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HUBER TECHNOLOGY
WASTE WATER Solutions

First complete treatment plant for sewer grit installed in China

1. General

Fig. 1: COANDA Grit Washer RoSF4 units

During the past 20 years China has significantly stepped up its efforts to improve wastewater treatment. Already 3,243 sewage treatment plants were built until June 2012. These state-of-the-art plants clarify an average daily amount of 130 million m³ wastewater. Frequently, however, problems occur especially with sludge digestion due to sediments which hinder optimal digestion and cause wear on the sludge dewatering systems.

The problems are caused by the numerous building projects going on in China's cities. A lot of debris, grit and silt, i.e. a lot of inorganic material, is washed into the sewer network and further on into the sewage treatment plants. The grit traps are often unable to cope with these large amounts so that these mineral materials arrive in the preliminary clarification tanks and even in the digester towers. Investigations have shown that the organic content in digested sewage sludge is only 30 - 50% in China. In Germany, this rate is about 20% higher because fewer minerals are washed into the sewers here and the sewers are cleaned regularly.

The customer defined his requirements for a new treatment plant as follows:

- the plant must remove and wash coarse material, sand and silt from the sewer grit.
- organic material must be separated from the sewer grit.
- the wash water must be discharged directly into the STP Qinghe.

2. Description of the treatment plant

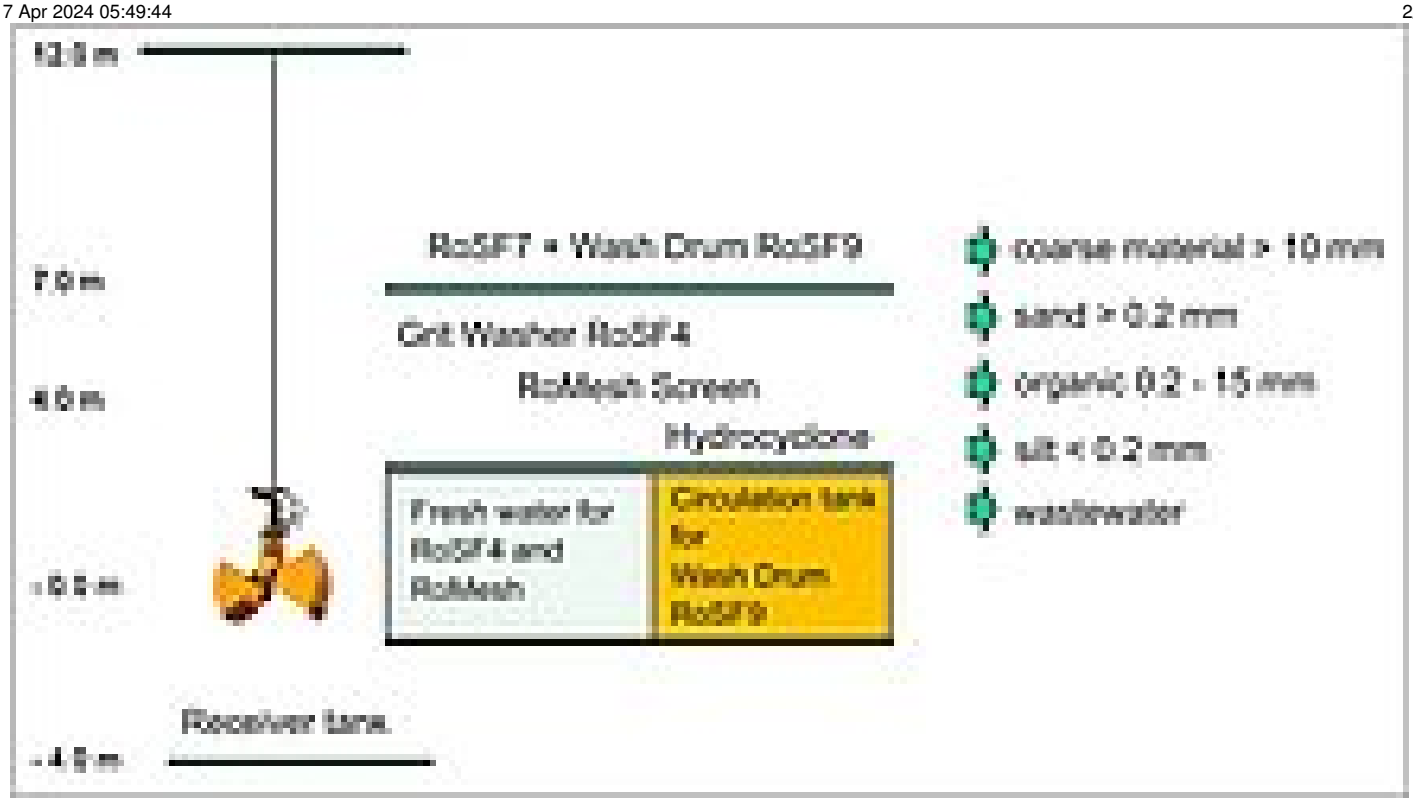

Fig. 2: Process flow of the sewer grit treatment plant

The plant is installed on STP Qinghe in Bejing in a new separate building and is designed for an hourly throughput of 6 t/h. During peak periods the daily throughput can increase to up to 60 tons.

- Design data:
  - Throughput capacity: 60 t/d or 6 t/h
  - Operating hours per day. 8 to 16 h
  - Sewer cleaning and transport is during the night from 11 p.m. to 6 a.m.
