
The Commercial Use of Ultrafiltration Membranes in the Resolution of Aqueous Problems

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Abstract

This paper describes the commercial application of custom ultrafiltration (UF) membranes in the resolution of two aqueous-based problems: the recovery and recycling of laundry wash water and the final polishing of sodium hydroxide sterilization solution in the dairy and brewing industries. Both applications are currently in the pilot stage and employ custom-made UF membranes developed by Liumar Technologies Corporation of Ottawa, Canada.

Introduction

Liumar Technologies Corporation manufactures ultrafiltration (UF) polymeric membranes, membrane modules and membrane-based separation systems for the separation of dissolved substances. The company has been in active business since 1991. In addition to providing a range of pre-characterized UF membranes and modules, Liumar offers a "custom" membrane service where, working with the client, Liumar will develop membranes specifically tailored to the application that will provide optimum operating efficiencies.

This paper provides a description of two applications that utilize Liumar technology to overcome aqueous-based problems: the first is the use of ultrafiltration membranes in the polishing of caustic sterilization liquids; the second utilizes ultrafiltration membrane technology in the recycling of laundry water.

Caustic Polishing Systems

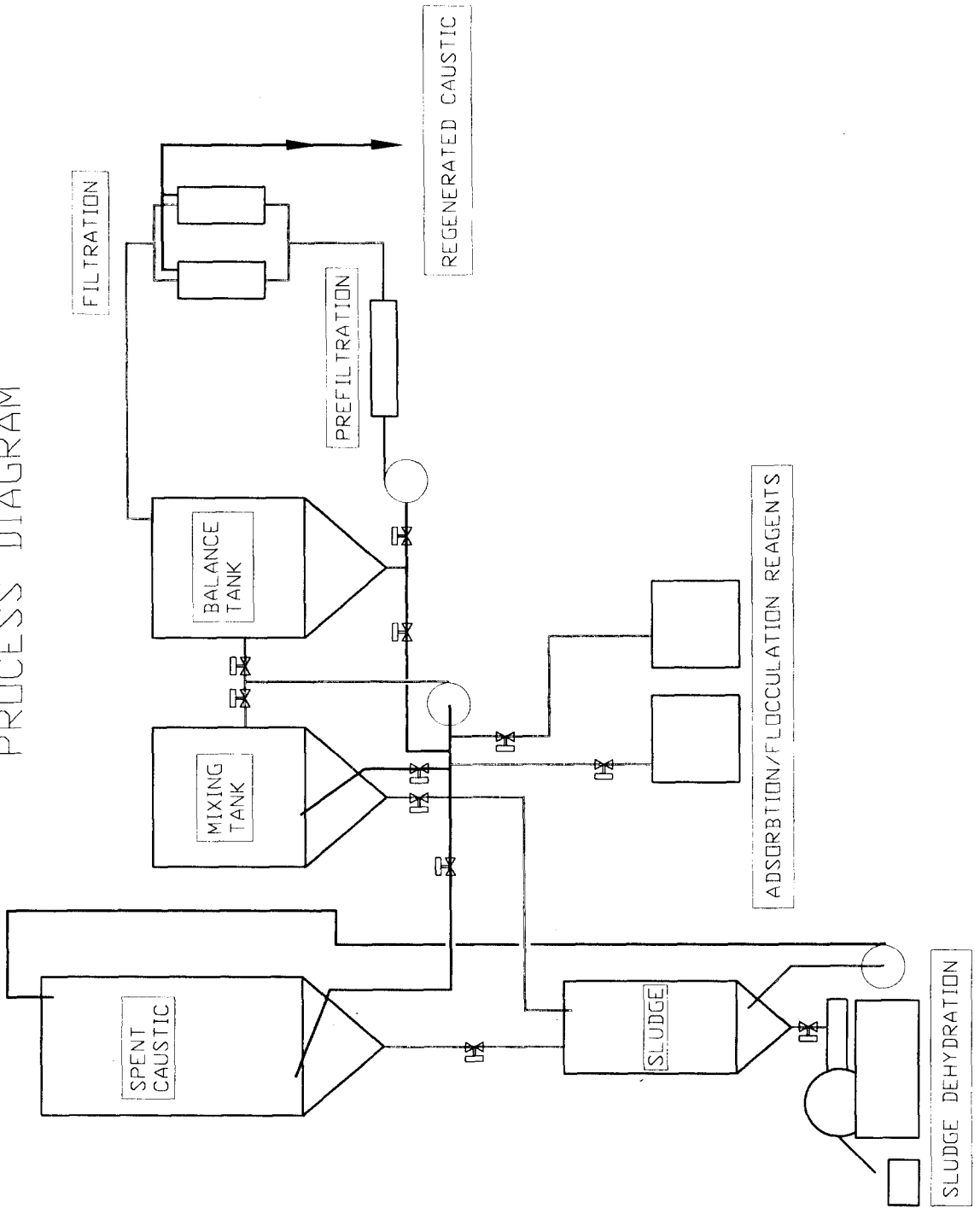
In co-operation with Water Technology International Corporation¹, Liumar has formulated an ultrafiltration membrane system that is used in the final stages of the purification of a caustic cleaning solution used in both breweries and dairies to sterilize the food processing systems. The process of regeneration of the caustic cleaning liquid is a multi-step one:

