

Are **unmaintained** sensors useful to monitor wastewater treatment plants?

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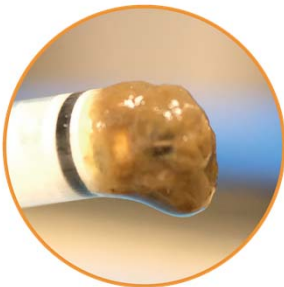
Motivation

- Monitoring can improve the treatment performance of wastewater treatment plants (i.e. low ammonium effluent).
- Especially for on-site wastewater treatment plants monitoring comes at high monetary costs.
- Unmaintained** sensors are an attractive solution.

maintained pH



VS

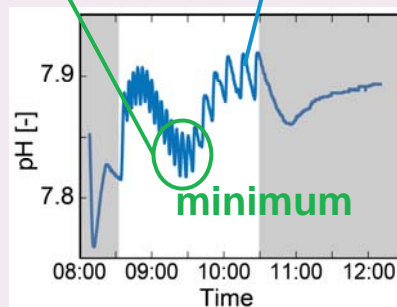


**unmaintained,
drifting pH**

Analytical approach

A local **minimum** in the pH signal acts as a proxy for the ammonium effluent concentration. As a **minimum** in the pH occurs when the ammonium is fully oxidised.

pH signal during aeration



INPUT + MODEL = PREDICTION

automatic **minimum** detection per cycle:
minimum present?

yes

no

ammonium effluent $\leq 1 \text{ g}_N\text{m}^{-3}$

ammonium effluent $> 1 \text{ g}_N\text{m}^{-3}$

Experiment

- Sequencing batch reactor monitored for one year.
- One **maintained** and four **unmaintained** pH sensors.
- Ammonium effluent concentration measured for 107 cycles.

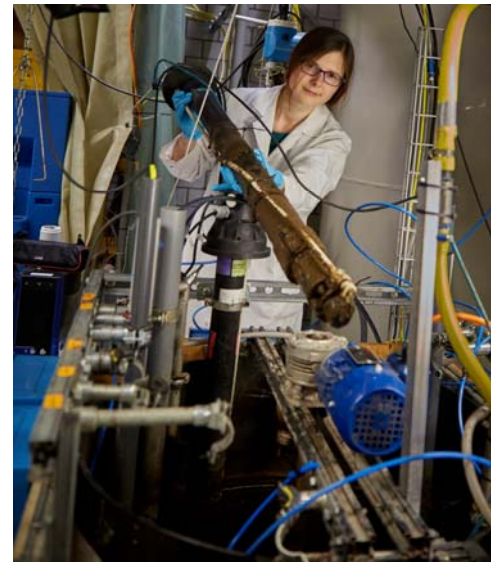


Figure: Experimental setup with unmaintained sensors.

The ammonium effluent measurements are used as a measure of success for the prediction.

Results

		measured ammonium effluent concentration									
		$\leq 1 \text{ g}_N\text{m}^{-3}$				$> 1 \text{ g}_N\text{m}^{-3}$					
maint. = maintained pH sensor unm. = unmaintained pH sensor	minimum observed?	maint.	unm. 1	unm. 2	unm. 3	unm. 4	maint.	unm. 1	unm. 2	unm. 3	unm. 4
		yes	41	40	41	39	39	1	1	1	1
	no	15	16	15	17	17	50	50	50	50	50

Conclusions

- Same prediction accuracy with **unmaintained** (despite a drift of about 0.5-1 pH/year) and **maintained** pH signal as input.
- High accuracy when detecting a **minimum**, lower accuracy when not detecting a **minimum**.
- A key step towards online, real-time remote monitoring of on-site wastewater treatment plants.