перші 60 хв. досягає 55% за початкової концентрації 234 мг/л. Виходячи з цього, можна зробити висновок, що на поверхні сорбенту має місце як фізична так і хімічна адсорбція.

Зважаючи на невелику швидкість вилучення можна використовувати дану методику першим етапом багатостадійної технології очищення промислових стоків. Завдяки цьому вирішується проблема утилізації відходів та здешевлення процесу очистки стічних вод фармацевтичних підприємств, які знаходяться на території м. Шостка.

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USING DISTRIBUTED TEMPERATURE SENSING FOR LOCATING INFILTRATION AND INFLOW INTO WASTEWATER SEWERS

O. Panasiuk
Luleå University of Technology
Laboratorievägen 14, 971 87 Luleå, Sweden
e-mail: oleksandr.panasiuk@ltu.se

Infiltration and inflow (I/I) into wastewater sewers have number of negative effects on both the sewer system and wastewater treatment plant (WWTP) including reduced effective capacity of sewers, increased risks of flooding and sanitary sewer overflows, increased hydraulic load on WWTP and reduced efficiency of wastewater treatment, accelerated deterioration of the system and increased costs of operation [1]. The causes for I/I may include the excessive water entering the sewers through broken pipes, poor pipes connections, manholes, roof and basement drains [2]. Such inflows frequently occur as rainfall derived inflow and infiltration [3] but also during the snowmelt period, which is of special importance in cold climate regions such as Scandinavia, Canada and northern USA [4]. The measurements of the I/I rate can improve the strategies for the sewer rehabilitation [2] and the locations of the inflows should be identified in order to remove the sources of I/I [5]. This paper presents the use of distributed temperature sensing (DTS) for identification and locating of I/I into the wastewater system during the snowmelt period, under dry and wet weather conditions.

DTS setup consists of the fibre-optic cable and the control unit equipped with the laser and sensing optoelectronics. The laser pulses are continuously emitted into the fibre-optic cable and partially reflected along it. The reflected signals are analysed by the DTS unit: location and temperature values along the cable are determined by the travel time of the signals and their Raman backscattering, respectively [5].

Two fibre-optic cables with the length of 2 km and 1.2 km were installed at the invert of a foul sewer in the village with 355 inhabitants in 2010, Skellefteå municipality, Sweden. The time and space resolutions were around 14 seconds and 0.25 m with the precision of around 0.1°C. The DTS monitoring campaign took place between March, 16 (with the snow cover still present on the ground) and June, 24, 2015.

The data from the DTS monitoring campaign were analysed and presented in form of colour-coded plots, where time and location are represented by the vertical and horizontal axes, respectively. Analysis of the plots may reveal temperature anomalies that indicate I/I. For example, in Fig. 1 several I/I locations were found on DTS plots. Snowmelt and rainfall induced I/I have shown different locations indicating also different pathways these types of I/I entered the sewers.

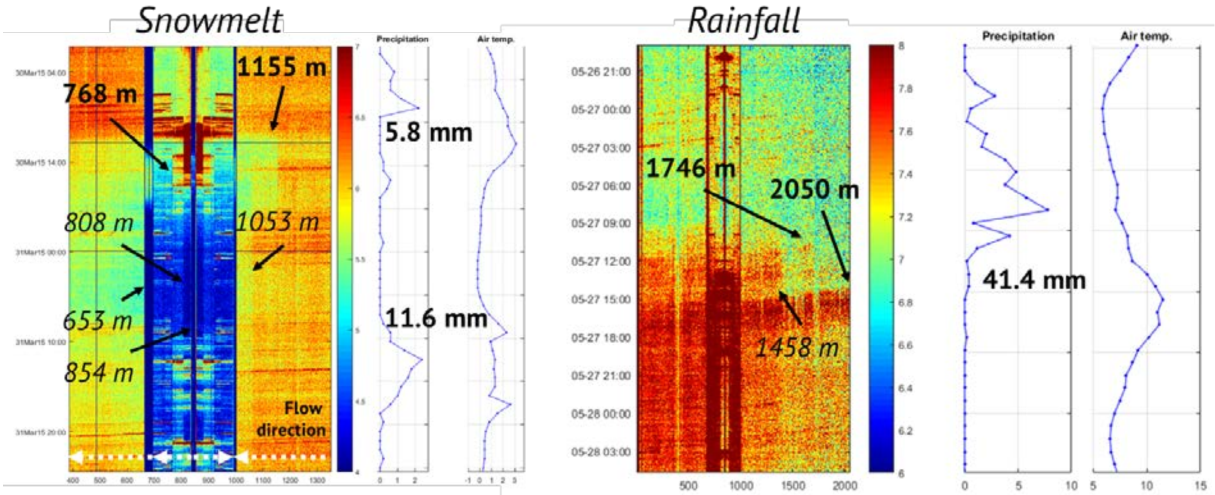

Figure 1. DTS analysis results from snowmelt (left) and rainfall (right) induced I/I with marked distances along DTS cable

Due to the high temporal and spatial resolution as well as the measurements over prolonged period of time (over 3 months), DTS has shown to be effective for identifying and locating I/I inflows into the wastewater system during the snowmelt period, dry and wet weather conditions. Snowmelt has shown to contribute to inflow via the same entries as rainfall as well as to infiltration via a range of entries, such as broken pipes or leaking manholes.

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