- adsorption/flocculation (with precipitation and decanting of the cleaned caustic);
- membrane filtration (providing clarification and colour removal); and
- solids management.

The diagram on the following page represents schematically the cleaning process.

¹Water Technology International Corporation, 867 Lakeshore Road, P.O. Box 5068, Burlington, Ontario, Canada, L7R 4L7, Contact: Gilles Testayre - gilles.testayre@cciw.ca

CAUSTIC REGENERATION PROCESS DIAGRAM



This process of cleaning and sanitizing utilizes a “clean-in-place” (CIP) strategy. The characteristics of the CIP process are as follows:

- CIP loop volume: 1,870 litres
- flow rate: 472 litres/min
- rinse temperature: 45° C
- wash temperature: 85° C
- acid descaling temperature: 65° C
- caustic concentration: 2%
- acid concentration (for neutralization): 1%

The marriage of membrane technology with absorption/flocculation results in a Dynamic Cleaning™² process that averages 60 to 70% more efficient than alternative sterilization techniques.

Laundry Systems

Liumar Technologies, working with an Ottawa-based commercial laundry, has developed a system for the recycling of laundry wash water using a custom pre-filtration system coupled with a patented ultrafiltration membrane. The problems posed by this application included the elimination of laundry lint prior to exposing the wash water solution to the membrane in order to minimize fouling and thus rendering the membrane unusable.

The technology employed by the client involves the use of a tunnel washer that processes the laundry through ten stages. The benefits of recycling include the reduced consumption of municipal water supplies (an initiative that is currently becoming legislatively controlled in Canada) as well as the retention of water temperature which reduces the requirement for heating for the client.

The diagram on the following page depicts the architecture of the system, including the volumetrics for each stage. The system is currently installed as a pilot in the laundry and has the following characteristics:

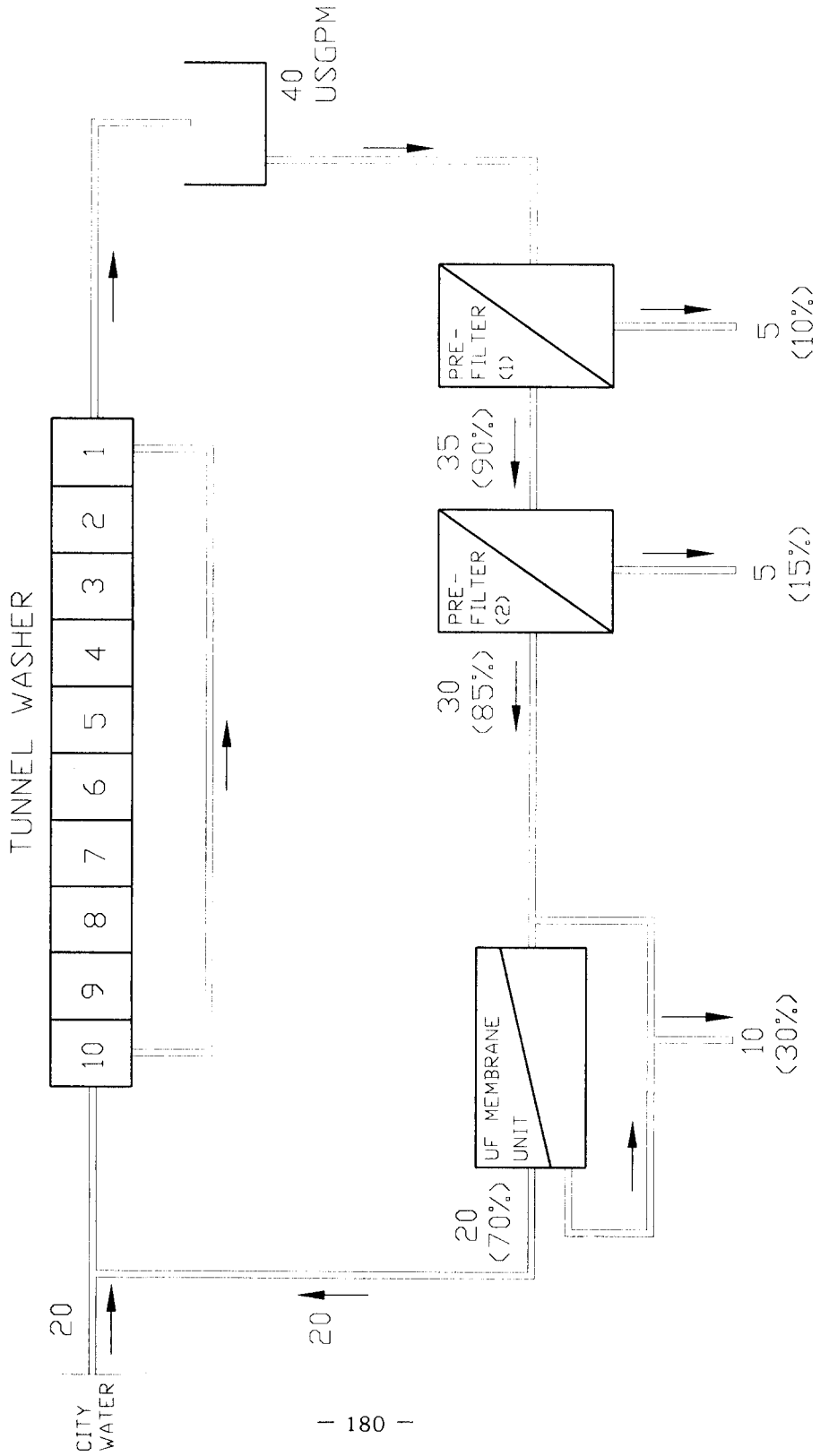
- waste water feed is 40 US gallons per minute
- the return of purified water is 20 US gallons per minute

A key indicator of the purification process is the turbidity of the product, turbidity quantifying the suspended solid composition of the solution. Turbidity is measured in Nephelometric Turbidity Units (NTU's) and the following describes how this parameter is reduced by the process:

- feed to pre-filter (1) 34.6 NTU (average) - 83.5 NTU (max)

²Trade Mark of Water Technology International Corporation

LAUNDRY WATER RECYCLING



- feed to pre-filter (2) from (1) 30.8 NTU (average) - 48.7 NTU (max)³
- feed from pre-filter (2)
to membrane module 17.9 NTU (average) - 30.5 NTU (max)
- ultrafiltration permeate 1.1 NTU (average) - 1.45 (max)

It should be noted that the client's domestic feed water analyzes at 0.65 NTU. This pilot will continue to be exercised in order to verify that the pre-filters preserve the integrity and life of the membrane. At this point in time, the final parameter to be tested is the "graying" of the laundry product which is related to the retention of dissolved solids in the laundry.

We expect the results of this pilot within the next three months. In September, 1997, a system will be implemented for full scale operation of the laundry. Current estimates are that the feed water processed will be 200 US gallons per minute and the return of processed water to the laundry operation will be 100 US gallons per minute (i.e. a 50% savings for the operator).

³ note that all lint has been removed at this point.