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ENVIRONMENTAL RISKS OF WASTE THERMAL WATER DISPOSAL: LONG-TERM EFFECTS OF THERMAL WATER SEEPAGE ON DIFFERENT SOIL TYPES

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Abstract

In Hungary, 0.5 million m^3 of thermal water is exploited every day for diverse purposes. After utilization, this enormous amount of thermal water becomes sewage water with a high concentration of salts, heavy metals, ammonia, nitrate, an unfavorable ion composition and high temperature. A common treatment is to dispose of waste water into a surface recipient through uninsulated channels surrounded by arable land. By infiltration, sewage water can cause potential salinization/sodification/alkalinization and contamination of soil and groundwater. This work investigates the manifestation of these problems in different soil types, Chernozem, Phaeozem and Arenosol, representing case studies regarding the environmental risks of used thermal water.

The results conclude that seeping thermal water has a high Na^+-concentration and salt content, which represents risk of soil sodification/salinization, while leaching facilitates a rise in the salty groundwater table, and a change in the chemical type (Na^+-dominance) surrounding the channel. Together, these factors lead to soil degradation in the investigated Chernozem and Phaeozem profiles. In Arenosol, the aforementioned processes were not observed, but infiltrating thermal water reached groundwater adjacent to the channel and enhanced its total salt content and Na^+-rate. Referring to the Chernozem and Phaeozem soils, statistical analyses were carried out to determine the significant variation in soil properties between profiles located at different distances from the channel. Via principal component analysis combined with discriminant analysis, Mg^{2+}-mobilization and salinization processes were identified near the channel. On the basis of the computed discriminant function, sample groups of two localities (control and thermal water affected) can be unambiguously distinguished.

Key words: human-induced soil-salinization, soil degradation, waste thermal water seepage, discriminant analysis

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