

Development of a Concentrating Pipette Tip (CPT) Device for Liquid Samples

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Introduction

InnovaPrep has commercialized and developed unique technologies for preparation and concentration of bacteria, viruses, and other biological particles from large sample volumes. This core technology is commercially available in the bench-top concentration instrument, the HSC-40.



HSC-40 Bench-Top Concentrator

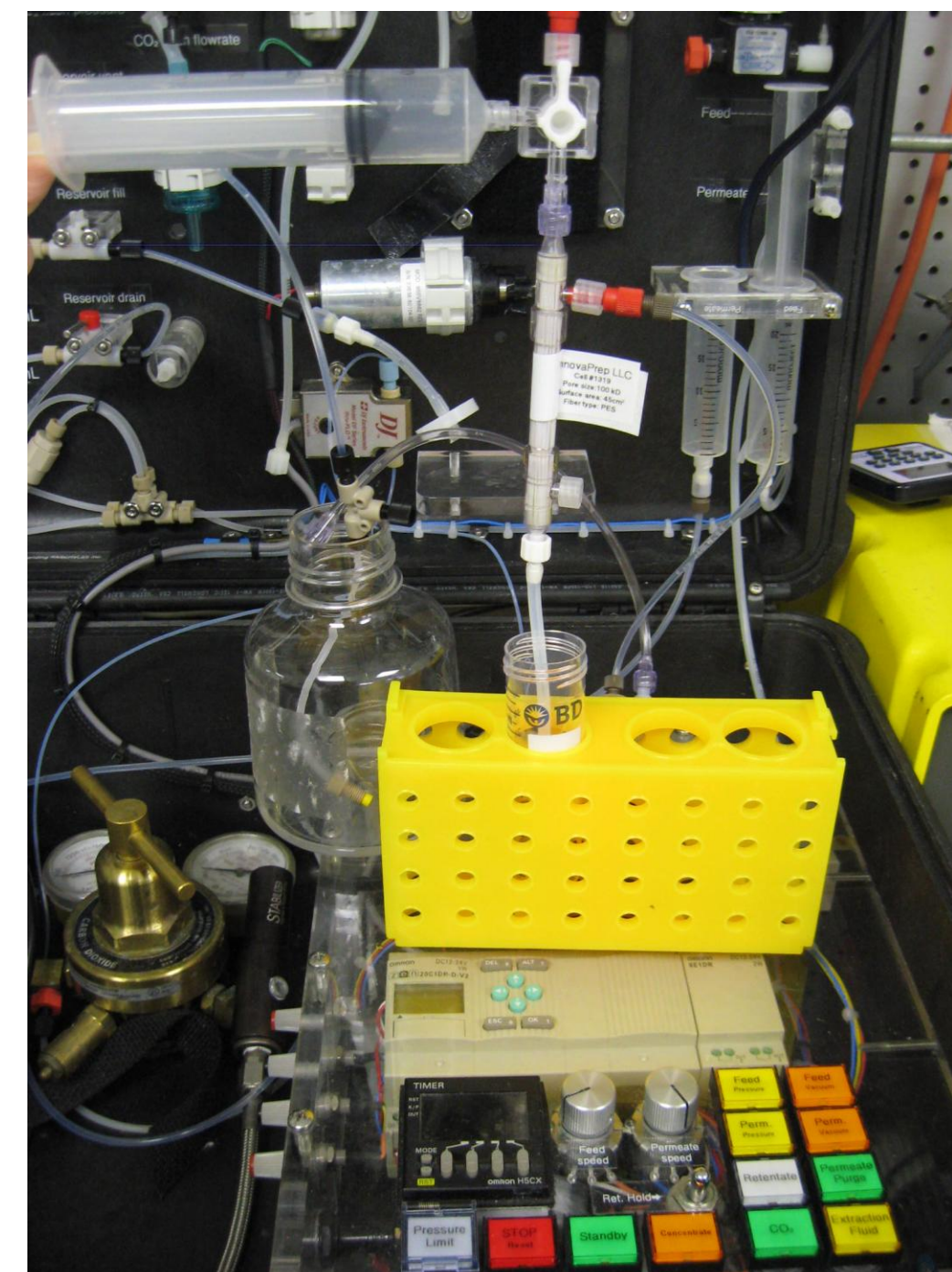
The InnovaPrep concentration process uses hollow fiber or flat membrane filters to capture particles from the starting fluid volume while operating in a dead-end filtration mode. Following capture onto the membrane filter, recovery of collected organisms is performed with a novel technique termed “wet foam elution”. InnovaPrep’s carbonated “wet foam” has unique properties that make it a superior method for extraction of particles from hollow fiber filters and from other membrane filter types, depth filters, and solid surfaces.

