Flow injection determination of fluoride for monitoring the biodegradation of fluorophenol in a biorreactor

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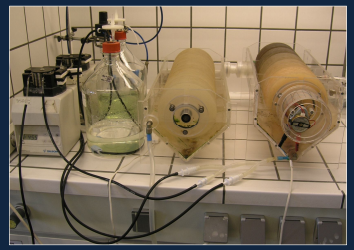
Objectives

☞ Development of a flow injection system for fluoride determination

☞ Application to the monitoring of the fluorophenol biodegradation in a biorreactor (RBC - rotating biological contactors)

- ↳ quantification of the byproducts
- ↳ minimization of growth medium interference



RBC

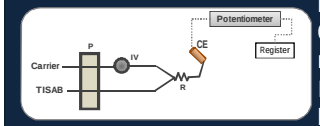
⇨ Systems with high biomass retention

⇨ Effective for biological treatment (or post-treatment) of contamination with organic pollutants, i.e. halogenated aromatic compounds

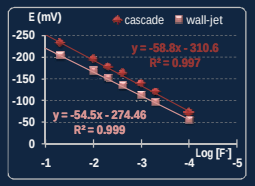
Flow injection manifold for fluoride determination

Two detection arrangements

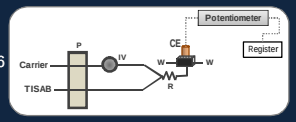
⇨ **CASCADE**

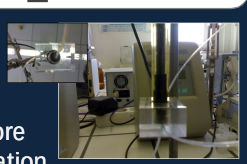


P, peristaltic pump; IV, injection valve; CE, combined fluoride electrode; R, mixing coil; W, waste; Carrier, $[F^-] = 10^{-6}$ M; TISAB, total ionic strength adjusting buffer



⇨ **WALL-JET**





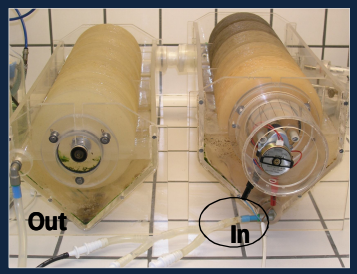
The wall-jet represents a more robust configuration

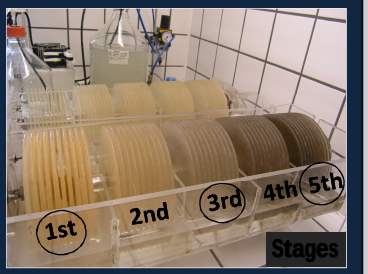
Minimization of the interference of growth medium

⇨ Addition of 3 g/L EGTA to the TISAB solution

Interferent species	Growth medium concentration (mM)	% interference: TISAB	% interference: TISAB with EGTA 3 g/L
Mn^{2+}	$1.8x10^{-2}$	-2.4	-2.6
Zn^{2+}	$1.4x10^{-2}$	-7.1	0.0
Fe^{2+}	$7.2x10^{-2}$	-10.3	0.5
NH^{4+}	7.6	-12.2	-0.5
Cu^{2+}	1.0	-2.0	3.9
Cu^{2+}	$8.0x10^{-2}$	-3.4	3.4
SO_4^{2-}	5.4	-6.4	0.5
HPO_4^{2-}	15.0	-13.2	-4.2
$H_2PO_4^-$	10.3	-5.3	-1.5
Co^{2+}	$6.4x10^{-3}$	-	-0.6

RBC sampling points





Sample preparation

⇨ After collection, samples were centrifuged and filtrated (0.45 µm)

Sampling point	$[F^-] \pm SD$ (mM)	RSD (%)
In	0.029±0.002	9.0
1st stage	0.250±0.026	10.5
3rd stage	0.243±0.020	8.5
5th stage	0.360±0.009	2.5
Out D	0.276±0.021	7.5
Out E	0.246±0.012	4.8

Conclusion

↳ The developed system decreases the analysis time enabling a fast ("real time") determination

↳ The growth medium possible interference was effectively minimised using EGTA in the TISAB solution (< 5% interference)

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