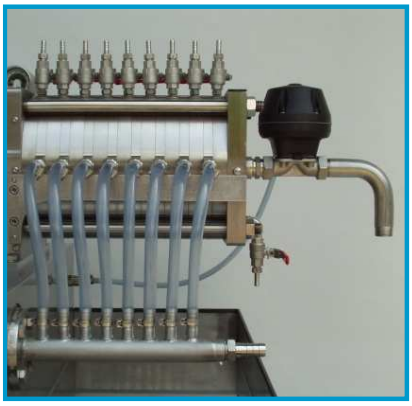
The DYNO Filter



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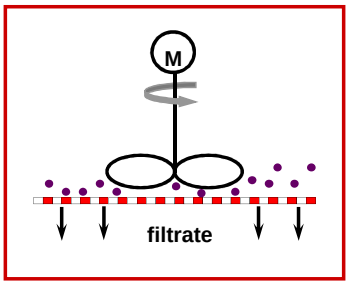
Dynamic Crossflow Filtration

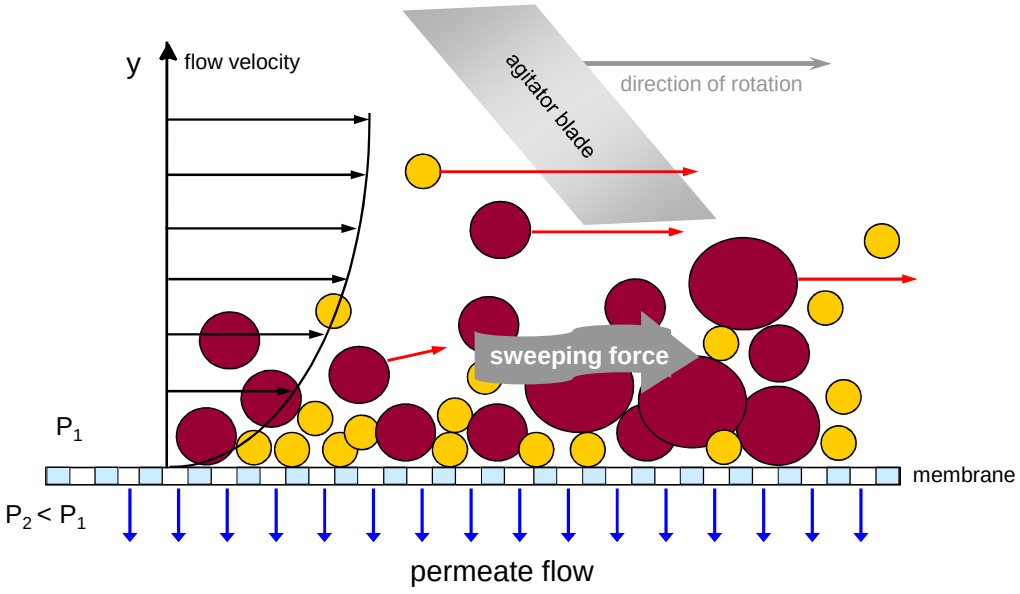
- Separation of solid particles > 0.01 µm (micro and ultra filtration)
- Dead end filtration: absolute clear filtrate
- High flow rates even with highly concentrated suspensions
- High end-concentrations (like firm filter cakes)
- Classification even at high concentrations
- Slimy, jelly smooth particles which are difficult to separate
- Suspensions with high viscosity, plastic or thixotrope characteristics
- Washing
- Hermetically sealed process
- Continuous operation



