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Prevention of Odor Formation and Corrosion in Sewers through Precise Linear Treatment of Waste Water with the DRAUSY Hose System

FUNCTIONAL SUITABILITY OF THE DRAUSY HOSE SYSTEM

1. The Problem

In some sections of the waste water collection system of a municipality in southern Germany, malodorous emissions were occurring as the result of a lack of oxygen in the waste water. To prevent these odor emissions, the DRAUSY hose system was used in a pilot project carried out by the municipality, the Department of Applied Geology at the University of Karlsruhe, and DRAUSY GmbH. The objective was to raise the oxygen content in the waste water by means of the linear addition of air. The technical and functional suitability of the DRAUSY hose system was tested in the course of the project.

2. Functional Principle and Material Properties of the DRAUSY Hose System

Because of its material properties and specific geometry, the DRAUSY hose compensates for different internal pressures by means of cross-sectional deformation. In the process, modifications occur in the size of the holes, which are uniform in the hose's initial state. Thus a small hole is produced at high pressure, and as the pressure decreases, the holes become larger (Fig. 1). The result is an equal amount of outflow from each opening. This property makes it possible for liquids and gases to be evenly distributed in waste water in precise dosages over long distances (up to 10 kilometers).

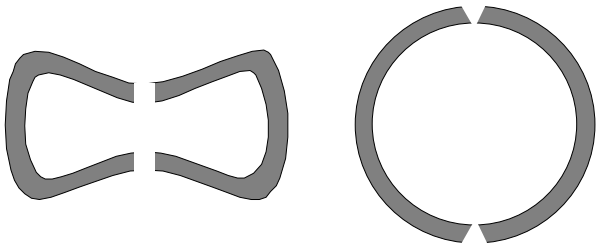

Abb. 1: Cross-sectional deformation of the DRAUSY Hose -- pressure compensation through modification of the openings.

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The DRAUSY hose is manufactured in one piece and is custom perforated in terms of the number and size of the openings to meet the oxygen requirements of the specific sewer segment in which it will be used. The DRAUSY hose is made of thermoplastic polyurethane (PUR). This material combines the high-quality mechanical properties of elastomers with the processing technology for thermoplastics. Even within the temperature ranges that occur under the extreme conditions in sewers, the hose possesses the characteristic elastic properties of rubber. An outstanding feature of the hose is its high resistance to wear, in terms of its impact and abrasion resistance, its initial resistance to tearing and tear-growth, and its tensile strength. To relieve strain and prevent floating, the hose is bonded with a steel wire sheathed in plastic.

3. Suitability Test

To test the technical suitability of the hose, the DRAUSY hose system was installed in a 211-meter-long section of sewer. This sewer segment has a gradient of 11% and is traversed by domestic and industrial sewage with a highly variable flow rate.

The installed hose system was perforated with holes 40 µm in diameter placed at a distance of 40 cm from each other. The objective was an air dispersion quantity of 125 cm^3 x min^{-1} x m^{-1}. With a running length of 210 meters, there was a total of 525 holes on each side of the hose. Air was fed into the hose via a V12YR-type side channel compressor made by ORPU (Oranienburger Pumpen und Verdichter GmbH). This extremely compact device, including all of the technical connections, is housed in a casing 81 cm wide, 84 cm deep and 125 cm high. Due to the side channel compressor's excellent sound dissipation qualities and the supplementary damping of the housing, sound emissions were not even audible at the nearest developed property (approximately 10 meters away).

The air was fed into the hose at a pressure of 0.3 bar. Thus 25 cm^3 of air per minute was dispersed in the sewage through each hole (Fig. 2). Stable system pressure was achieved at > 0.5 bar, which corresponded to a gas dispersion quantity of 30 cm^3/min/hole.

With the help of online measurements using an oxygen sensor along the treatment segment, a very constant distribution of air was detected and with it, an increase in the oxygen content of the sewage to over 80% of oxygen saturation. At the average saturation values already present in the sewage, this corresponded to an additional infusion of 2 mg/l of oxygen.

Once oxygen began to be added using the DRAUSY hose system, there was no longer any odor annoyance along the treated segment.

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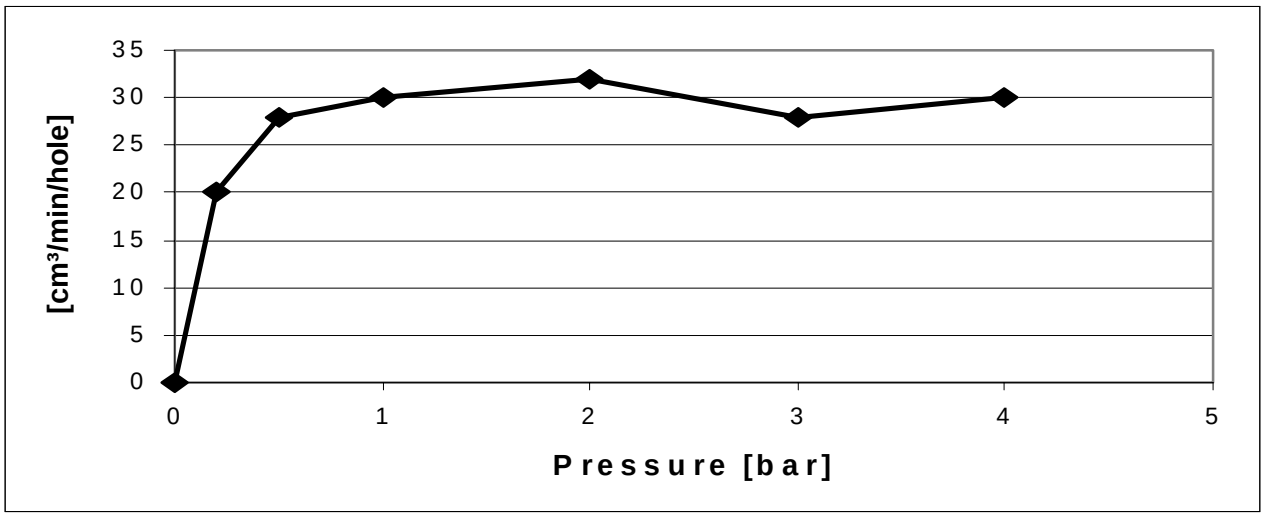

