Alternative solutions for inhibiting Legionella in domestic hot water systems based on low-temperature district heating

Abstract
District heating is a cost-effective way of providing heat to high heat density areas. Low-temperature district heating (LTDH) is a promising way to make district heating more energy-efficient and adaptable to well-insulated buildings with low heating demand in the future. However, one concern is the multiplication of Legionella due to insufficient temperature elevation with low-temperature supply. The aim of this study was to find optimal solutions to this dilemma for specific situations. The solutions were of two types: alternative system designs and various methods of sterilization. The alternative design approach can eliminate the risk factors of Legionella by local temperature boosting and restricting system volume. Decentralized substations, micro heat pumps, electric heating elements and electric heat tracing are all investigated as alternative designs. With regard to sterilization methods, thermal treatment, ionization, chlorine, chlorine dioxide, ultraviolet light, photocatalysis and filtration are discussed as the most frequently used methods in hot water systems. The characteristics, efficacy and operation methods of LTDH using the solutions investigated are documented and compared. Finally, recommendations are given for their use in practice.

Practical application: The methods for inhibiting Legionella should fit into applicable situations according to their characteristics. This study aims to recommend optimum solutions for inhibiting Legionella in LTDH scenarios, and includes a comprehensive overview of their efficiency, installation, operation and costs, so as to give adequate information for selecting appropriate solutions. In addition to sterilization methods, alternative system design implemented with new technologies can also help prevent Legionella in hot water systems. They have the additional benefit of reducing the heat loss of the hot water system. The alternative design solutions both enrich our options for water sanitation and improve the energy efficiency of our energy systems.

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