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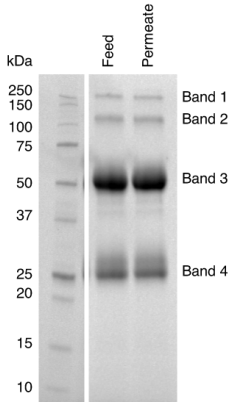
Process-economic efficiency of plasma-derived IgG filtration with Nvigorea's filter paper

Polyclonal immunoglobulin G (IgG) is one of the most important protein products derived from plasma. Collectively, the volume of plasma being processed worldwide is around 42 million liters, and roughly 3.5-5.4 g of IgG per L plasma can be produced. In the industry, it is not uncommon to process very large batches, i.e., about 5000 L/batch, which roughly corresponds to 40 kg of IgG. Processing of such large batches requires tens of m^2 of virus removal filter per batch. Because virus removal filters are very expensive, process-economic factors, such as product throughput, flux, filter sizing and cost per unit area, are crucial to consider. In this application note, the filtration properties of Nvigorea's filter paper were tested with real-life industrial sample from IgG manufacturer (at 11 g/L, pH 4.9).[1]



The performance of the paper filter (47 mm disc) was tested at an actual volumetric feed load corresponding to 288 L/m^2 or 3.16 kg/m^2 protein per filter surface area. Full recovery of IgG was observed and paralleled by log_{10} reduction value (LRV) ≥6 for a model small-size virus. The calculation of V_{max} and m_{max} yielded 1734 L/m^2 or 19 kg/m^2 values for Nvigorea's filers, which are remarkable. These values were compared to side-by-side experimental data from commercial filters as summarized in **Table 1**. Nvigorea's filter paper offers attractive combination of high throughput and low filter sizing, comparable to Competitor B filter but at a more affordable cost.

Table 1. Illustrative Vmax analysis of 11 g/L IgG filtration.

Type	Vmax, L/m^2	J_0, LMH	LRV	TMP, bar	A_{min}, m^2	A_{min}+30% safety margin	Savings per batch*, %
Nvigorea's filter	1734	28	≥6	3	25	32	+34.4
Competitor A	120	350	≥5	2	43	56	-404
Competitor B	2000	25	≥5	1	28	36	0
Competitor C	1200	20	≥6	2	35	45	-102

*Benchmarked against competitor B
Vmax- calculated maximum throughput before complete filter fouling
J_0- initial flux
LMH- $L\ m^{-2}\ h^{-1}$
LRV- log_{10} reduction value (MS2 bacteriophage, 27 nm)
TMP- transmembrane (operating) pressure
A_{min}- minimum effective filter area to process one IgG batch (5000 L)

Reference:

[1]. Wu et al. Nanocellulose-Based Nanoporous Filter Paper for Virus Removal Filtration of Human Intravenous Immunoglobulin, *ACS Appl. Nano Mater.* 2019, 2, 10, 6352–6359