



# Alternative concentration methods for improving drinking water quality control

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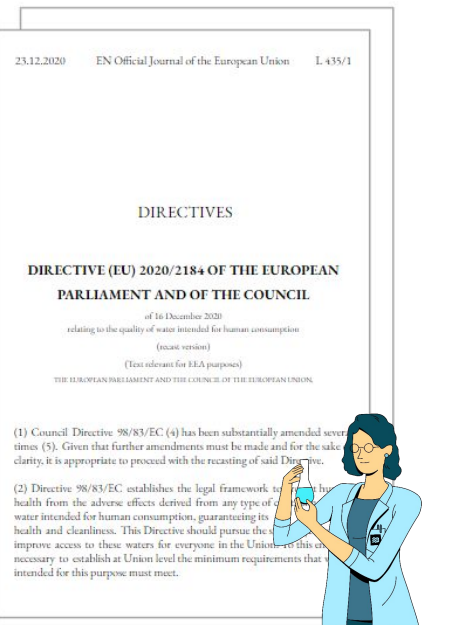
# Improve the knowledge of drinking water quality networks



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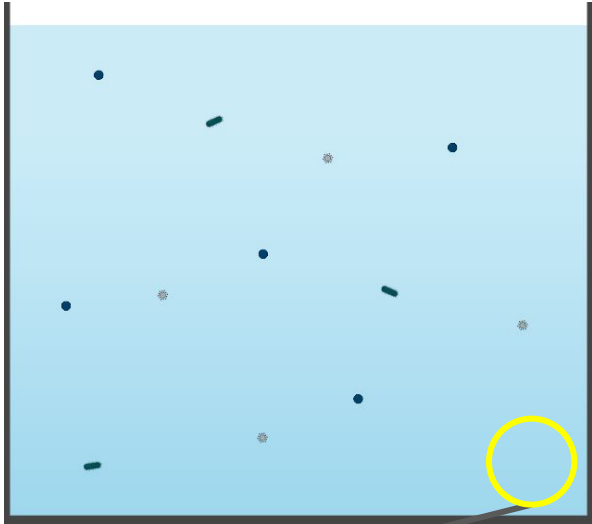


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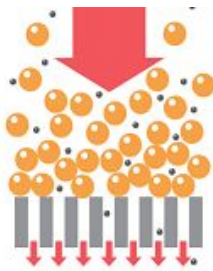
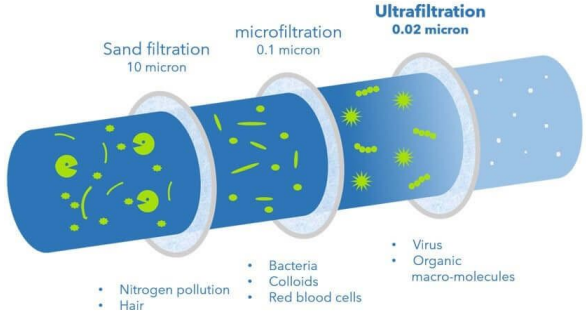


# Sample concentration



100 mL samples in a large-volume water tank, may not be sufficiently representative

