

**EN 16713-1 DOMESTIC SWIMMING POOLS - WATER SYSTEMS -
PART1: FILTRATION SYSTEMS REQUIREMENTS AND TEST METHODS**

§ 7.3 FILTRATION EFFICIENCY WITH ONLINE PARTICLES COUNT

Filter ref. 20kg Hi -tech glass filter media n°1

| CUSTOMER IDENTIFICATION | |
|--------------------------------|--|
| Company | NATURE WORKS TECNOLOGIAS |
| Address | C/ Tabarca n° 16, 3580 ALICANTE, SPAIN |
| Contact | Mr Guillermo GIL VENEZIANI |
| Purchase Order nb | Email Mr VENEZIANI 30/12/2015 |

| IFTS REFERENCES | |
|----------------------------|-----------------|
| IFTS order number | 9382 |
| Quotation nb | DEV_00000105.00 |
| Test date | 03/02/2016 |
| Date of receipt of samples | 04/01/2016 |

Written by
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Validated and signed by
The Test Manager,
Date: 04/02/2016

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NATURE WORKS TECHNOLOGIAS

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1 - SCOPE

NATURE WORKS TECNOLOGIAS has requested IFTS (Institut de la Filtration et des Techniques Séparatives), as per Email from Mr GIL VENEZIANI dated 30/12/2015, to evaluate the performance of a specified number of samples according to EN 16713 domestic swimming pools - water system - part 1: filtration systems requirements and test methods, §7.3 Filtration efficiency & retention capacity.

The data contained in the following paragraphs establishes the report of the test performed on the sample identified in paragraph 2 of this document. A separate test report is issued for any other test requested as per the purchase order.

This test has been performed with qualified personnel using thoroughly selected equipments in order to comply with test conditions summarized in paragraph 3 of this document. IFTS is accredited by the COFRAC to carry out tests and perform modular activities dealt with by the ISO/IEC 17025.

2 - TEST SAMPLE

| Sample Ref. | IFTS Ref. |
|---|------------|
| 20kg Hi -tech glass filter media n°1 | 984 |



Fig.1 : Filter ref. 20kg Hi -tech glass filter media n°1
supplied by NATURE WORKS TECNOLOGIAS

3- TEST CONDITIONS

The following conditions have been applied to measure the filtration efficiency and the retention capacity of the test filter :

The filter medium is initially washed three times (back washing at 30 m/h (8,7 L/min)).

- Procedure: EN 16713-1 §7.3
- Multipass test mode
- Test liquid : microfiltered water
- Test temperature : 23°C (+/- 3°C)
- Test contaminant : ISO CTD as per ISO 12103-A4
- On line particle count at : 20, 30, 40,45,50, 60, 70, and 80 µm
- Contaminant concentration: 50 mg/l
- Test volume (V_2) = $10 \cdot Q_1 + V_1$ (L) = 20 m/h **(corresponding to 5,86 L/min)**
 - Q_1 : Flow rate of the filter pump module (m^3/h)
 - V_1 : Volume of the filter (L)
- End of test criteria : DP increase of 0,7 bar
- Height/diameter of filtration sand : 70 cm / 15 cm
- Height/diameter of support sand* : 15 cm / 15 cm

