BHS Primer: Pressure Filtration Testing & Technologies (Part 2: Constant Flow)

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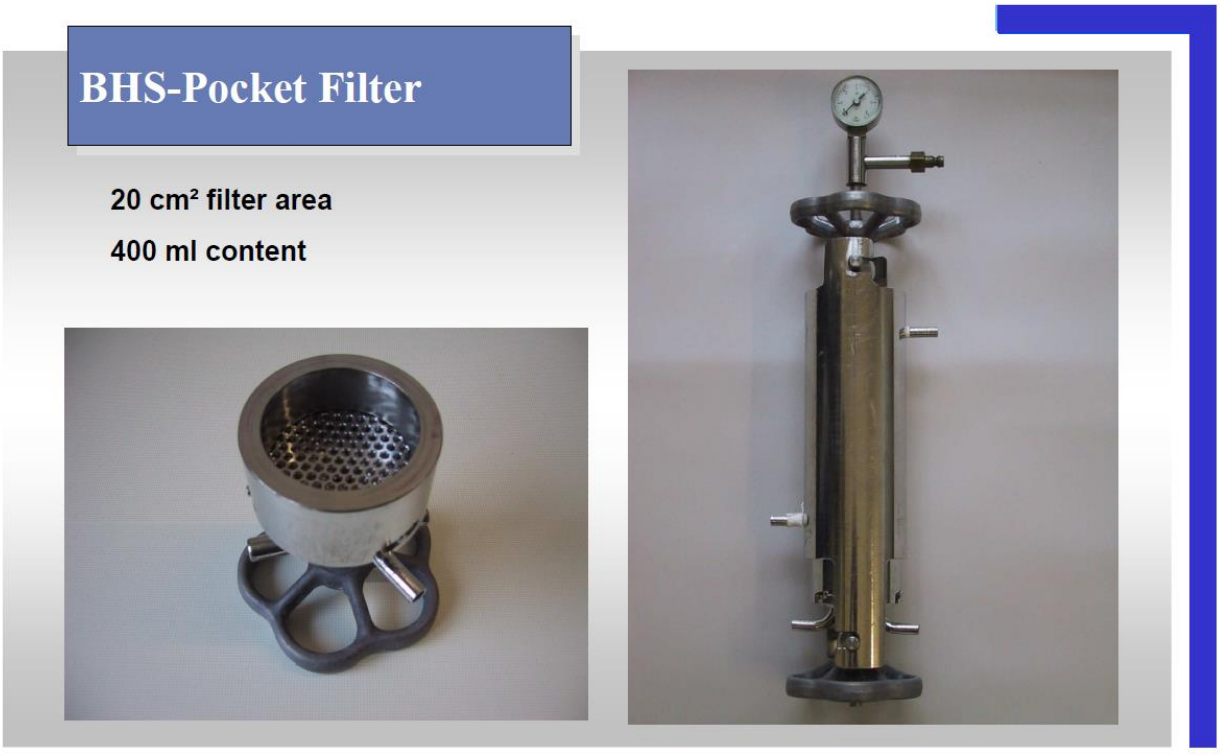
1. BHS POCKET LEAF FILTER DESCRIPTION

The BHS Pocket Leaf Filter (PLF) shown below is used for pressure and vacuum filtration testing to determine filtration rates, filtrate clarity, filter media, cake thickness, washing and drying efficiencies, cycle times, quality parameters and qualitative cake discharge. It is jacketed for heating or cooling and is rated 90 psig to full vacuum. The scale-up to the BHS pressure filter technologies is directed by the BHS process engineers. With accurate PLF testing, BHS can provide applicable process guarantees.