## Ultrafiltration

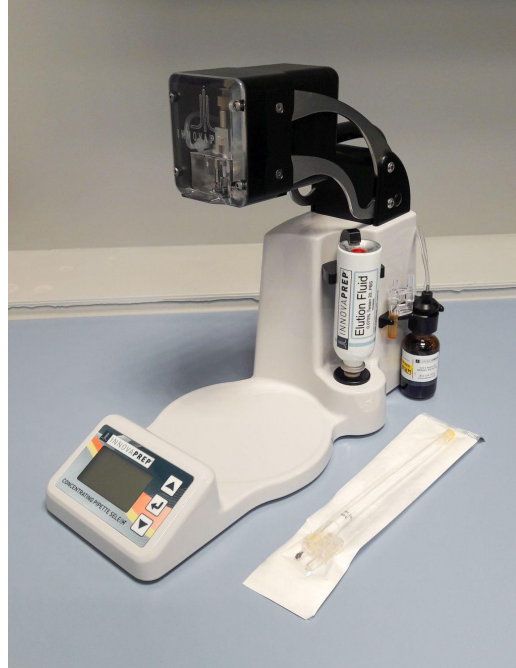


Dead-end filtration





## **Bacteria (Legionella spp.)**



**InnovaPrep Concentrating  
Pipette Select**



## **Bioterrorism or Intrusion detection**





# Legionella spp. concentrating methods

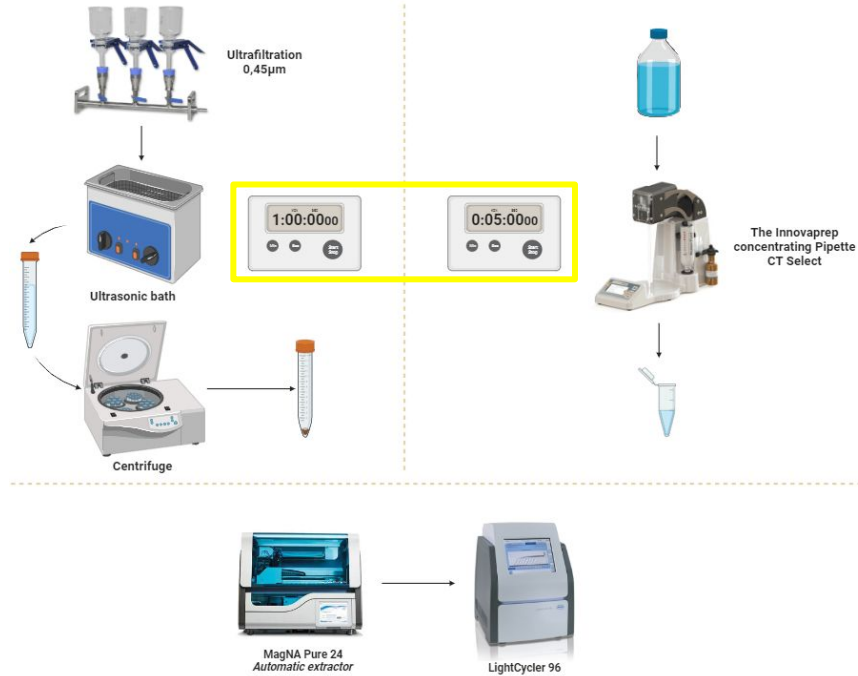


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## Filtration & sonication vs Concentrating pipette





# Legionella quantification results



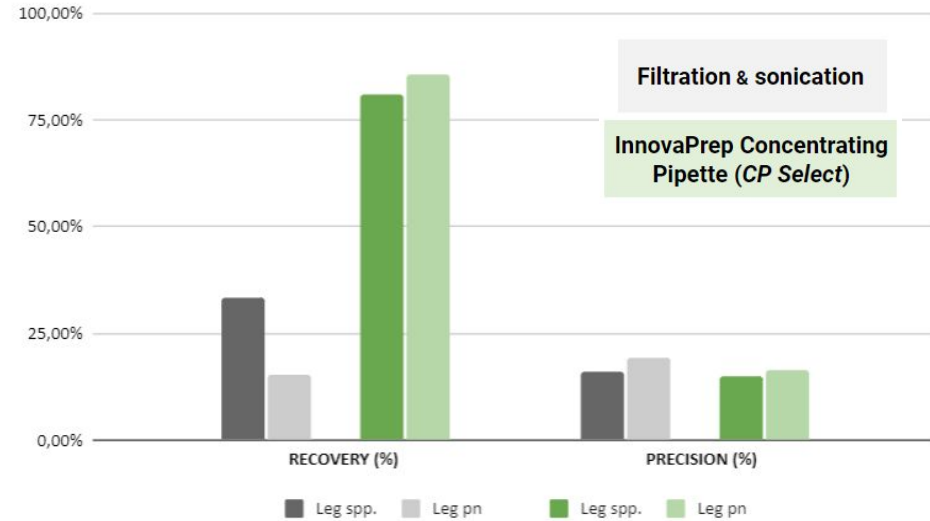
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**Table 1.** Comparison of recovery, accuracy, uncertainty and time parameters of the two methods implemented: filtration and sonication versus *InnovaPrep Concentrating Pipette Select (CP Select)* for *Legionella* spp. concentration and quantification of water samples.

	Filtration & sonication		InnovaPrep Concentrating Pipette (CP Select)	
	Leg spp.	Leg pn	Leg spp.	Leg pn
RECOVERY (%)	33,30%	15,30%	81,10%	85,80%
PRECISION (%)	16%	19,30%	14,90%	16,40%
UNCERTAINTY (LOG)	1,32	1,7	0,52	0,47
CONCENTRATION TIME (min)	60 min		5 min	