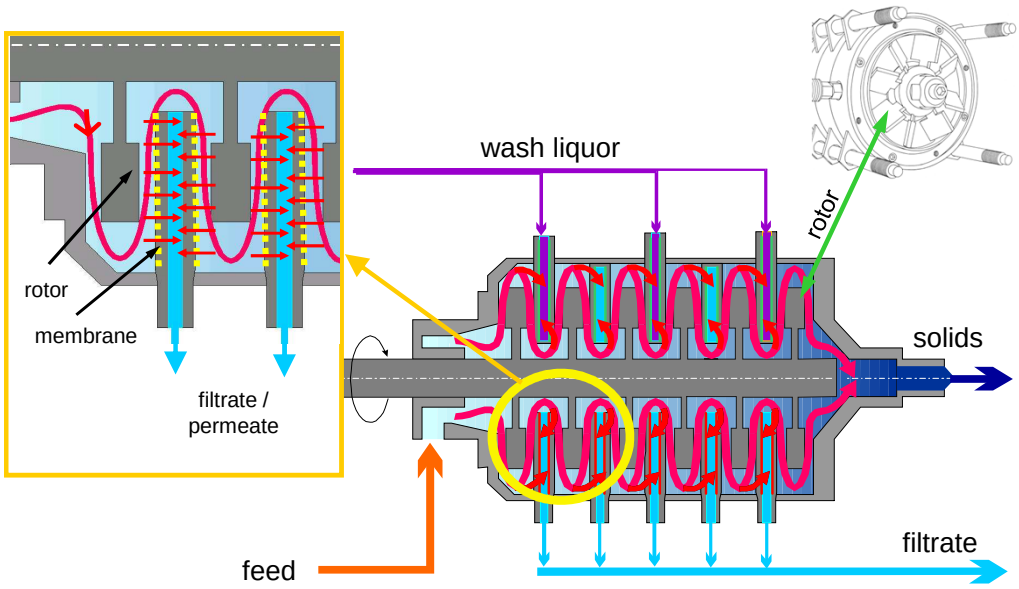
- **Cross flow (shear stress) of the suspension** generated by a rotating agitator and not by a pump
- **Filter media** disc-shaped filter elements installed near to a rotating agitator