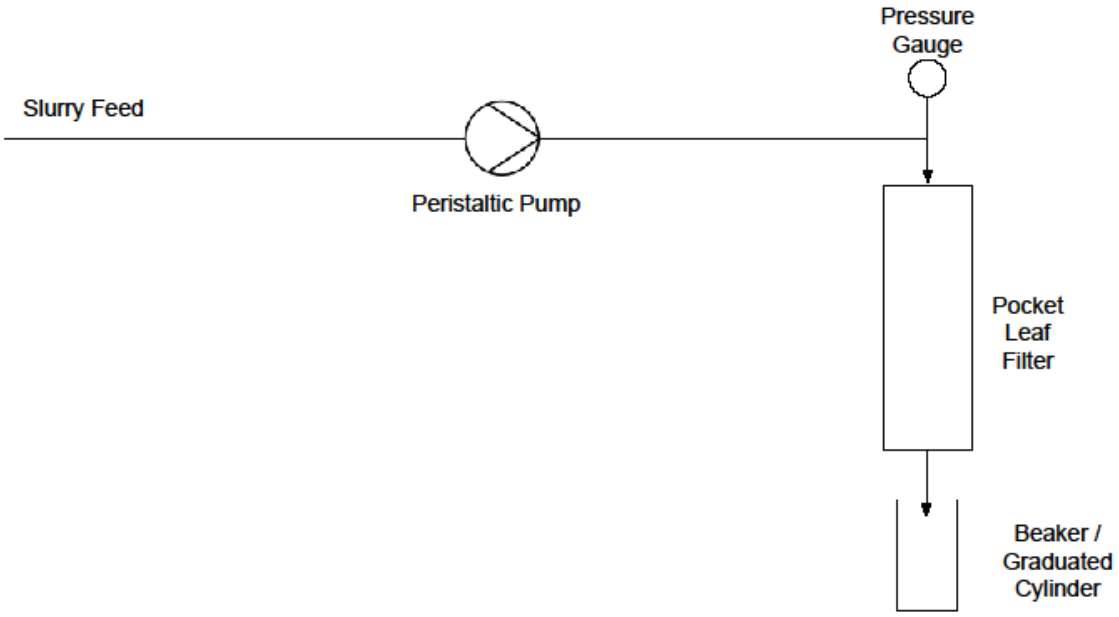


2. BHS POCKET LEAF FILTER SET-UP

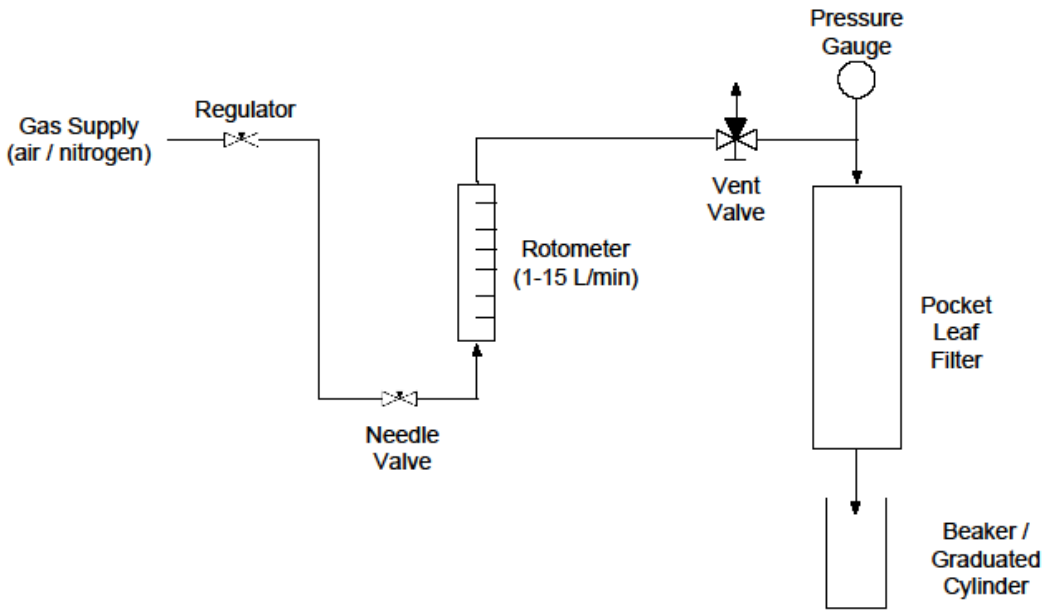
The constant flow process can be used to effectively evaluate samples that require more than 400 mL of slurry to be processed during a single test run. This particular method eliminates the need to stop, open, and refill the PLF. It is most typically used to evaluate clarification applications with solids in the lower ppm ranges.