# Legionella quantification results



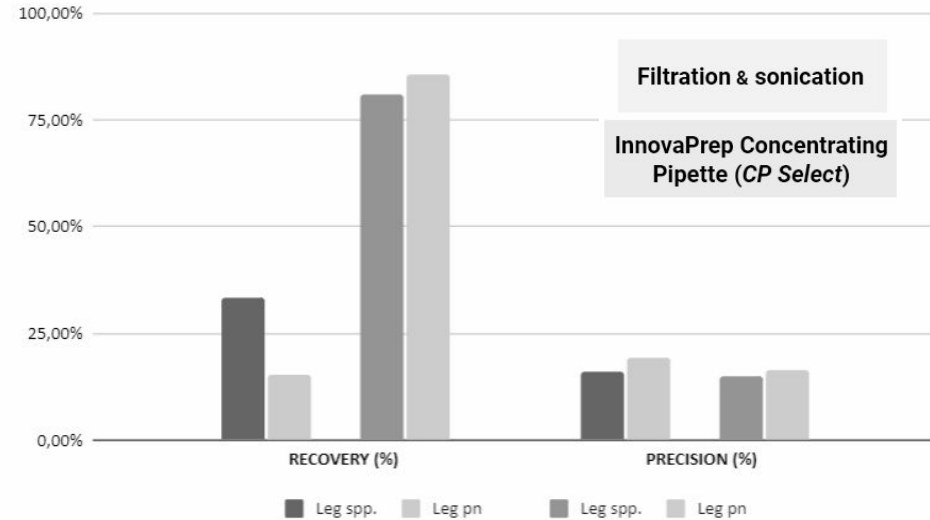
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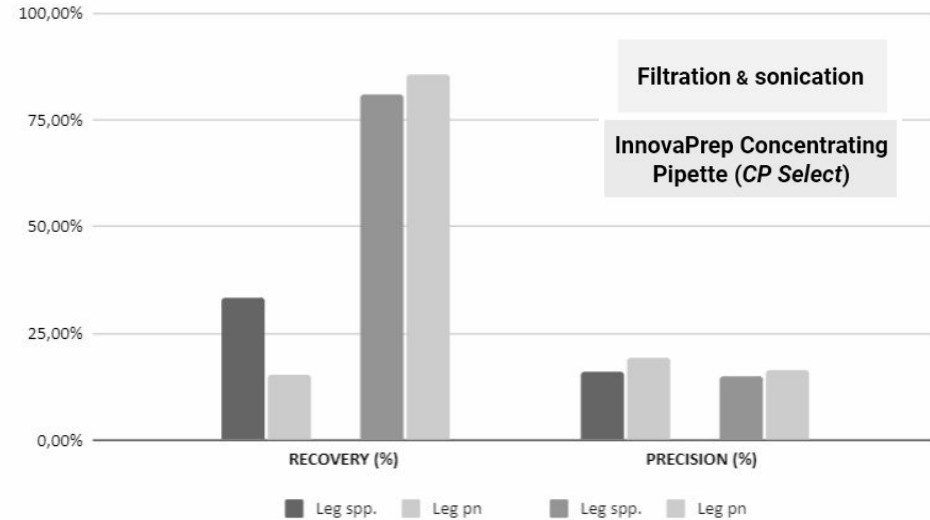
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# Bioterrorism or Intrusion detection



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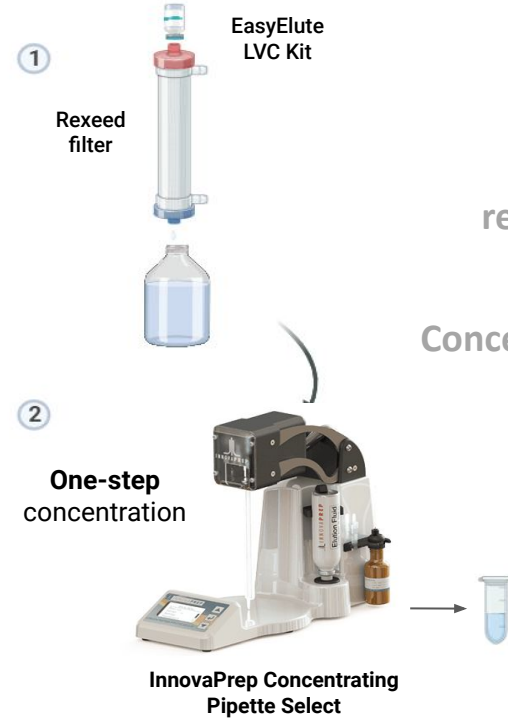
**A**

Rexeed  
Standard elution  
+  
Centricon



**B**

Alternative  
rexeed elution  
+  
Concentrating  
pipette





# Bioterrorism or Intrusion detection Results



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## Which protocol provides the best results?