Dynamic Crossflow Filtration

Flow Forces on a Particle



Meander-Shaped Suspension Flow



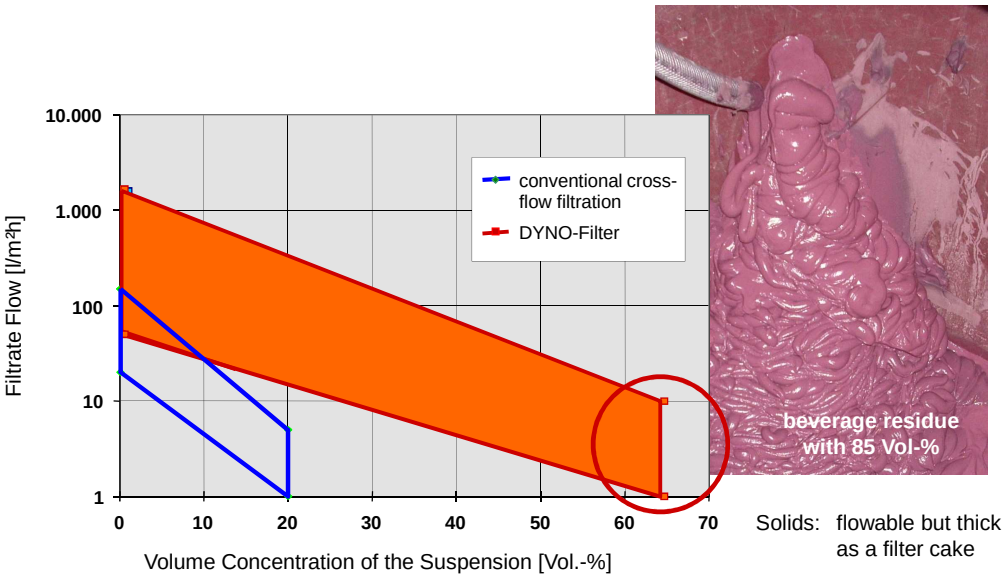
Dynamic Membrane Filtration

4 m² membrane filter unit

0.4 m² membrane filter unit

Dynamic Membrane Filtration

High Flow Rates even with Highly Concentrated Suspensions



Solids: flowable but thick as a filter cake

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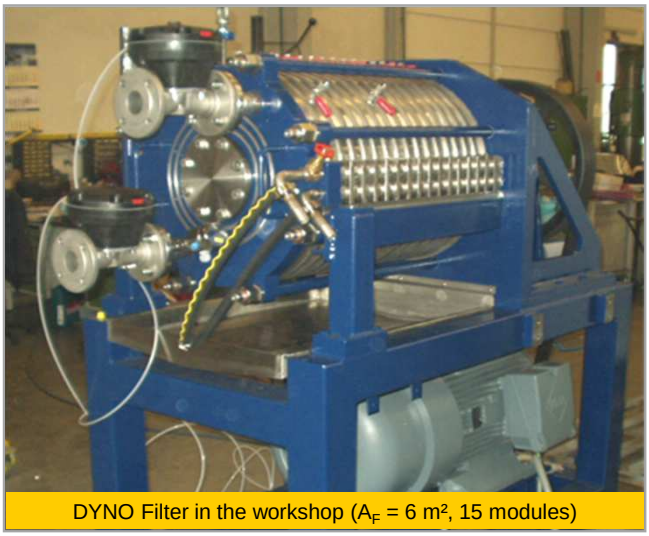
Dynamic Membrane Filtration

Filtration of a White Pigment with DYNO L-Type 6-15-MF



DYNO Filter in the workshop (A_F = 6 m², 15 modules)

Product

- fine pigment
- x,50 << 1 µm
- spec. surface 40 m²/g
- c_{feed} = 13 wt-% DS

Process requirements

- high end concentration
- no air inclusions
- pastous flow behaviour

Performance

- 39 wt.-% DS in the concentrate
- viscosity 25,000 mPas
- 200 l/m²h filtrate

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Dynamic Membrane Filtration / Diafiltration

DYNO Filter in Pharma Design

Washing of a micro-fine pharmaceutical suspension with salt and active ingredient

Product

- suspension with NaCl: 10%
- active product: 3.5%
- particle size: 1 – 50 µm
- thixotropic behaviour

Target

- NaCl < 0.1 %
- active product > 7.5 %
- sanitary design
- temperature: < 30°C
- low wash water demand (Diafiltration)
- sterilization of machine
- automatic cleaning
- short dead time between batches
- high throughput

DYNO Filter L-Type (A_F = 8 m²) in the Workshop, Pharma Design

Dynamic Membrane Filtration

Separation of Nano-Sized Particles

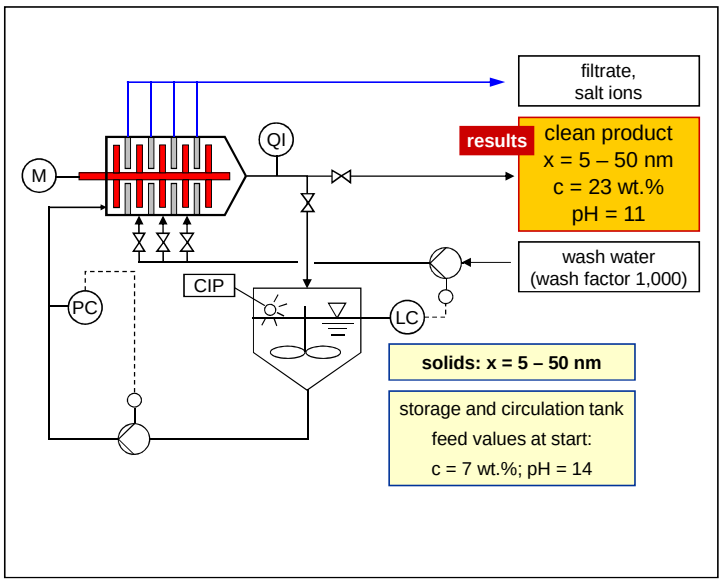
Batch Operation for Filtration & Washing

Product specification:

- nano-scale chemical product
- x = 5 - 50 nm
- c_{Feed} = 7 wt%

Target:

- high end concentration of solids
- pH-value reduction from pH = 14 to pH = 11
- salt ions reduction



Performance Data for Membrane Filtration

PRODUCT	characteristics / process features	feed concentration [wt-%]	concentration of retentate [wt-%]	filtrate throughput [m³/m²h]
industrial waste water		0.3	**11**	**0.9**
red mud		30	**65**	**0.3**
TiO_2	abrasive, high porosity	34 40	**59** **50**	**0.4** **1.0**
ultramarine		17	**55**	**0.3**
yellow pigment		4.5	**20**	**0.4**
molybdenum orange	high intrinsic viscosity	5	**50**	**0.75**
silica acid SiO_2		13	**40**	**0.8**
boric carbide	abrasive	21	**52**	**0.15**
glaze for ceramics	washing out of slimy contents	33	**79**	**0.15**
calcium carbonate	X_{50} < 1 µm	45	**70**	**0.1**
nano scale chemical product	nano particles: x = 5 – 50 nm	5 5	**30** **40**	**0.17** **0.12**

