

**Demineralization of Lactose**  
*Synder Nanofiltration Membranes*



**Background**

In the concentration of whey protein, the byproduct generated is a salty lactose solution. This lactose can be concentrated with a nanofiltration membrane for use in the food, pharmaceutical, and brewing industries. Synder offers two different NF membranes, the NFX (150-300Da) and the NFW (300-600Da), which were both tested for effectiveness in concentrating and desalting a simulated lactose feed stream.

**Test 1: NFX**

Feed Solution, Membrane, and Operating Conditions

Feed Solution	
Material	Simulated Sweet Whey UF Permeate
Lactose Concentration	4%
Salt Concentration (NaCl)	0.5%
Synder Membrane	
Element	NFX-Spiral Element
Membrane	Polyamide-TFC
NF Standard Operating Parameters	
Pressure (PSI)	110
Temperature (C)	20-25

## Results

Conductivity and TOC were measured to evaluate the NFX's performance in both concentrating lactose and rejecting salt. The performance is summarized below.

Filtration Results	
Lactose Concentration Factor	3-4
Lactose Concentration in Resulting Feed	14%
Average Permeate Flux (GFD)	21
Overall Lactose Rejection (%)	>98.5

## Test 2: NFW

Synder's NFW membrane was also tested in a constant volume diafiltration mode where DI water was added to the feed stream with an equal amount of permeate water extracted from the demineralization process. The operating conditions and membrane specification are listed below. The feed solution is a simulated UF permeate from sweet whey protein separation process, which contains 8% lactose and 0.44% sodium chloride.

### Feed Solution, Membrane, and Operating Conditions

Feed Solution	
Material	Simulated Sweet Whey UF Permeate
Lactose Concentration	8%
Salt Concentration (NaCL, ppm)	4400
Synder Membrane	
Element	NFW-Spiral Element
Membrane	Polyamide-TFC
NF Standard Operating Parameters	
Pressure (PSI)	110
Temperature (C)	20-25

## Results

Filtration Results	
Total Volume of DI Water Used (Gal)	>18
Salt Dilution Factor	5.7
Salt Concentration in Final Feed (ppm)	770
Average Permeate Flux (GFD)	11.6
Overall Lactose Rejection (%)	>94%

## Conclusion

Both the NFX and NFW membranes were effective in concentrating lactose from simulated UF permeate. The NFX performs better with respect to overall lactose yield, while the NFW offers a better balance of lactose yield and salt passage through the membrane. The NFW achieves excellent fractionation of lactose and salt while operating at lower pressures than typical NF membranes. These results suggest that Synder's NF membranes are well suited for multiple types of lactose concentration.