  - Main delivery from March to May and September to November (80% of the annual amount)
  - Input material: 10 – 70% DR; on average 62 % DR with 16% organic material
- Structures:
  - Underground receiver silo
  - Treatment hall
  - Office and control panel room
- Technical process flow (see fig. 2):
  - Grabbing crane
  - Intermediate storage and dosing plant RoSF7 size 1
  - Wash drum RoSF9 size 2 with screw conveyor
  - 2 Grit Washer RoSF9 units, size 2-S3
  - Hydrocyclone with classifying screw
  - RoMesh screen, size 3, with screw conveyor
  - Longitudinal grit trap with horizontal removal screw
  - Pumping station for service and circulation water
  - Biofilter

3. Detailed description of the process flow

3.1 Receiver silo:

The sewer grit is delivered to the sewage treatment plant by a suction vehicle as a sludge mixture, or in already dewatered form by a truck, and immediately emptied into a receiver silo. The storage volume of the underground concrete silo is 150 m³ (8 m × 5 m × 4.5m [L x W x H]). A grate is fitted above the silo to retain trash.
A dewatering channel in the silo ensures that the seepage water can by gravity flow into a pump from where it is delivered into the

Fig. 3: ROTAMAT® Wash Drum RoSF9

Fig. 4: Screening with an ultra-fine RoMesh® Rotary Drum Screen

RoSF9 Wash Drum by a submersible pump (15 m delivery height).
A biofilter is installed outside directly beside the silo. The exhaust air is sucked from the silo via a DN 500 pipeline and is introduced directly into the biofilter.

3.2 Dosing plant and coarse material removal

A grabbing crane takes the solids from the silo and lifts them to a geodetic height of approximately 10 m. From this height the contaminated material is dropped into a 6 m³ intermediate storage facility (RoSF7). A horizontally installed dosing screw (size 500) transports the material into the RoSF9 Wash Drum (see fig. 3).
Inside the Wash Drum all materials bigger than 15 mm are separated, washed and discharged into a screw conveyor. The wash water consumption of the Wash Drum is approximately 90 m³/h (circulation water).