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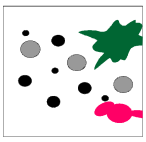
Dynamic Sieve Filtration

Principle of Dynamic Sieve Filtration

Feed



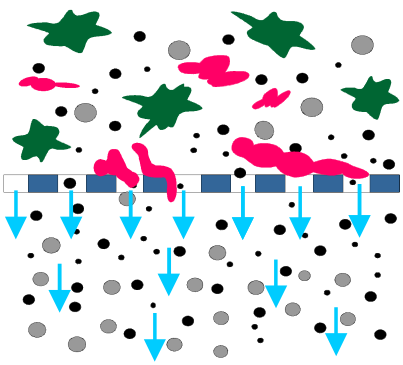
Concentration of coarse particles

c_{coarse} = **50 ppm**

Metal sieve: 20 µm

separation of low concentrated coarse particles

flow direction



Retentate

Concentration of coarse particles

c_{coarse} = **5.000 ppm**

$V_{retentate}$ = 0,001 V_{zu}
(minimal product loss)

Filtrate

c_{coarse} = 1 - 5 ppm

c_{fine} = 10 - 50 %

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Dynamic Sieve Filtration

Main Characteristics

- continuous separation of coarse particles
- sieve cut down to 5 µm
- high feed concentration sieving at high viscosity and thixotrope flow behaviour
- minimal product loss with discharge of the coarse particles
- hermetically sealed apparatus
- automatic and self cleaning apparatus
- cooling or heating during sieving
- sieving without air contact

Typical Application Data

- throughput performance: up to 20,000 l/h per machine
- feed concentration: 1 - 50 (60) % (still pumpable)
- retentate concentration: enrichment of coarse fraction by factor 20 - 500
- energy demand: 2 – 4 kW / m²
- rotor speed: 2 – 6 m/s
- pressure: 0.1 – 6 bar
- filter medium: multi-layered sinter medium (3) 20 – 200 µm
- sieve cleaning: short-timed, pulsed backflush

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Dynamic Sieve Filtration

Typical Applications

- finest minerals like $BaCO_3$, SiC, BC, etc.
- lattices
- white pigments like TiO_2, $CaCO_3$, kaolin, etc.
- polymeric dispersions
- emulsions, dispersions in the food industry like chocolate, cocoa butter, mayonnaise, etc.
  - downstream from colloid or ball mills or similar comminution technologies

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DYNO Sieve Filter

for High Viscous Polymeric Suspension

Process Demands

Product specification:

- highly viscous polymeric suspension of 2 liquid components with suspended organic solids
- solids consistency: soft with changeable form
- feed concentration (a + b)
  a) x = 2 - 10 µm: 30 Vol-%
  b) x = 10 - 500 µm: 10 - 1,000 ppm

Target(s):

- separation of the coarse particles
- sieve cut of 20 µm
- no dilution

Apparatus demands:

- continuous process
- automatic discharge of the coarse fraction (> 20 µm)
- minimum filter throughput: 4 m³/h
- hermetically closed apparatus with little space demand
- explosion protection
- feed control via feed pressure control range: 50 - 100 % of throughput
- automatic operation, automatic start-up and shut-down
- self-cleaning apparatus
- solvent resistant materials

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DYNO Sieve Filter

for High Viscous Polymeric Suspension

Performance Data of a 12 m² DYNO Filter

feed pressure	1.5 bar
feed concentration	30 Vol.-%
viscosity	1,000 mPas
• viscosity of water	1 mPas
sieve cut	20 µm
concentration of coarse particles	(x > 20 µm)
• in the feed	20 ppm
• in the concentrate	5,000 ppm
• in the filtrate	< 5 ppm
filtrate throughput	4,000 l/h
regular sieve maintenance	> 1 year

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Machine Sizes

Type	Filter Area [m²]	No. of Filter Modules [-]	Filter Diameter [mm]	Drive [kW]
Lab Membrane / Sieve	0.013	1	145	0.5
Pilot Membrane / Sieve	0.13	5	145	3
S Membrane / Sieve	0.4	10	200	< 5.5
M Membrane / Sieve	1.8	12	335	< 15
L Membrane / Sieve	8 / 4. 8	20 / 12	550	≤ 55
XL Sieve	12	12	850	≥ 45