Sample	Enterovirus PFU/ 100mL		crAss-phage CG/100mL		Rotavirus CC-RT-PCR-U/100mL		Hepatitis A Virus CG/100mL		Norovirus GI CG/100mL		Norovirus GII CG/100mL		Adeno Virus CG/100mL	
	A (standard)	B (alternative)	A (standard)	B (alternative)	A (standard)	B (alternative)	A (standard)	B (alternative)	A (standard)	B (alternative)	A (standard)	B (alternative)	A (standard)	B (alternative)
Raw water	<3,70E-02	4,81E-02	2,80E+03	7,93E+02	<2,70E-01	<8,22E+00	<1,40E-01	<4,39E+00	1,59E-01	1,31E+02	<1,40E-01	<4,39E+00	3,33E+00	1,18E+02
	<2,69E-02	<1,90E-03	4,46E+03	1,84E+02	NA	NA	NA	NA	1,21E+00	4,85E+02	7,69E+00	1,70E+02	2,28E+00	8,93E+01
Sand Filter	<3,30E-03	<8,60E-03	2,48E+00	<6,80E-01	<1,60E-01	4,70E-01	<9,00E-02	<2,50E-01	3,48E-03	1,37E-01	<9,00E-02	<2,50E-01	9,22E-01	<2,50E-01
	<3,30E-03	<3,30E-03	2,54E+01	9,59E+00	NA	NA	NA	NA	7,56E+00	1,61E+01	6,20E-01	2,17E+00	<7,00E-02	<2,50E-01
GAC Filter	<1,00E-03	<2,30E-03	<1,00E-01	<1,50E-01	<6,00E-02	<1,40E-01	<3,00E-02	<8,00E-02	<3,00E-02	<8,00E-02	<3,00E-02	<8,00E-02	<3,00E-02	<8,00E-02
	<1,00E-03	<1,00E-03	4,29E+00	2,46E+00	NA	NA	NA	NA	<3,00E-02	<1,40E-01	<3,00E-02	5,78E-02	<3,00E-02	1,40E-01

**Table 2.** Comparison of concentrations obtained by qPCR for Enterovirus, crAssphage, Rotavirus, Hepatitis A, norovirus GI and GII, and Adenovirus in water samples at different stages of treatment, such as, raw water, sand filter and GAC filter.



# Bioterrorism or Intrusion detection Results



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## Standard vs alternative method by Filmarray



### FilmArray™ Gastrointestinal Panel

1 Test. 22 Targets. All in about an hour.



#### Bacteria

*Campylobacter (jejuni, coli and upsaliensis)*  
*Clostridium difficile (toxin A/B)*  
*Plesiomonas shigelloides*  
*Salmonella*  
*Yersinia enterocolitica*  
*Vibrio (parahaemolyticus, vulnificus and cholerae)*  
*Vibrio cholerae*  
**Diarrheagenic E. coli/Shigella**  
 Enteroaggregative *E. coli* (EAEC)  
 Enteropathogenic *E. coli* (EPEC)  
 Enterotoxigenic *E. coli* (ETEC) *lt/stx*  
 Shiga-like toxin-producing *E. coli* (STEC) *stx1/stx2*  
*E. coli* O157  
*Shigella*/Enteroinvasive *E. coli* (EIEC)



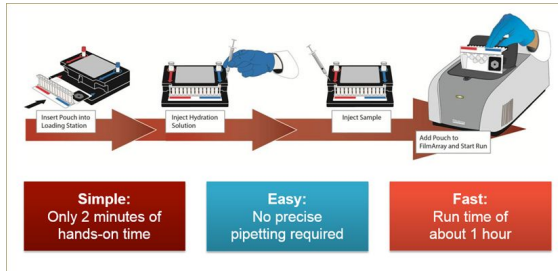
#### Parasites

*Cryptosporidium*  
*Cyclospora cayetanensis*  
*Entamoeba histolytica*  
*Giardia lamblia*



#### Viruses

Adenovirus F 40/41  
 Astrovirus  
 Norovirus GI/GII  
 Rotavirus A  
 Sapovirus (I, II, IV and V)



Percentage of positives with the filmarray (%)		A (Standard)		
		Positive	Negative	
B (Alternative)	Positive	30,6	11,3	41,9%
	Negative	1,6	56,5	58,1%
		32,2%	67,8%	100,0%



# Future applications

1

Protocol improvement

2

Wastewater matrix implementation

3

Quality monitoring during drought

4

Metagenomics

# Take home messages



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In situ  
sampling and  
concentration

Quick  
answer

Better  
recoveries and  
precision in  
**less time**

Increase the  
knowledge of the  
drinking water  
network's status



# Thank you

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