



**FOCUSED WATER  
RECOVERY USING  
NANOFILTRATION IN  
THE FOOD INDUSTRY**

*Case study*

*Using the ESNA1-LF-LD membranes for recycling wastewater from the wash process in a UK salad factory*

**PROBLEM**

Water is a critical resource for food manufacturing process. It is used to maintain hygiene in the process and to ensure food quality and safety. With an aim to use water efficiently, a lot of food manufacturing plants are now making efforts to recycle and reuse wastewater. One such case is of a Hydranautics' key customer, a salad processing plant which focuses on recycling and reuse of wastewater from the salad wash process.

The Salad processing plant produces 1,000 m<sup>3</sup>/day of NF permeate which is blended

back with the local municipal water supply and used again in the salad wash process. A large amount of organic compounds such as biocides, surfactants, polymers and chlorine based chemicals, are used in the wash process. The wastewater which is reclaimed contains high concentrations of COD, BOD and TSS.

Hydranautics' ESNA1-LF-LD membranes were installed at the plant to reclaim the high COD wastewater. Premature fouling of NF elements used in the last step of the wastewater treatment process led to very frequent CIPs.



**UNITED KINGDOM**

<i>Location</i>	UK
<i>Feed water source</i>	Wastewater
<i>Application</i>	Water reuse
<i>Capacity</i>	1,400 m <sup>3</sup> /day
<i>Recovery</i>	72%
<i>Pretreatment from NF</i>	1,000 m <sup>3</sup> /day (75% Recovery)
<i>NF Membrane</i>	ESNA1-LF-LD
<i>NF Design</i>	Two stages 4x6 / 3x6

The fouling produced very high feed pressure in both stages of the NF system, while the differential pressures remained constant. Hydranautics' team visited the site for elements autopsy and recommended process modifications.

Parameters of wastewater to be treated:

- TDS 400-500 mg/l
- COD 200 - 800 mg/l
- BOD 100-300 mg/l
- TSS 100-250 mg/l

# The SOLUTION

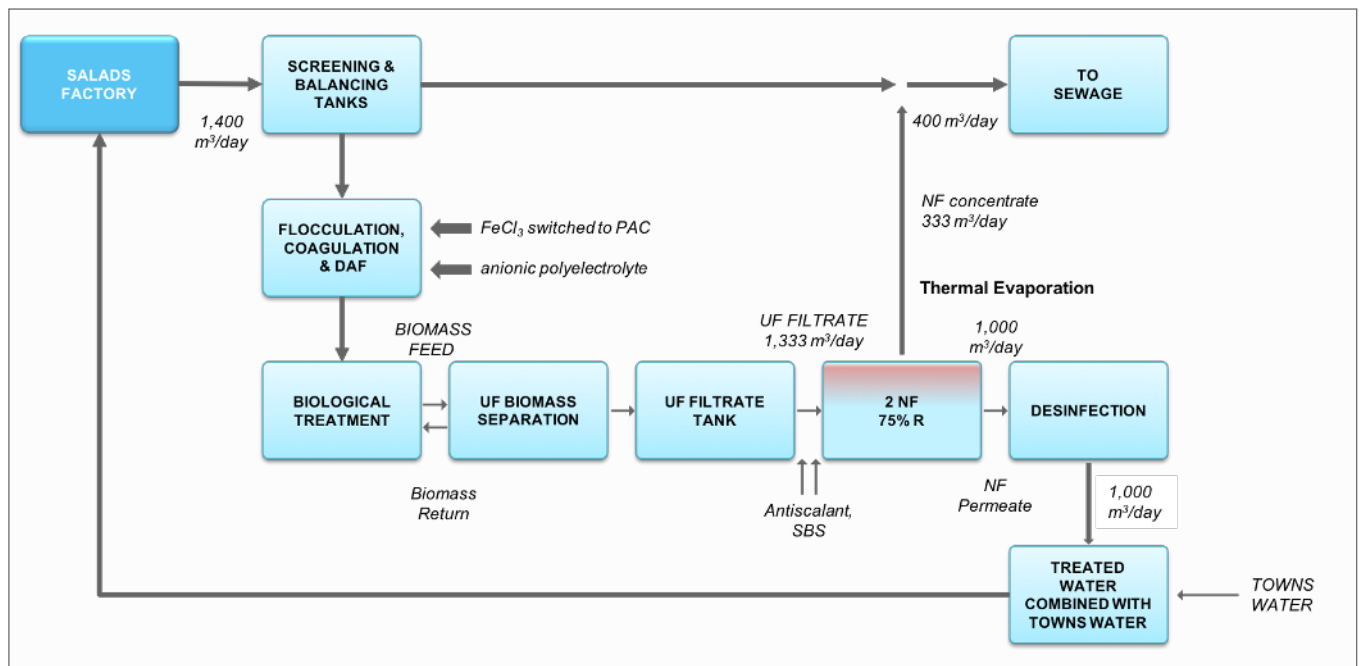
RO membranes installed in the plant before 2012, experienced regular flux loss in stage 1 from organic fouling and in stage 2 from  $\text{Ca}_3(\text{PO}_4)_2$  scaling. The client switched to Hydranautics' ESNA1-LF-LD membranes, which increased the salt passage, that provided less concentrated brine and also eliminated  $\text{Ca}_3(\text{PO}_4)_2$  scaling.

