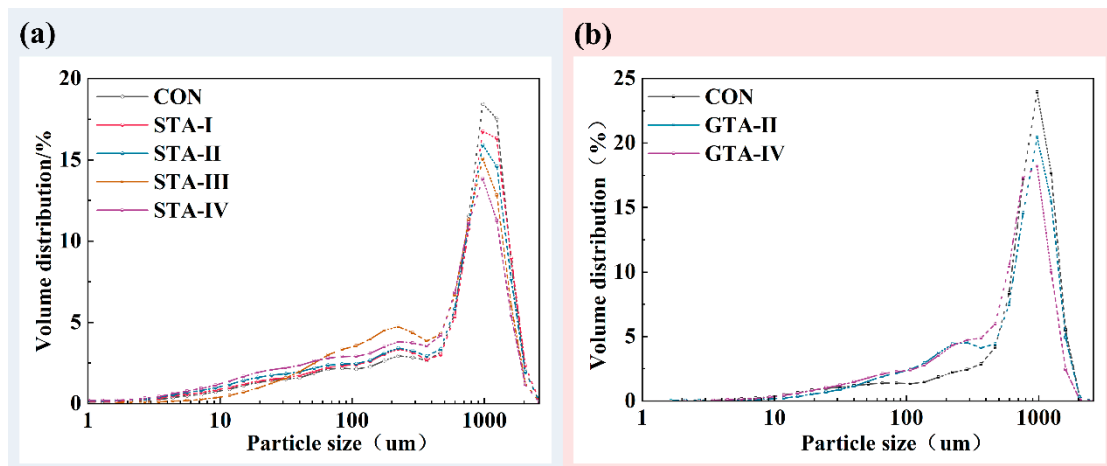**Figure. S2** Turbidity image of anaerobically digested effluent under TA stress.

Figure. S3 Particle size distribution of AnGS at the end of the experiment under TA stress (a: sodium acetate group; b: glucose gro