Recent work at InnovaPrep has focused on the development of the CPT, a disposable tip concentration system, for food safety, medical, forensics, and other applications where tolerance for sample-to-sample carryover is zero and where use of disposable devices within the laboratory setting is the norm. The CPT consists of a pipette tip type of device containing a number of hollow fiber, flat, or microsieve filters. An instrument for operation of the CPT is used to draw sample into the CPT, through the filter and to a waste container. Upon passing through the filter wall, particles of interest are retained on the filter surface. When the entire sample has been processed, wet foam elution of the filter is used to recover the particles into a small concentrated volume.

Waste lines and sample recovery lines within the instrument are separate, and thus, the potential for sample-to-sample carryover is eliminated. A number of sample types have been processed with the prototype CPTs and efficiencies essentially equivalent to the standard flow-through InnovaPrep system have been demonstrated.

Prototype Progression

Prototype 1 – April 2011



This series of testing utilized the prototype concentrator that preceded the commercial version of the HSC-40 for the mechanical operation of the wet foam elution. Manual manipulation was required to initiate sample processing and to switch tubing during a run. A 100 KD hollow fiber filter was used with 1 μ m YG polystyrene microspheres.

Prototype 2 – April and May 2011

This series of tests utilized more basic mechanical components which included an automated foam valve controlled by a PC. Manual priming was still required to initiate sample processing.