However, the membranes still continued to have problems with organic fouling and experienced a rapid increase in feed pressure that led to frequent CIPs. Hydranautics' experts noticed that an organic chemical used in the salad wash process was responsible for this fouling. The client replaced the chemical which resulted in decrease in organic fouling.

The wastewater treatment process incorporates an advanced membrane bioreactor with external UF and a NF system to treat and purify the water for reuse and discharge. The pretreatment consists of screen filtrations, equalization tanks, coagulation/flocculation (PAC 8 ppm as Al + 1 ppm anionic

polyelectrolyte) and DAF. The MBR consists of an active sludge reactor with a MLSS of 8,000 – 12,000 mg/l and 25 days' sludge retention time. Urea and phosphoric acid are dosed to increase the nutrients to adjust F/M ratio in the reactor. Some molasses is also dosed to increase the carbon source. Aeration and mixing in the reactor are produced by two jet mixers. To avoid foam formation, fatty alcohol based defoamer agent is dosed into the bioreactor. The type of ultrafiltration to separate the biomass is Berghof external UF.

Two ESNA1-LF-LD racks were installed to reduce TDS and COD/BOD to the requested levels. The chemicals used in the NF feed included SBS to reduce free chlorine after UF mini cleaning and antiscalant to prevent membrane scaling. Two NF trains were equipped with 5 micron cartridges filters, a high pressure pump and two stages of ESNA1-LF-LD elements. A total of 84 elements were installed in the two NF trains.



The

## IMPACT

Hydranautics' team provided technical support to the client and recommended to reduce the number of cleaning in place from 50 per year to 7 per year. Due to the reduced number of CIPs, less than 12% of the elements were replaced per year in 8 years of operation. The ESNA1-LF-LD elements achieved the permeate conductivity of < 300  $\mu$ S/cm and reduced the COD and BOD to the levels acceptable for water reuse in the salads process.

Hydranautics' investigation concluded that the organic chemical used in the salad wash

process was responsible for the surface membrane fouling and dramatic flux loss. When the customer discontinued using the chemical, the organic fouling and associated increase in feed pressure stopped. The use of ESNA1-LF-LD elements for this application proved to be the right selection, even after 8 years of installation the elements are still operating successfully. The factory has not experienced any water shortage from the wastewater treatment plant and has maintained a recovery rate of 72 %.

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#### About Hydranautics

Since our founding in 1963, Hydranautics has been committed to the highest standards of technology research, product excellence and customer fulfillment. Hydranautics entered the Reverse Osmosis (RO) water treatment field in 1970 and is now one of the global leaders in Integrated Membrane Solutions. Hydranautics became a part of the Nitto Group in 1987. Nitto is Japan's leading diversified materials manufacturer. The group offers over 13,000 high value specialty products worldwide including optical films for liquid crystal displays, automotive materials, reverse osmosis membranes for desalination and transversal drug delivery patches.

As leaders of high quality membrane solutions, we believe our commitments extend beyond manufacturing and selling our products. Our skilled staff of technicians, engineers and service professionals assist in designing, operating and maintaining a robust, reliable and efficient membrane system to meet your requirements and exceed your expectations.

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**HYDRANAUTICS**