BiOWiSH® TECHNOLOGIES

Case Study

BiOWiSH® Aqua

BiOWiSH® Aqua Reduces Ammonia in the Ju River, Sanhe City, Hebei Province, China

Background

Sanhe is a county-level city administered by Langfang prefecture in eastern Hebei province, China. Sanhe City is surrounded by the Beijing and Tianjin municipalities. The name of the city translates to “Three Rivers”. Sanhe belongs to the plan named Jing-Jin-Ji (Beijing, Tianjin, and the ancient name for Hebei, Ji). This urban development plan was designed to distribute industrial and social resources across these counties. By relieving congestion in Beijing, moving pollutant-heavy industry away from the capital, and combining the resources of the three areas, the planners hope to create a more balanced economic structure.

The Ju River (Fig. 1) is the largest water body in the city, with a total length of 206 km and a total area of 1712 km^2. The population has grown rapidly in the past few decades, and the old sewage network system cannot manage the increase in sewage flow. As a result of the increase in sewage, the Ju River has become “Black & Odorous” (B&O) and requires an effective treatment solution by the Sanhe Government. Criteria for defining water bodies as B&O are shown in the table below.

	Light B&O	Serious B&O
Transparency (cm)	25~100	< 10
DO (mg/L)	0.2~2.0	< 0.2
ORP (mV)	-200~50	< -200
NH_3-N (mg/L)	1.5~8.0	> 15

Table 1: Definitions of “Black & Odorous”

In 2018, the government commissioned a process (Fig. 2) to treat the by-pass water flow from the Ju River. It is an attached growth system with a gravel bed, promoting biofilm growth for the removal of biological nutrients, especially ammonia nitrogen (NH_3-N), which is a major pollution factor for this river. The designed capacity of this by-pass treatment system is 100,000 m^3/day. It contains two gravel bed systems in series. The first uses aeration to lower NH_3-N and the second uses anoxic conditions to lower Total Nitrogen (TN). The design parameters for influent and effluent are shown below.

	COD (mg/L)	**NH_3-N** (mg/L)
Designed Influent	80	7
Target Effluent	40	2

Table 2: Designed influent and target effluent concentrations

Since the system came online in early 2018, NH_3-N has been fluctuating between 8 mg/L and 10 mg/L, which does not meet the required effluent compliance levels. During the winter, the attached growth system has little biological activity, especially in the denitrification system. Local EPC firms suggested a partnership between BiOWiSH and the City of Sanhe government as an opportunity to demonstrate BiOWiSH® Aqua’s capacity to improve nitrification and reduce NH_3-N levels through an all-natural bioaugmentation protocol.

BiOWiSH® Aqua

- Rapid nitrification and denitrification in aerobic and anaerobic conditions
- Reduces sludge production
- Increases plant treatment capacity
- Reduces odors
- Reduces aeration requirements
- Reduces need for chemical additives
- Improves plant stability
- Pre-treats influent in collection systems
- Natural and non-toxic

Available Sizes

- 100g/3.5oz
- 1kg/2.2lbs
- 5kg/11lbs
- 10kg/22lbs

Figure 1: Ju River and Lock

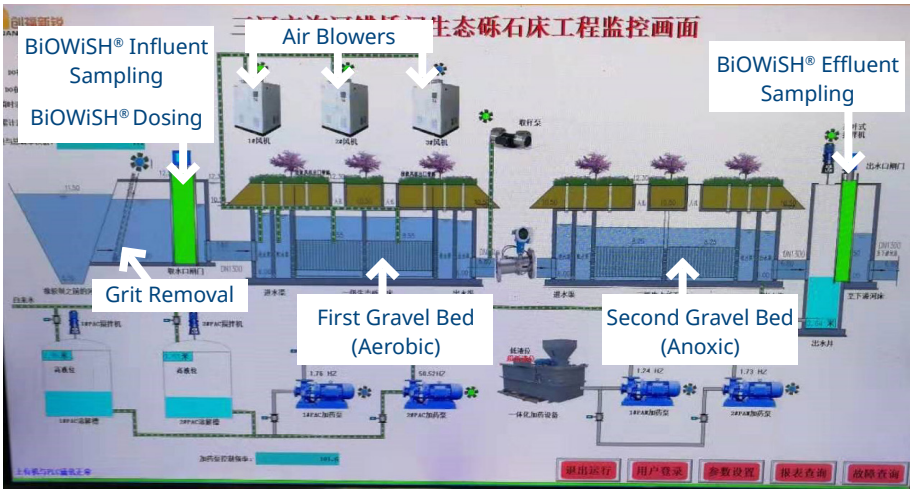

Figure 2: PFD for the attached growth treatment process

Objectives

Ammonia levels for the Ju River have been non-compliant with the limit of 2 mg/L for 10 continuous months. The bioaugmentation protocol with BiOWiSH® aims to accelerate the biological activity of the current attached growth system and degrade NH_3-N rapidly to achieve compliance within a 30-day period.