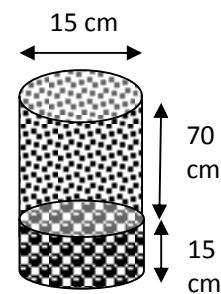
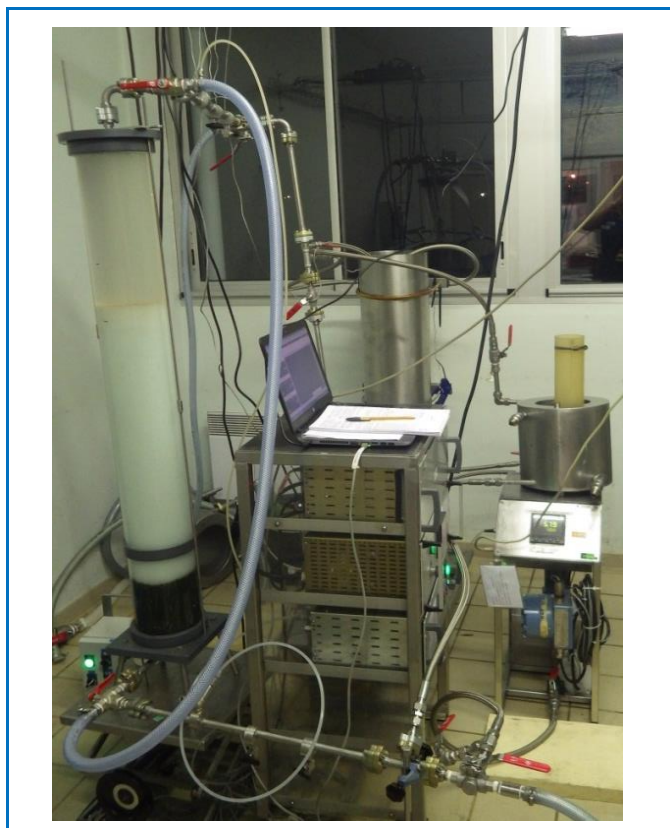


Fig.2: Picture for test rig according to EN 16713-1 §7.2.4

4- TEST RESULTS

4.1 End of test criteria

| | Initial | Final | End of test condition | Actual value | End of test criteria |
|---------------------|---------|-------|-----------------------|--------------|----------------------|
| Flow rate (m/h) | 20 | 20 | - | 20 | NO |
| DP (mbar) | 142 | 856 | ≥ +700 | 714.00 | YES |
| Test duration (min) | | | ≤ 360 | 24 | NO |

4.2 Filtration performances

| Customer Ref. | IFTS Ref. | retention capacity (g) | Filtration rating at 80% (µm) | Filtration Efficiency at 45µm (%) | Comments |
|--------------------------------------|-----------|------------------------|-------------------------------|-----------------------------------|----------|
| | | | Global | Final | |
| 20kg Hi -tech glass filter media n°1 | 984 | 7 | < 20 | 88% | - |

Note 1 :

The global filtration rating and the global filtration efficiency are calculated from total counting data collected during all periods at 50 mg/L.

4.3 Detailed test results

Detailed test results are presented in appendix.