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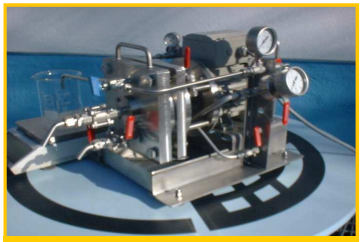
Machine Sizes



Lab-Type, A_F = 130 cm²

S-Type, A_F = 0.4 m²

L-Type, A_F = 8 m²

XL-Type, A_F = 12 m²

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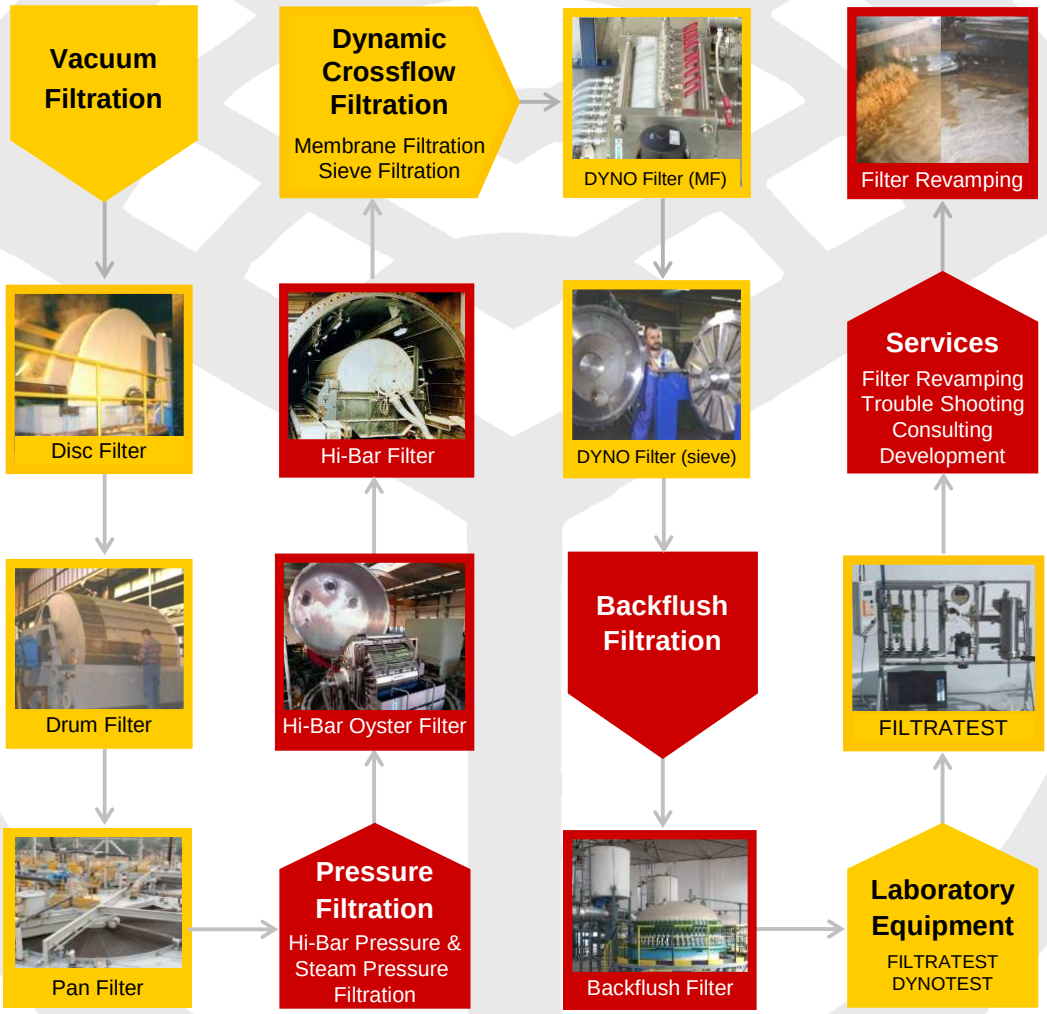

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