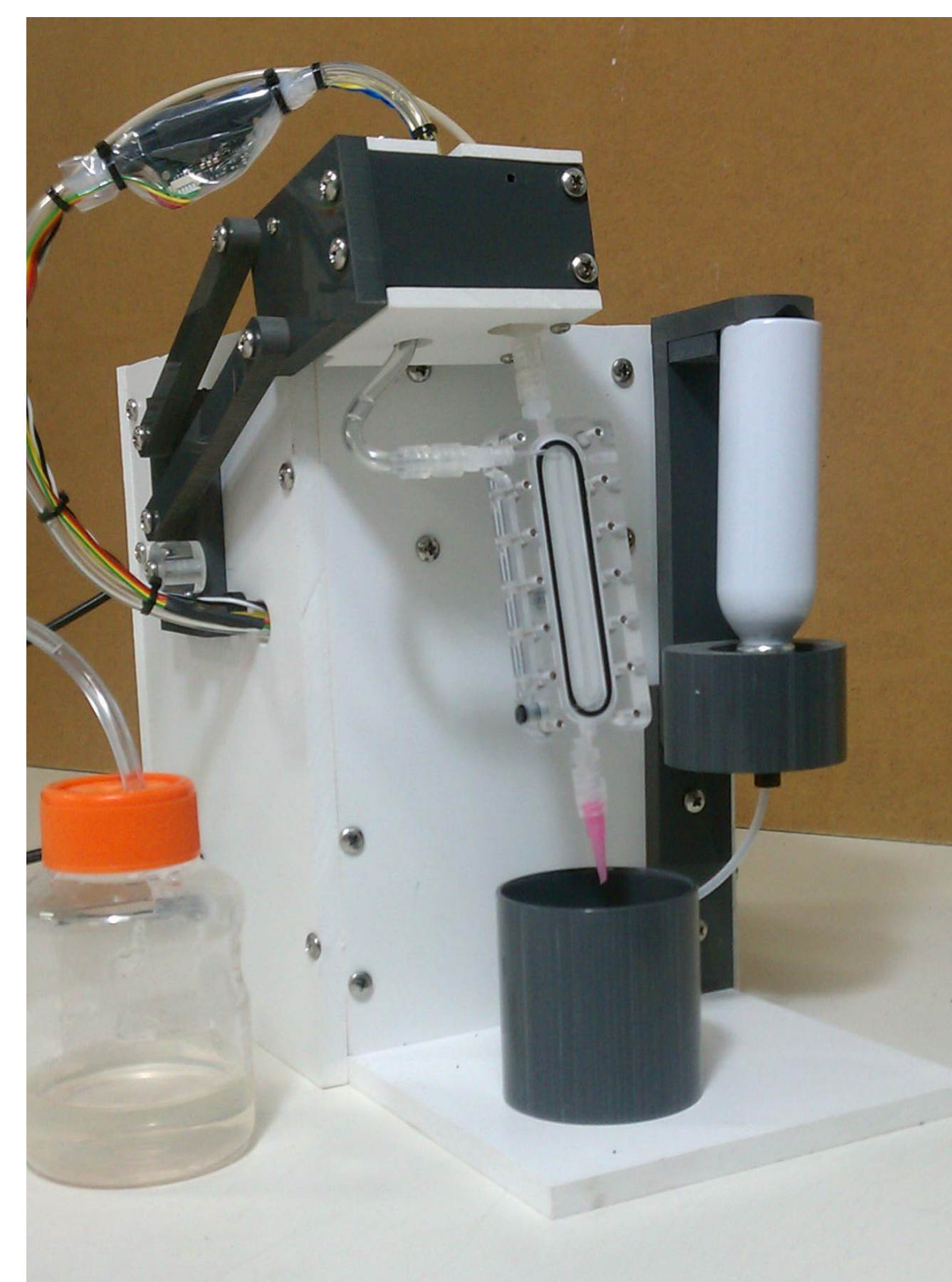
Three filter types were tested: a 0.05 μ m pore size hollow fiber concentration cell; a flat filter concentration assembly loaded with a 0.6 μ m flat filter; and a 0.2 μ m flat filter. Testing was performed with 1 μ m YG polystyrene microspheres.



Prototype 3 – June 2011

The latest prototype CPT unit is fully automated with push button operation. It also utilizes a newly developed disposable aerosol can filled with the pressurized extraction fluid.