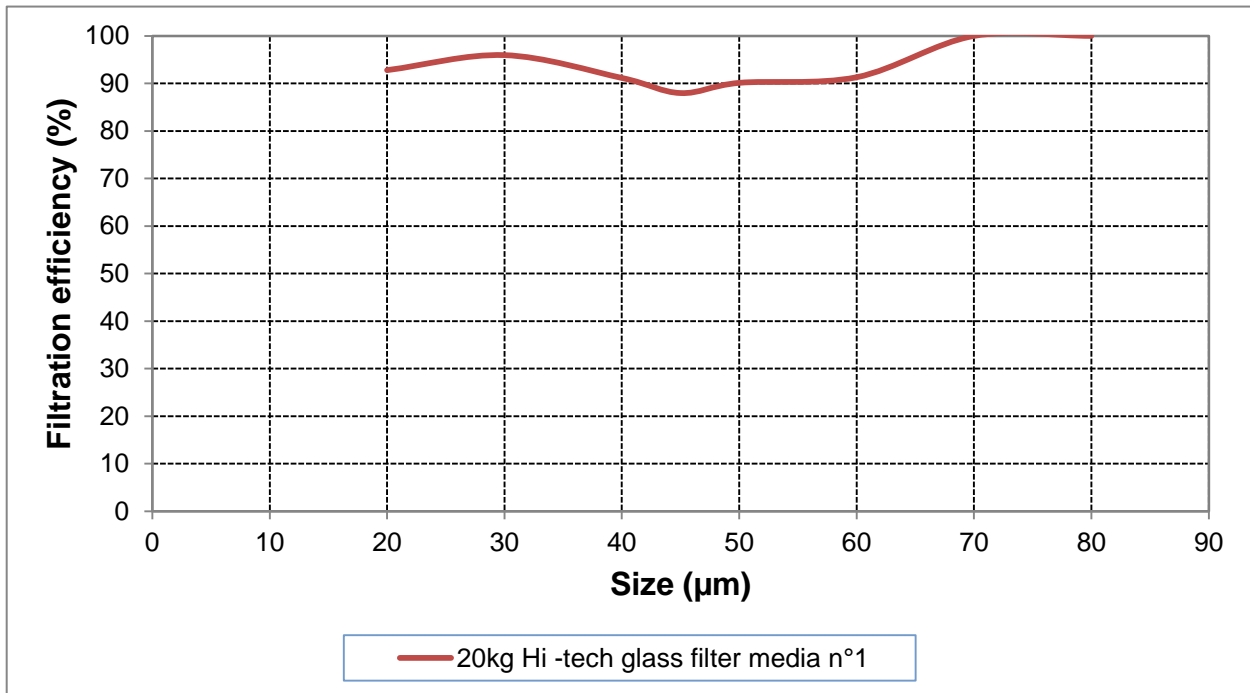


Fig. 2 : Filtration efficiency vs. particle size

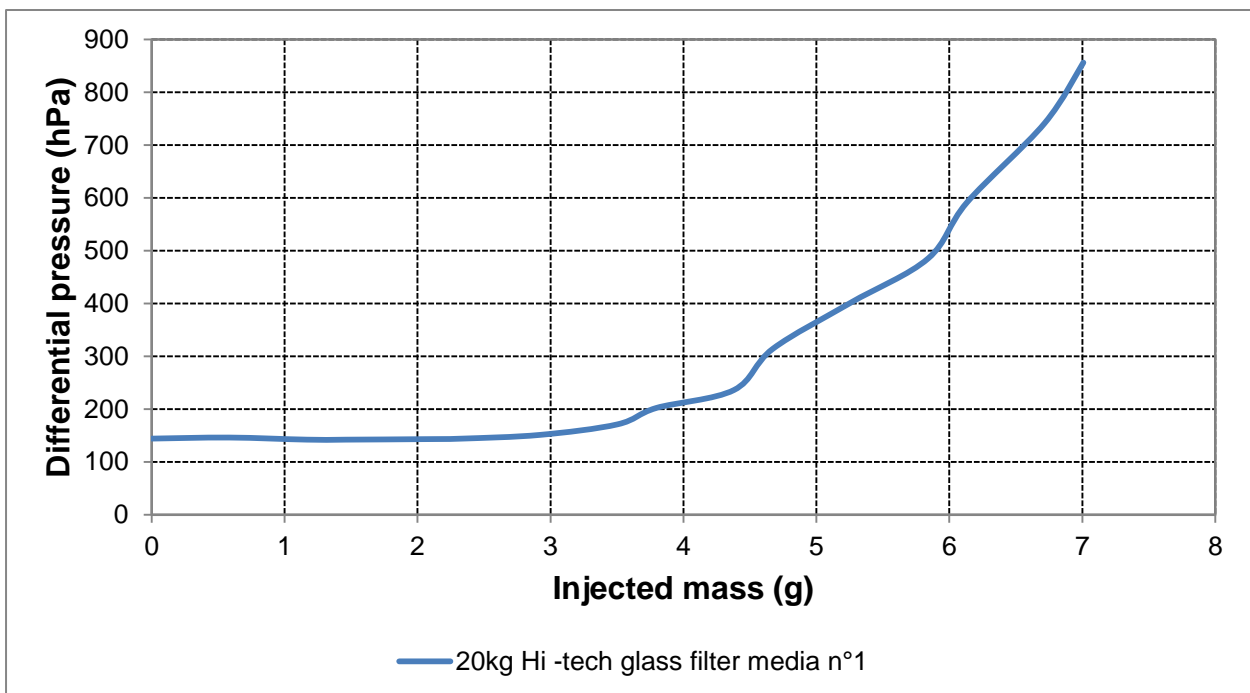


Fig. 3 : Clogging curve

APPENDIX

TEST REPORT N° 160309-A
DETERMINATION OF FILTRATION EFFICIENCY AND RETENTION CAPACITY

According to EN 16713-1 §7.3

TEST IDENTIFICATION

| | | |
|------------------------|---------------|--------------------------|
| Test date : 02/04/2016 | Operator : ml | IFTS sample number : 984 |
|------------------------|---------------|--------------------------|

FILTER IDENTIFICATION

| | |
|----------------------------|--|
| Housing ref. : IFTS column | Filter element ref. : 20kg Hi -tech glass filter media n°1 |
|----------------------------|--|

OPERATING CONDITIONS

| | | | | | | | | | | |
|---|--------------------------------|----------------------------------|--------------------------|----------------------|-------|---------|-----------|---------|--------------------|-------------|
| Test fluid | Type : Microfiltered water | Temperature (°C): 21 | | | | | | | | |
| Initial cleanliness level | Upstream : 6,4 part > 20 µm/mL | Downstream : 1,4 part > 20 µm/mL | | | | | | | | |
| Test contaminant | Type : ISO CTD | Batch number : 12299C | | | | | | | | |
| Fluid circuit | | | | | | | | | | |
| | Filter test | Contaminant injection | Particle counting | | | | | | | |