A lab scale peristaltic pump can be used to supply a constant flow of slurry to the vessel. The pressure will rise as a cake is built on top of the filter media. Unlike the constant pressure version of the test, this test focuses on the time required to reach a particular differential pressure (dP) at a constant rate of flow through the filter.

Washing analysis can be completed using the peristaltic pump to run liquid through at the same flow rate or by adding a measured amount of wash liquid to the PLF and applying air pressure at the target dP as in constant pressure testing.



Pressure Filtration Equipment Setup
Filtering



Pressure Filtration Equipment Setup
Drying

Equipment Required:

1.) Pocket Leaf Filter (PLF)
   a. Includes pressure gauge
   b. Includes gas quick connect with safety vent valve
   c. Includes one (1) top assembly set up for gas connection
2.) Peristaltic Pump
3.) Second top assembly set up to attach pump
   a. Includes small hose barb
4.) Gas Rotameter
   a. Measurement range 0 – 15 l/min
   b. Includes needle valve
5.) Source of air/nitrogen (up to 6 bar)
6.) Regulator to control pressure accurately

Note: Make sure the lines used for pressure connections are properly rated for 6 bar pressure. Ensure clamps are used on all hose connections and PTFE tape on all threaded connections. Close off the PLF and check for leaks.

3. BHS POCKET LEAF FILTER OPERATION

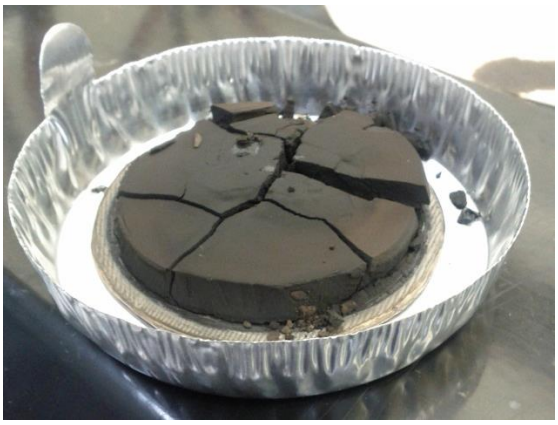
A) Filtration

1.) Prepare feed slurry for test. Continuously agitated slurry will ensure dispersion of solids during entire test.
2.) Insert pump feed hose into slurry.
3.) Attach the peristaltic pump to the pump top assembly.
4.) Place a receiver (graduated cylinder) under the unit for collecting the filtrate.
5.) Attach the pump top assembly to the PLF.
6.) Turn on the peristaltic pump.
7.) Start the stop watch and measure the amount of time until the pressure reaches the desired level.
8.) Turn off the pump and disengage the hose clamping mechanism in order to relieve the pressure from the vessel.
9.) Remove the pump top assembly
10.) There will be slurry remaining in the PLF at this time. Place the gas top assembly onto the PLF. Attach the gas quick connect line and drain the remaining fluid.

B) Washing (This step may be repeated as needed)

11.) Place a receiver (graduated cylinder) under the unit for collecting the filtrate.
12.) Either…
    1) Repeat steps 1-10 to complete the wash -or-
    2) Slowly pour the measured wash material into the unit. The wash should be poured slowly down the sidewall or sprinkled on the surface to avoid disturbing the cake.
13.) Attach the gas top assembly to the PLF.
14.) Close the vent valve to apply pressure to the vessel.
15.) Start the stop watch and measure the amount of time until gas is passed through the cake. This is usually indicated by a bubble forming on the outlet of the filter instead of a normal drip/stream.
16.) Open the vent to stop the wash and release the pressure from the PLF. Record the data (Data Sheet - Appendix A). In addition to total wash time and total wash volume, it is helpful to take incremental time vs. volume measurements to construct a wash curve.

