

Efficiency Assessment of Wastewater and Sludge Treatment Using Dielectric Constant and Loss Factor Measurements

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INTRODUCTION & AIM

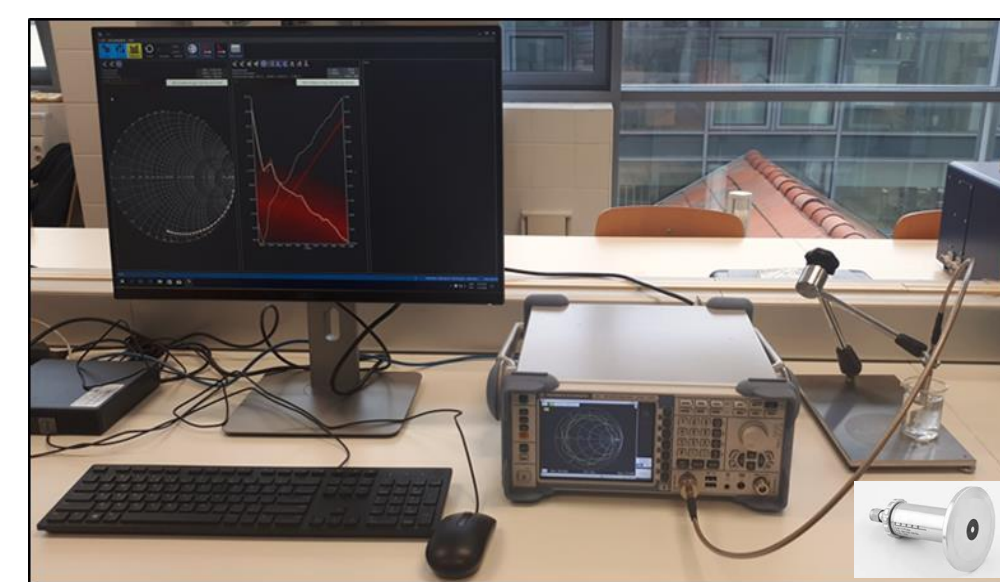
In wastewater and sludge treatment processes, it is important to develop rapid and green measurement methods (i.e. with minimal chemical usage) that can be applied under industrial conditions, in addition to detailed analytical methods.

Such methods could, for example, be used in the future for real-time efficiency monitoring. These requirements—non-destructive measurement, no chemical reagents required, and rapid determination—can be fulfilled by dielectric measurements.

In our research, an open-ended coaxial dielectric sensor was used to investigate the dielectric constant and loss factor during various wastewater purification and sludge pre-treatment processes. Quantitative changes in organic pollutants in the wastewater were monitored by determining COD and BOD.

During sludge treatments, changes in the solubility of organic matter as well as aerobic and anaerobic biodegradability indicators (BOD and mesophilic biogas production) were also assessed.