| Phase | Test flow rate (L/min) | 5.86 | Flow rate (L/h) | Concentration (mg/L) | | | Counter | Sensor | Flow rate (mL/min) | Volume (mL) |
| | Volume (L) | 28 | | Initial | Final | Average | | | | |
| Counting | Concentration (mg/L) | 49.8 | 10 | 1752 | 1752 | 1752 | HIAC 8000 | HRLD400 | 20 | 20 |
| Test parameters evolution (see figure 5) | | | | | | | | | | |

TEST RESULTS

| | | | | | | | | | | | | | | | | | | |
|---|-----|------|--|---|---------------------------------------|---|--|---|--|---|--|---|--|---|--|---|--|---|
| Differential pressure at test flow rate | | | | | | | | | | | | | | | | | | |
| Housing (hPa) : 50 | | | | | Clean assy (hPa) : 142.0 | | | | | | | | | | | | | |
| Filter cartridge (hPa) : 92.0 | | | | | Final ΔP filter cartridge (hPa) : 806 | | | | | | | | | | | | | |
| Table 1 : Clogging curve (see figure 4) | | | | | | | | | | | | | | | | | | |
| Period n. | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 |
| Concentration (mg/L) | - | 49.8 | | | | | | | | | | | | | | | | |
| Test time (min) | 0.0 | 24.0 | | | | | | | | | | | | | | | | |
| Differential pressure (hPa) | 142 | 856 | | | | | | | | | | | | | | | | |
| Injected mass (g) | 0.0 | 7.0 | | | | | | | | | | | | | | | | |
| Retention capacity : C_R = 7.0 g | | | | | | | | | | | | | | | | | | |