Solution

A continuous dosing plan was designed with an initial daily dosage of 0.16 ppm while water temperature remained below 15°C. Once the daily average water temperature rose above 15°C, the daily dosage was increased to 0.4 ppm. After effluent NH_3-N became compliant below 2 mg/L, the daily dosage was decreased back to 0.16 mg/L to optimize operational costs.

Figure 3: Dosing tank

Figure 4: Dissolving BiOWiSH® Aqua into the dosing tank

Results

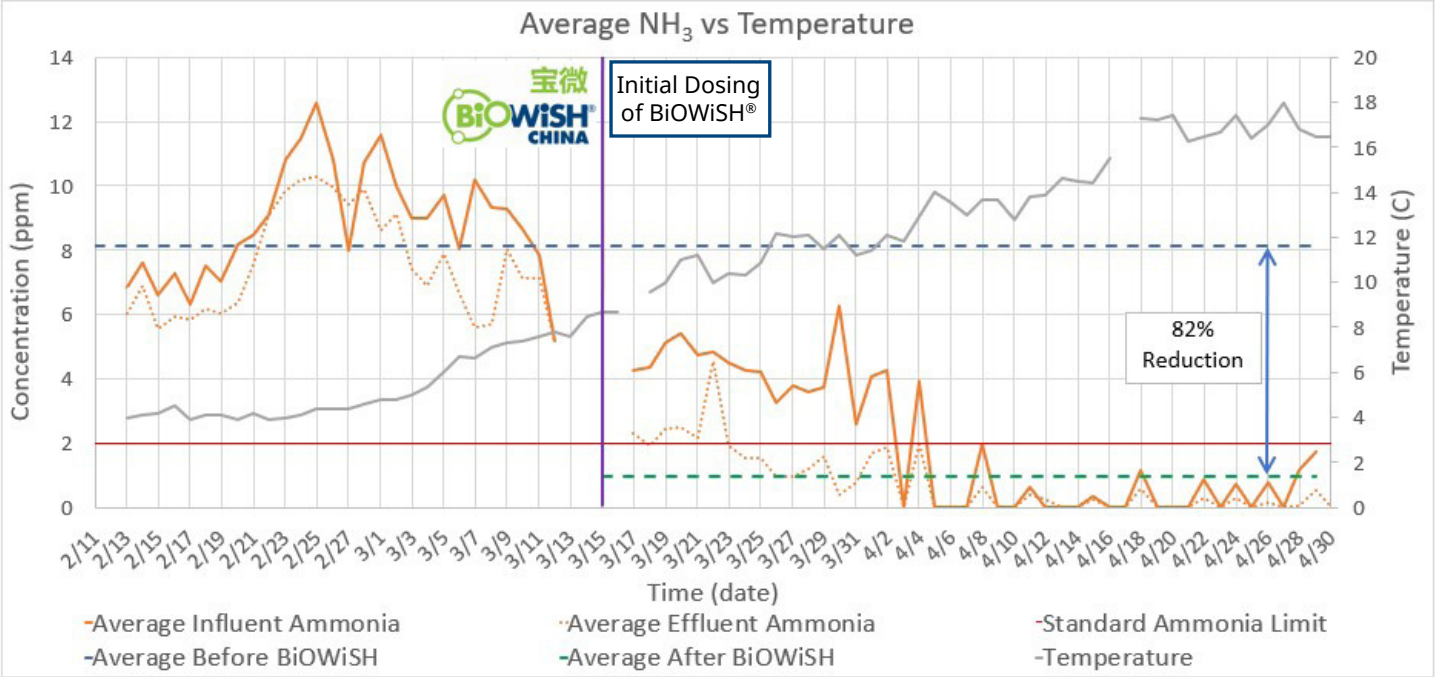

Figure 5: Average influent and effluent NH_3 concentrations before and after BiOWiSH®