C) Cake Formation



Cracked Cake

Well-Formed Cake

D) Drying

Drying on the PLF is accomplished using compressed air/nitrogen. The drying design on the PLF is directly scalable to the BHS production technologies as long as proper flow rates are used in the lab. Using too much air in the lab can lead to optimistic moisture targets and uneconomical air assumptions on commercial equipment.

The three important variables for drying cake are pressure, air flow, and time. Pressure can vary from the filtration pressure in order to achieve the desired result. Higher pressures typically provide better drying.

Air flow should be maintained below 10 SCFH with 4-6 SCFH being a good starting range for initial testing.

E) Cake Discharge

1) Remove the inlet cover from the unit.
2) Remove the bottom outlet piece.
3) Measure the cake thickness.
4) Remove cake.
5) Weigh the cake and carry out any desired lab tests (% moisture, etc.).
6) Inspect the cake for cracking as well as the cake removal from the filter media

4. BHS PRESSURE FILTER TECHNOLOGIES

BHS manufactures three types of pressure filters to meet various process requirements: the candle filter, the pressure plate filter, and the rotary pressure filter. A summary of the technologies is below. Please refer to the BHS website at www.bhs-filtration.com for further information.

Rotary Pressure Filter

- Continuous slurry feed
- Pressure up to 6 bar
- Up to 8.8 m² filter area
- High solid slurries
- Multi-stage cake washing
- Cake discharge under atmosphere
- ATEX certified explosion proof

Candle Filter

- Batch operation
- Pressure up to 6 bar
- Up to 150 m² filter area
- Low solids slurries (clarification)
- Full washing and drying capability
- Precoat and body feed filter aid options
- Dry or slurry discharge options
- < 20 mm cake

Pressure Plate Filter

- Batch operation
- Pressure up to 6 bar
- Up to 50 m² filter area
- Low solids slurries (clarification)
- Full washing and drying capability
- Precoat and body feed filter aid options
- Vibratory assisted cake release
- > 20 mm cake

5. SUMMARY

This BHS Primer provides information for pressure testing. The PLF testing can be conducted in the BHS laboratory or on-site in your facility. The PLF can also be rented or purchased for use and is always supported by the BHS process engineers. Good luck with your testing and we look forward to being of assistance to you as a resource for testing help data analysis and future pilot rental units. The PLF is also a useful tool for troubleshooting BHS installations or installations from our competitors.

Appendix A: PLF Data Sheet

Customer:			**Project #:**					
Date :			**Test Unit:**					
* 1 = good, 3 = bad		Units	Run #	Run #	Run #	Run #	Run #	Run #
Basic Info								
Material	Media Type							
	Slurry Name							
	% Solids	%						
	Wash 1							
	Wash 2							
Temperature	Slurry	C						
	Wash 1	C						
	Wash 2	C						
	Drying	C						
Feed Amount	Slurry	g						
	Wash 1	g						
	Wash 2	g						
Process Data								
Pressure	Filtration	bar						
	Wash 1	bar						
	Wash 2	bar						
	Drying	bar						
Time	Filtration	sec						
	Wash 1	sec						
	Wash 2	sec						
	Drying	sec						
Filtrate Amount	Filtrate	mL						
	Wash 1	mL						
	Wash 2	mL						
Flow Rate	Drying Air	SCFH						
Analysis								
Filtrate/Solids Quality	% Solids in Filtrate	%						
	Washing Condition 1							
	Washing Condition 2							
Cake	Thickness	mm						
	Formation	1-3 *						
	Wet Weight	g						
	Dry Weight	g						
	% Moisture	%						
Media	Cake Discharge	1-3 *						
	Cleaning	1-3 *						