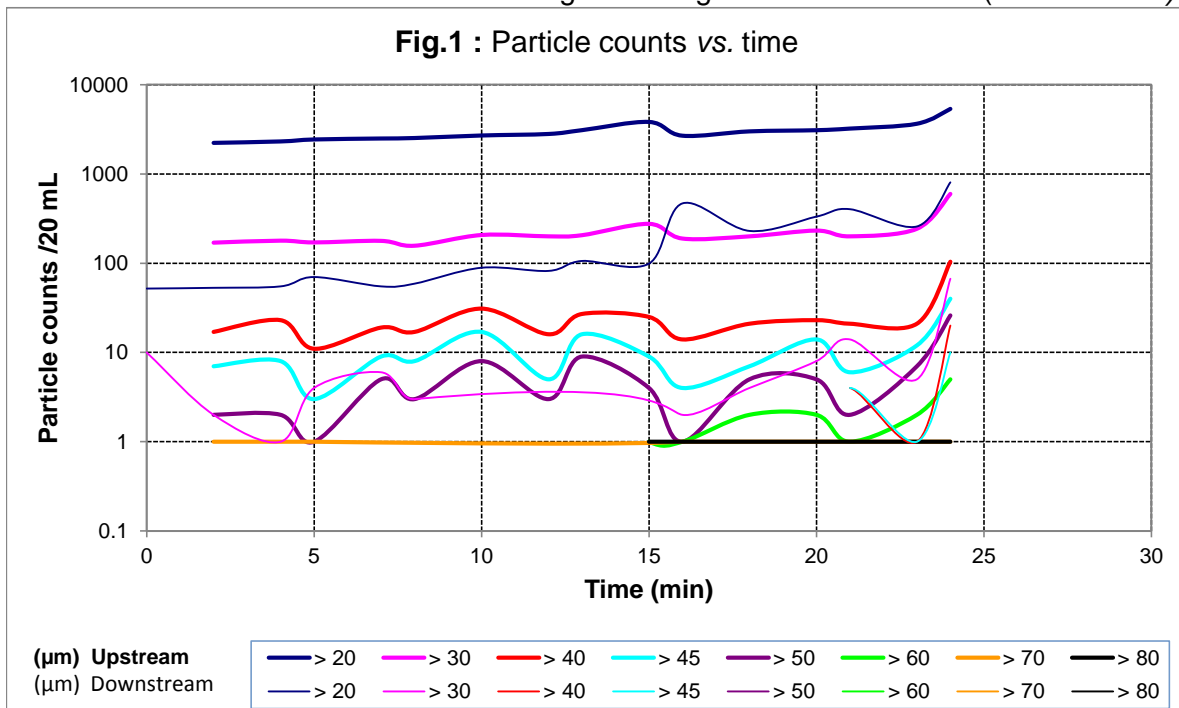
TEST RESULTS

Filter ref. 20kg Hi -tech glass filter media n°1 (IFTS : 0984)