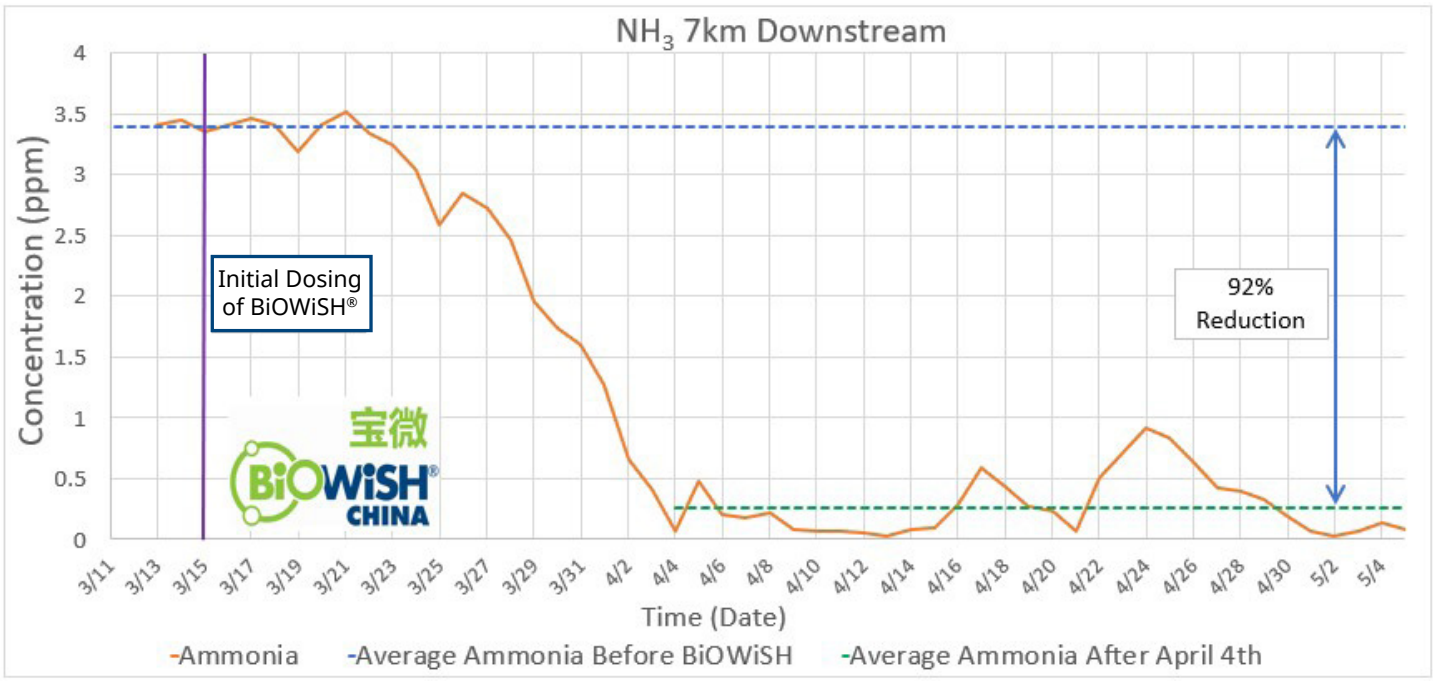

Figure 6: NH_3 concentrations at a government sampling site 7 km downstream

Within 3 weeks of dosing BiOWiSH® Aqua, NH_3 levels decreased dramatically. Average process influent and effluent ammonia concentrations showed an 82% decrease, from 8.13 ppm to 1.39 ppm. Samples from the sampling point located 7 km downstream showed an average 92% decrease in ammonia concentration, from 3.4 ppm to 0.26 ppm, only two weeks after implementing BiOWiSH®.

Conclusion

Bioaugmentation of the attached growth gravel beds with BiOWiSH® Aqua has proven to deliver rapid acceleration of the existing microbiome. Assisted by rising water temperatures, BiOWiSH® organisms were able to boost nitrification across the treatment unit. Two weeks after the initial dosing, the system effluent was back in compliance for NH_3 levels.

The application of this powerful, all-natural BiOWiSH® solution continues to work after leaving the unit, where BiOWiSH® helped to deliver the lowest NH_3 levels on record at the downstream monitoring station. Further optimization work is now underway to find the stable dosing program that is capable of delivering the minimum operating cost.

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