Fig. 2: Test protocol for the installed DRAUSY hose

Several options were considered for securing the hose system in the sewer. It was found that laying the hose loosely in the sewer made it least susceptible to material deposits. The hose was only attached inside the intake shaft. In this way sedimentation and the formation of tresses were avoided.

In order to check the hose's resistance to stress in the sewer pipe, the sewer was cleaned eight times with a high-pressure cleaning jet under extreme pressure. In a follow-up inspection, neither an impairment of the functioning of the hose nor any visible damage to the hose could be detected.

The hose is chemically resistant to oils and grease, gasoline and many solvents, acids and caustic solutions. The sewer liners, which have been in use for several years, are manufactured out of the same material. It can thus be assumed that, even in the most extreme circumstances, the hose will endure the conditions found in the sewer without any problem.

4. Summary Evaluation

The DRAUSY hose system proved to be completely capable of satisfying the demands placed upon it in terms of both its functional suitability for the uniform, linear dispersion of an agent and its resistance to stress.

Prof. Dr. H. Hötzl

Results of a comparison between punctual air dosage versus linear air dosage in wastewater, realized at Harz-University from 2006 to 2009 financially assisted by AIF
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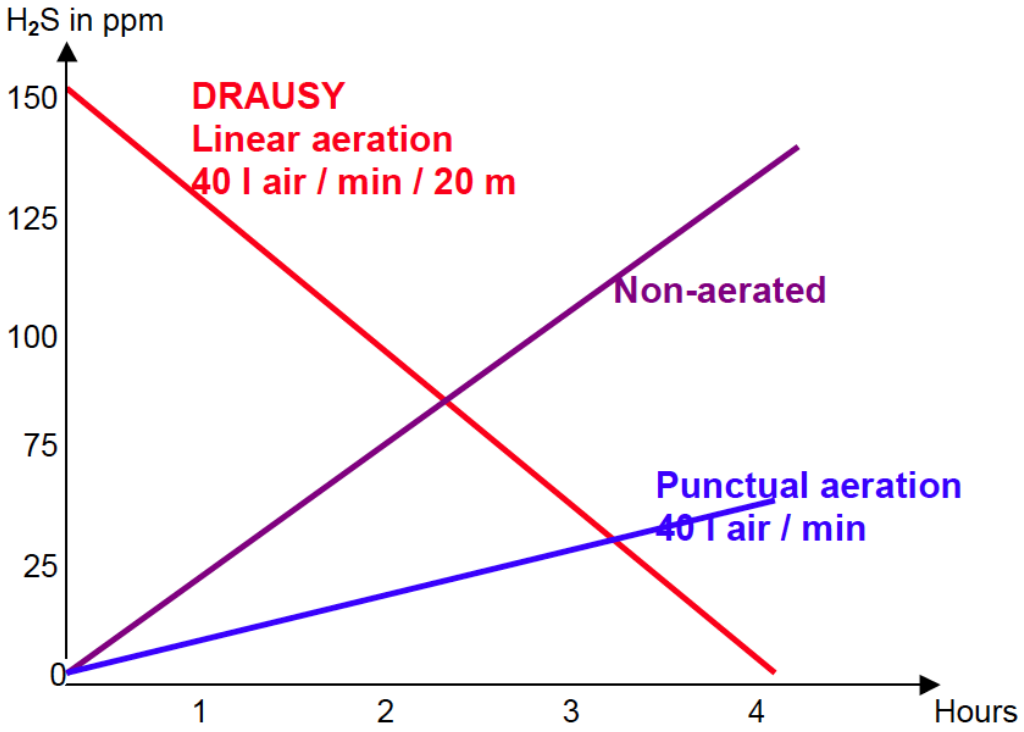
Different conditions had been analysed by varying the following parameters:

- Composition of wastewater
- Temperature
- Parameters of aeration

The experimental tests have shown that the used wastewater had a high potential of sulphide generation of nearly 4 mg/(lh)$^{-1}$ at 20 °C temperature in the wastewater. By aerating punctually the development of sulphide could be reduced considerably. Linear aeration was even able to oxidize already existing sulphide in the wastewater so that the concentration of sulphide was reduced. Odour nuisance could be avoided by this treatment.

The comparison between punctual and linear dispersion was elaborated in depth in the thesis of Mrs. Ute Urban, Hochschule Harz, Wernigerode.

Biological H_2S-Generation in a Wastewater pressure pipe



Thesis of Dr. Ute Urban (2008-2011): Results comparing punctual and linear Dosage