



IEA Bioenergy  
Technology Collaboration Programme

# Treatment of pigment wastewater and generation of natural gas standard biomethane in Hangzhou, China

## Case Story

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Figure 1: Biogas purification plant in Hangzhou Lily Group Co.,Ltd

### Treatment of pigment wastewater

The biogas plant treating pigment wastewater is located in the Lily group, Qiantang industrial new area, Hangzhou, Zhejiang Province. It is a typical project for environmental protection in China's coastal industry. The project was constructed in March 2021 and began operation in July 2021. It was developed, constructed (and is operated) by Beijing Huida Environmental Protection Technology Co., Ltd (Figure 1) at a total investment cost of 63 million yuan. The plant covers an area of 3.1 hectares and the facility can treat 4.5 million tonnes of sewage annually, reduce 11,250 tonnes of COD pollutants, and produce 2.7 million cubic meters of natural gas equivalent annually.

## Treatment process and discharge standard

The composition of the pigment wastewater may be noted in Table 1. The wastewater is treated by 10 Upflow Anaerobic Sludge Bed (UASB) reactors with a volume of 1,500m<sup>3</sup> per reactor under mesophilic conditions (Figure 2). The produced biogas is desulfurized (to maintain H<sub>2</sub>S below 10ppm) and upgraded (Figure 3). The upgraded biomethane is injected into the natural gas pipeline.

Table 1 Production and characteristics of pigment wastewater in Hangzhou Lily Group Co.,Ltd

Item	Value
Amount of pigment wastewater (m <sup>3</sup> /d)	15,000
pH	7.8 to 8.5
Chemical Oxygen Demand (COD) in units of (mg/L)	3,100 to 4,700
Total Ammonia Nitrogen (mg/L)	9.3 to 25.9
Fe (mg/L)	1.7 to 2.2
Ca (mg/L)	20.5 to 56
Na (mg/L)	63.7 to 109
Cu (µg/L)	8 to 17.3
Co (µg/L)	10.8 to 22
Ni (µg/L)	185.3 to 270
Zn (µg/L)	140 to 230
Se (µg/L)	36 to 57.6

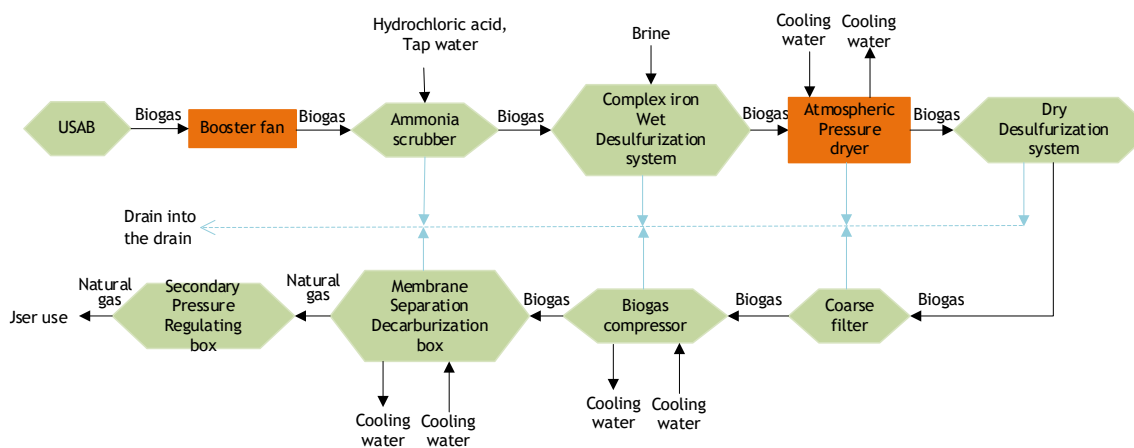


Figure 2: The flow chart of treatment process at the Hangzhou Lily Group Co.,Ltd



Figure 3: Membrane purification equipment

Table 2 Characteristics of the effluent of UASB treating pigment wastewater

Items	Value
pH	8.0 to 8.3
COD (mg/L)	980 to 1300
Total Ammonia Nitrogen (mg/L)	13 to 28
Volatile Fatty Acids (VFA) in units of mg/L	36 to 80
Suspended Solids (SS) in units of mg/L	100 to 300
Total Solids (TS) expressed as a %	0.5 to 0.8

The effluent (Table 2) is further treated aerobically to reach level 3 of the “Discharge standard of pollutants for municipal wastewater treatment Plant (GB 18918-2002)” as described in Table 3.

Table 3 Maximum allowable effluent concentration of basic control items (daily mean) (mg/L)

No.	Basic control index		Level 1 standard		Level 2 standard	Level 3 standard
			Grade A	Grade B		
1	Chemical Oxygen Demand (COD)		50	60	100	120 <sup>①</sup>
2	Biological Oxygen Demand (BOD <sub>5</sub> )		10	20	30	60 <sup>①</sup>
3	Suspended Substance (SS)		10	20	30	50
4	Animal and vegetable oils		1	3	5	20
5	Petroleum oil		1	3	5	15
6	Anionic surfactants		0.5	1	2	5
7	Total nitrogen (calculated by N)		15	20	-	-
8	Ammonia nitrogen (calculated by N) <sup>②</sup>		5 (8)	8 (15)	25 (30)	-
9	Total phosphorus (calculated by P)	Built before 2015.12.31	1	1.5	3	5
		Built since 2016.1.1	0.5	1	3	5
10	Colority (Dilution factor)		30	30	40	50
11	pH		6-9			
12	Fecal coliforms		103	104	104	-

Notes:

① In the following cases, it will be executed according to the removal rate index: When the influent COD is greater than 350 mg/L, the removal rate should be greater than 60%; When the influent BOD is greater than 160 mg/L, the removal rate should be greater than 60%

② The value outside the brackets is the control index when the water temperature is > 12; the value in the brackets is the control index when the water temperature is ≤ 12°C.

**IEA Bioenergy Task 37 “Energy from Biogas”** <http://task37.ieabioenergy.com>

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