A NONDESTRUCTIVE ELECTROMAGNETIC-BASED MODEL FOR DETECTING WATER POLLUTION IN UNDERGROUND PIPELINES

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ABSTRACT The prime objective of this study is to detect water pollution in underground pipelines buried in a dry soil. The analysis is based on a proposed electromagnetic model and experimental data taken under laboratory conditions. Detection of pollution is based on the contrast in the dielectric constant between contaminated and clean water. The modelling process includes multiple reflections within each layer. Water pollution is detected by observing the variation of reflected signals from subsurface structures. The complex dielectric permittivity of polluted water is measured as a function of frequency and analytically represented by Cole-Cole fit model. The experimental set up is described and the procedure followed to obtain an effective permittivity data is outlined. The reflection coefficient of a multi-layer medium is calculated in the frequency domain. The advocated microwave technique, discussed in this manuscript, is a potential tool for the detection of water pollutants. Results of this work show that microwave sensing is able to accurately discriminate between clean and polluted water. The current study can also serve as a useful tool to extract more detailed information about water properties in underground pipelines.

KEYWORDS Remote Sensing; Ground Penetrating Radar; Polluted Water; Underground Pipelines; Multi-Layer Model.

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