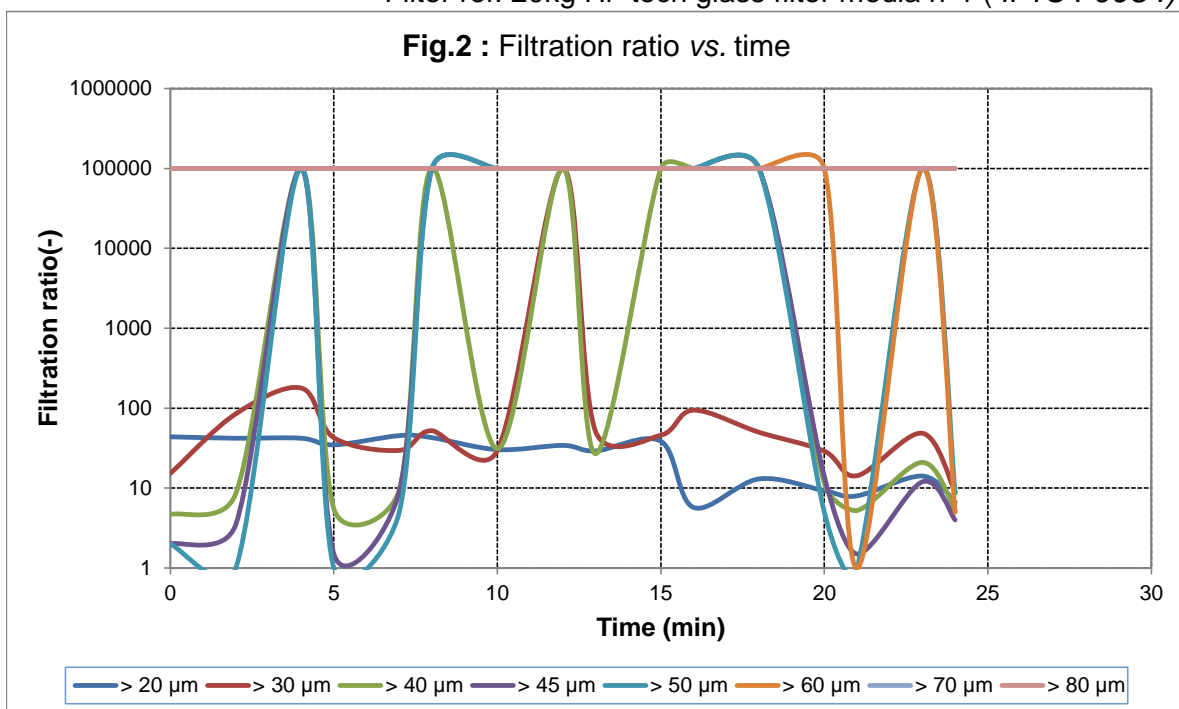
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|---|--------------------|---------|----------------|---------|----------------|---------|----------------|---------|----------------|---------|----------------|---------|----------------|---------|----------------|---------|----------------|----|----------------|
| Raw counting data (see figure 1-2-3) | | | | | | | | | | | | | | | | | | | |
| Table 2 : Filtration ratio and efficiency* vs. test period | | | | | | | | | | | | | | | | | | | |
| Cumulative counts (N/20 mL) | | | | | | | | | | | | | | | | | | | |
| | Particle size (µm) | > 20 µm | R ₁ | > 30 µm | R ₂ | > 40 µm | R ₃ | > 45 µm | R ₄ | > 50 µm | R ₅ | > 60 µm | R ₆ | > 70 µm | R ₇ | > 80 µm | R ₈ | µm | R ₉ |
| Counting period | | E% | E% | E% | E% | E% | E% | E% | E% | E% | E% | E% | E% | E% | E% | E% | E% | E% | E% |
| Upstream initial counts | | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| Average | Up | 3087 | 14 | 231 | 25 | 27 | 11 | 11 | 8 | 6 | 10 | 2 | 12 | 1.0 | ∞ | 0.8 | ∞ | | |
| | Down | 222 | 92.80 | 9.36 | 95.95 | 2.36 | 91.15 | 1.36 | 87.97 | 0.57 | 90.12 | 0.14 | 91.30 | 0.00 | 100.00 | 0.00 | 100.00 | | |