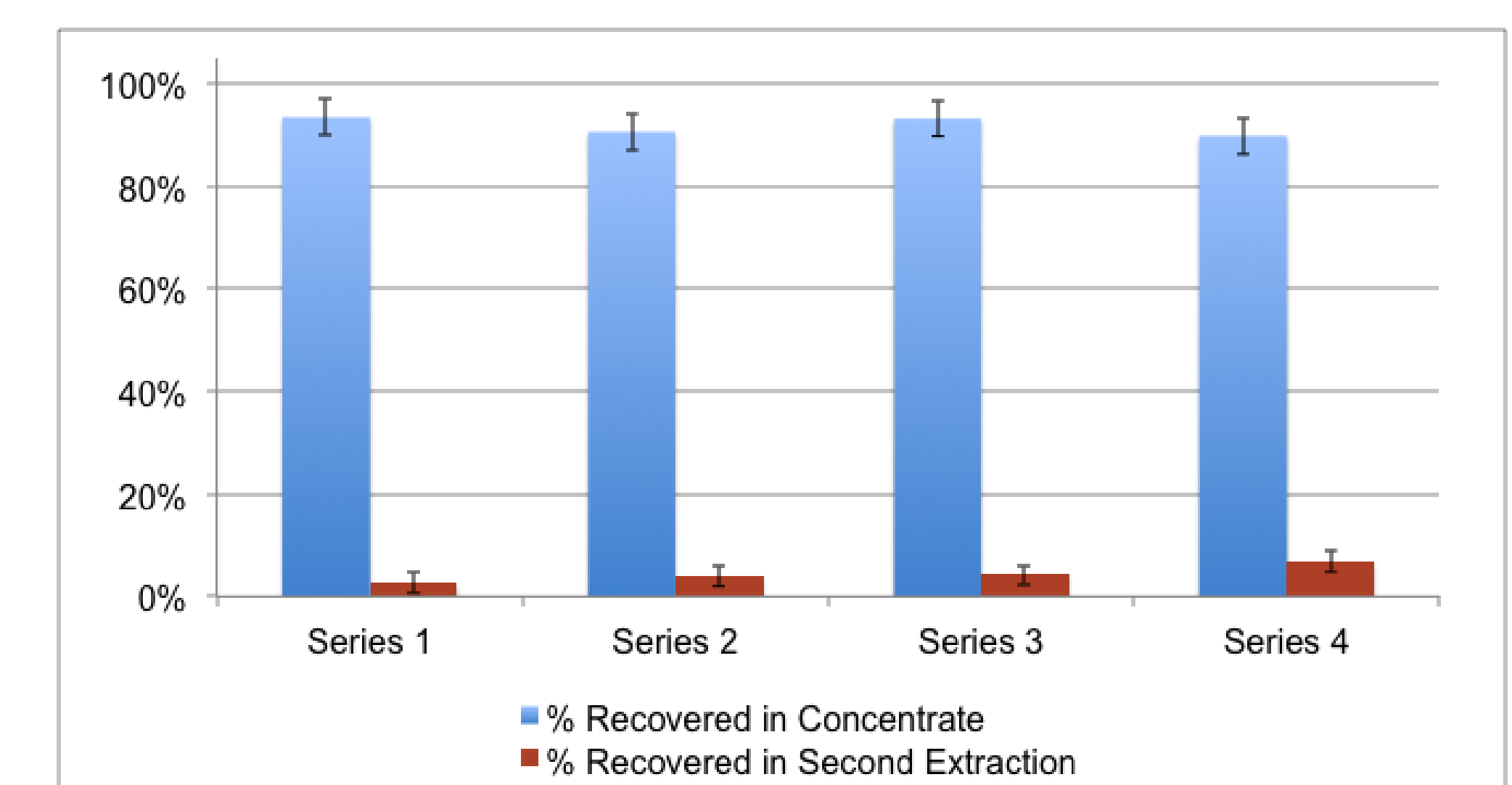
Preliminary testing has been performed with a variety of liquid samples including skim milk, apple juice and beer.



Testing Results

During recent testing, 100mL samples of 0.075% Tween 20/25 mM Tris or distilled water containing 1 μ m YG polystyrene microspheres were concentrated with the CPT Instrument in under 4 minutes. The YG-PSMs were then eluted from the CPTs with 0.075% Tween 20/25 mM Tris foam. Results presented below include concentration efficiencies and concentration factors.

	Series 1	Series 2	Series 3	Series 4
Run Data				
Wait Period, sec	0	60	0	60
Feed Matrix	0.075% Tween 20/ 25 mM Tris		Distilled Water	
Feed Volume, mL	100	100	100	100
Number of Beads Fed	1.83E+08	1.88E+08	1.85E+08	1.86E+08
Run Time, sec	152	107	97	100
Concentrate				
Volume Concentrate, mL	0.3162	0.2939	0.3606	0.3473
Number of Beads Recovered	1.77E+08	1.70E+08	1.73E+08	1.67E+08
CPT RE, %	93.5%	90.5%	93.2%	89.8%
CPT Concentration Factor	322.2	333.8	260.5	259.5
Extract #2				
Volume Extract #2, mL	0.2853	0.2853	0.3052	0.2976
Number of Beads Recovered	3.92E+06	7.44E+06	7.80E+06	1.27E+07
CPT RE, %	2.6%	4.0%	4.2%	6.8%
Cumulative RE, %	96.1%	94.5%	97.4%	96.6%



Path Forward - Commercialization

Development of low cost single use pipette tips and pressurized extraction fluid cans are proceeding quickly. InnovaPrep plans to have the CPT device commercially available by the end of 2011.

All of InnovaPrep processes are patent pending and available for licensing.



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