METHOD



SPEAG DAK dielectric measurement system



Oxitop BOD/biogas measurement system

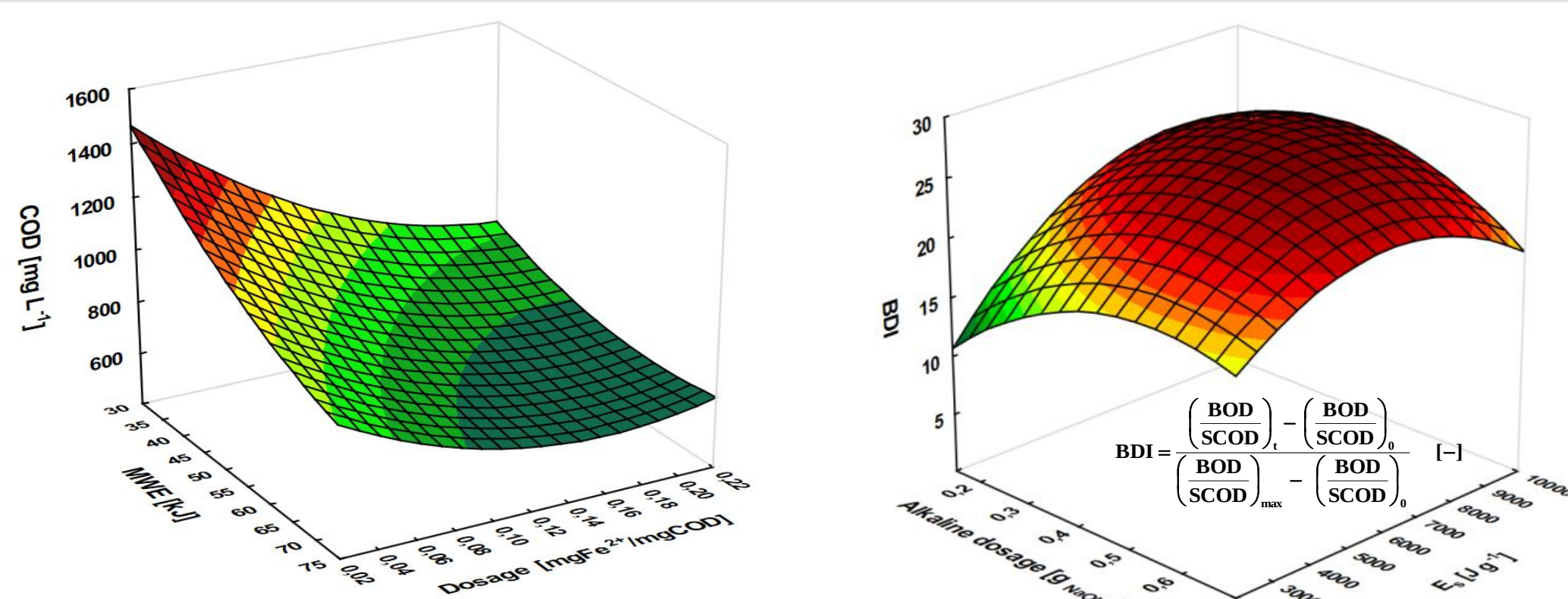


Lovibond PC Checkit COD photometer

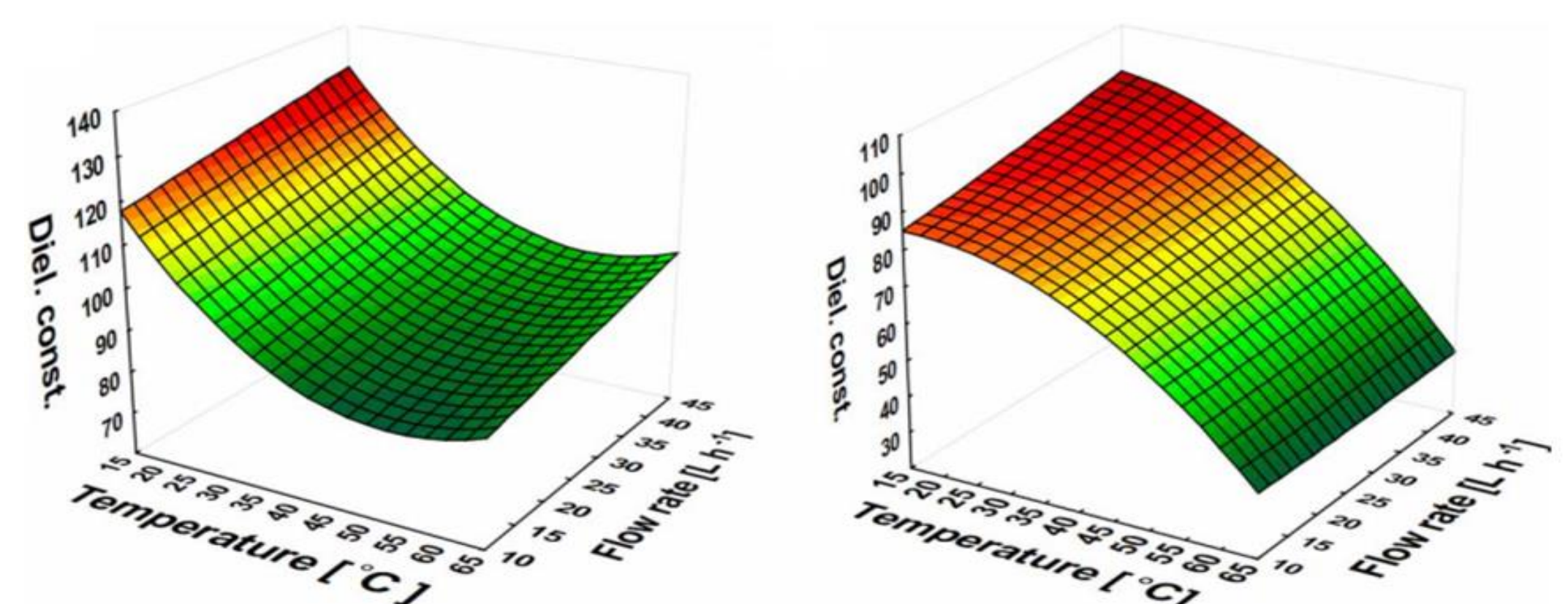


Microwave sludge treatment unit

RESULTS



Change of COD and biodegradability degree vs. MW-specific operational parameters

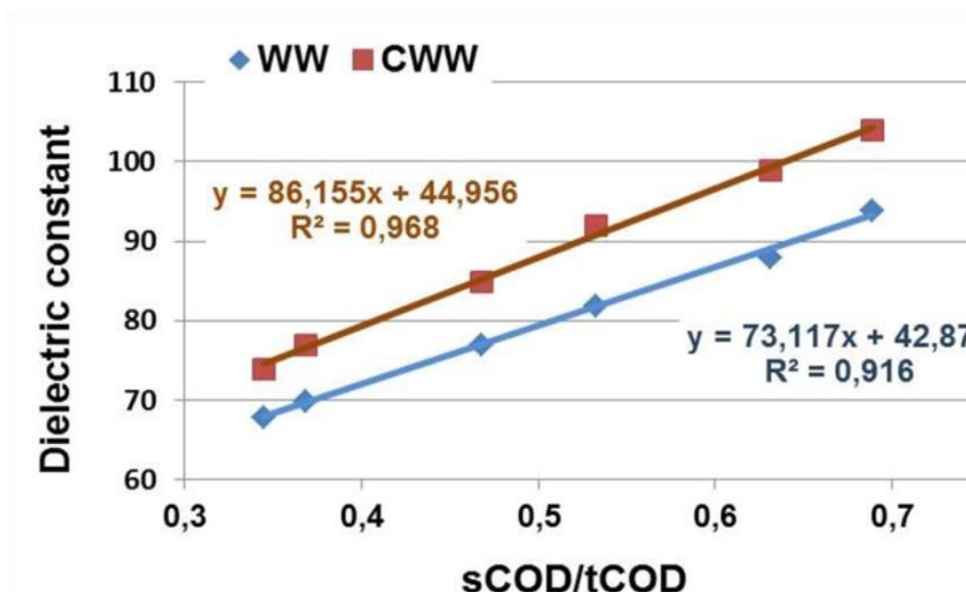


Effect of temperature and flow rate on dielectric constant of dairy sludge

CONCLUSION

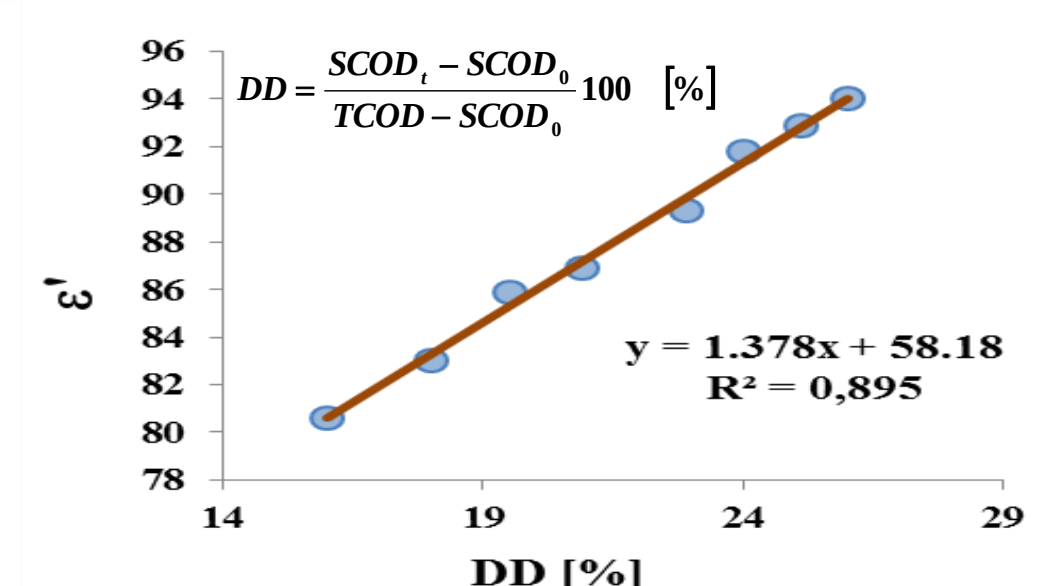
Dielectric constant measured from fermentation broth at lower frequencies (300-700 MHz) correlates well with the organic matter removal and biogas yield in anaerobic digestion process.

The change of organic pollutant concentrations of wastewater and disintegration degree (DD) correlated well with dielectric parameters in the 500-700 MHz frequency range.



Correlation of dielectric constant (ϵ' ; $f=600$ MHz) with organic matter solubility and disintegration degree (DD)

(WW-meat industry wastewater; CWW-sludge from WW)



ACKNOWLEDGEMENT

The research was financed by National Research, Development and Innovation Office (NKFI) FK 146344 project.