*Note: Efficiency value is rounded to 100% when above 99.995

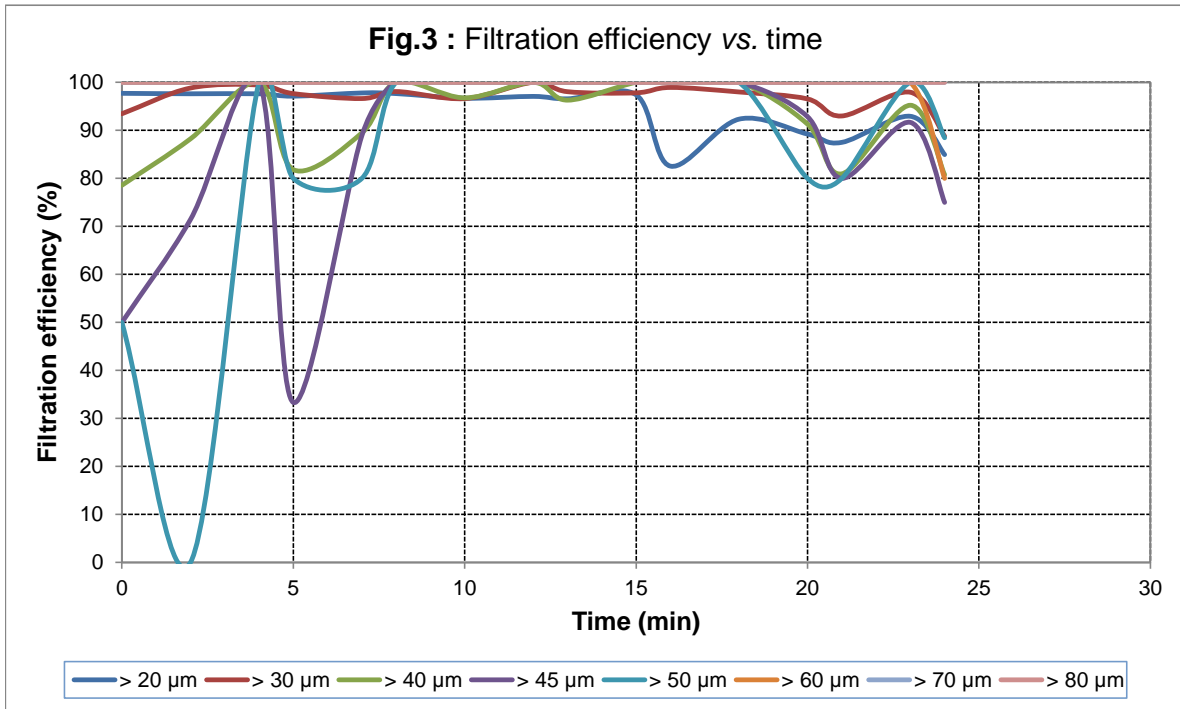
Filter ref. 20kg Hi -tech glass filter media n°1 (IFTS : 0984)



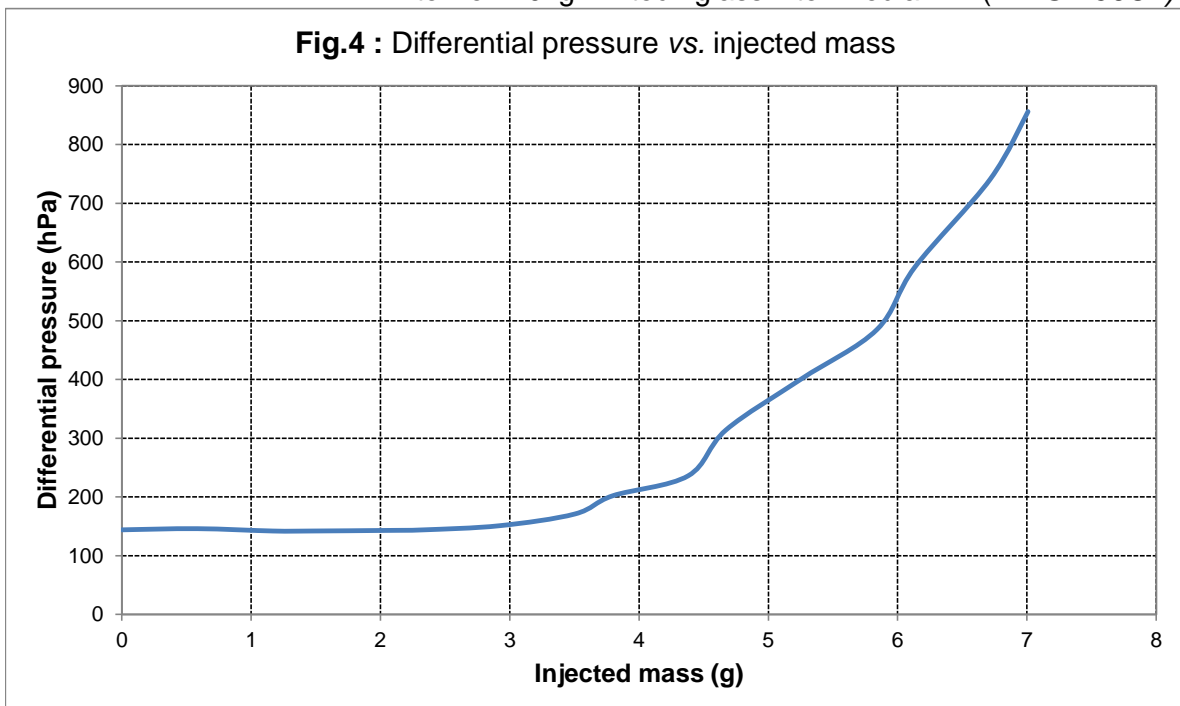
Filter ref. 20kg Hi -tech glass filter media n°1 (IFTS : 0984)