3.3 Grit separation and grit washing:

All undersized particles in the Wash Drum (a 15 mm) are discharged into two COANDA Grit Washer RoSF4 units (see fig. 1). The Grit Washer units separate the grit from the organics/silt, wash the grit and remove it via a screw. The organics content in the grit is below 3% with grain size 0.2 mm. The wash water demand of the two Grit Washer units is approximately 22 m³/h. The wash water comes from the MBR plant on STP Qinghe.

3.4 Separation of organics and process water treatment:

The effluent from the grit washing plant flows by gravity through a DN 350 pipeline into a HUBER Rotary Drum Screen RoMesh (see fig. 4) where all organics size 2 - 15 mm are separated and removed. The screened effluent flows directly into an unaerated grit trap which serves as an intermediate buffer for the process water (circulation water). The wash water demand of the RoMesh screen is approximately 12 m³/h. The wash water comes from the MBR plant on STP Qinghe.

3.5 Silt removal:

The unaerated grit trap serves not only as an intermediate buffer for the circulation water but separates also silt up to a grain size of approximately 60 µm. A horizontal screw conveyor installed in the grit trap delivers the fine grit/silt from one end to the other end of the grit trap. There, with a volume flow of approximately 30 m³/h, a wear-resistant grit pump delivers all sediments to a hydrocyclone which reliably separates the fine particles with a grain size of 60 µm. The downstream water of the cyclone flows directly into a classifying screw which dewaters the silt statically and delivers it into a container.
The upstream water of the cyclone is returned into the intermediate buffer through a DN 100 pipeline. The intermediate buffer supplies

the wash water for the Wash Drum (circulation water). Surplus water in the intermediate buffer, if any, is discharged directly into the sewer system, i.e. into the inflow to the sewage treatment plant.

3.6 Wash water management:

A total of up to 34 m³/h service water is required for the two RoSF4 Grit Washer units and the RoMesh screen. This amount of wash water is taken from the MBR plant on STP Qinghe. The inflowing service water is stored in a 25 m³ tank from where it is supplied to the consumers as needed. The circulation water from the intermediate buffer is taken as wash water for the RoSF9 Wash Drum as described above.

3.7 Exhaust air treatment:

The exhausts air treatment plant with a throughput capacity of 6,000 Nm³/h consists of several components: exhaust air ventilator, humidifier, biofilter plant, sprinkler system. The biofilter plant consists of a fixed bed reactor which is filled with active carbon. The exhaust air treatment plant cleans the contaminated air sucked from different areas of the whole plant. The biologically treated air is discharged into the atmosphere.

4. First results

Due to the well known separation size of its individual components this treatment solution provides cost-effective separation of sewer grit into different fractions. The table below gives an overview of the individual mass flows.

With an hourly throughput of 6 tons (which is a dry mass of 3.72 tons with a DR of 62%) the sewer grit is divided into five different fractions (see fig. 5). The washed grit with a loss on ignition below 3% can for example be used as material for road building or as filling material. Also the separated silt can be used as building material. The washed coarse materials (stones, domestic waste, plastic material) are landfilled. Due to their significantly reduced weight they help saving the city's landfill capacity. The separated organic material is composted so that nutritive media can be recovered from it. Only the wastewater flow containing the fine organic material flows to the sewage treatment plant where most of it is converted into sludge gas in the digester tower.

Due to regular sewer cleaning also the mineral solids load in the sewage treatment plant is significantly reduced which improves the function of the grit trap. The low amount of silt and sand in the digester sludge protects the sewage treatment plant from operational problems and reduces the costs for maintenance and wear repair.

In practice, the composition of the sewer grit varies continuously during the year as well as due to different sewer structures and ways of sewer grit "production". It will remain to be seen what the results will be in the medium term.

Material	Grain size	Rate
Anorganic material	> 15 mm	10%
	0.2 - 15 mm	41%
	< 0.2mm	49%
Organic material	> 15 mm	4%
	0.2 - 15 mm	61%
	< 0.2 mm	35%

Fig 5: Material flows in the treatment plant in Beijing

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