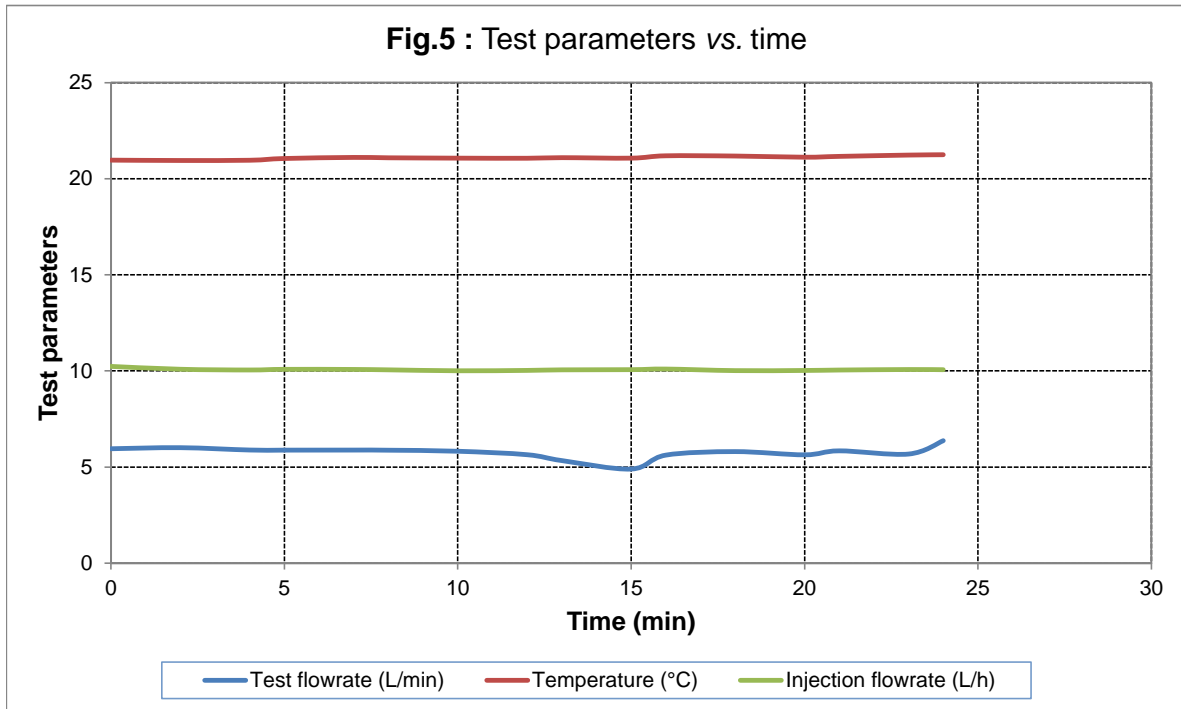
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