

CHAPTER V

EXPERIMENTAL CONSIDERATION

5.1 Experimental variables :

In order to investigate the parameters affecting the Performances of Reverse Osmosis and Ultrafiltration Systems, the following variables have been studied.

5.1.1 Operating pressure

For Ultrafiltration system the operating pressure was kept constant at about 9 to 10 Bar. For Reverse Osmosis system the operating pressure was varied from 40 to 60 Bar.

5.1.2 Initial concentration

The initial concentration for Reverse Osmosis system was varied from 0.6 to 10 Brix.

5.1.3 pH of feed

For Reverse Osmosis system pH of Feed was varied from 3 to 8

5.1.4 Type of membrane

For Ultrafiltration, 2 types of membranes were used, which are : T2/A and T6/B. For Reverse Osmosis system 2 types of membranes were used, and they are : T1/12W and T2/15W.

5.1.5 Type of feed

Two types of Feeds were used in this experiments and they are :

Liquid from solid waste and Liquid waste.

5.2 Experimental procedure

5.2.1 Reverse Osmosis plant :

Flushing new membranes:

The new membrane left from the factory were protected from frost and drying out by a glycerol/formaldehyde solution which must be flushed out before the membranes were used on the process fluid. This was done by flushing clean water through the module for at least half an hour. The procedure is :

- (1) $\frac{3}{4}$ " (19 mm.) OD pump feed inlet was connected to a supply of clean water. (at pH not greater than 7.5)
- (2) The following things were checked :
 - The feed isolating valve in the supply tank was open.
 - Feed pressure to plant was 2 Bar and not greater than 3 Bar.
 - Feed lines to the plant were not kinked or pinched as this will starve the pump.
- (3) The pressure control valve was fully open.
- (4) The main electrical supply was turned on.
- (5) The green start button was pressed and the plant was run at the minimum pressure.
- (6) The low pressure cut out was adjusted to just below the minimum operating pressure such that a feed failure will cause the plant to stop without damage to the pump. (caused by the pump running dry)

- (7) After 15 minutes, the operating was increased to 20 Bar and was run for a further 15 minutes.
- (8) The low pressure contact on the module pressure gauge was re-adjusted to a point just below the 20 Bar operating pressure.
- (9) After the flushing period, the plant was stopped by opening the pressure control valve fully and depressing the red stop button.
- (10) The clean water supply was isolated.

Procedure on process fluid

- (1) The $\frac{1}{2}$ " (12.5 mm.) outlet of the heat exchanger was then flexibly connected to the feed tank. Clean cooling water is piped to the lower $\frac{1}{2}$ " (12.5 mm.) hose spigot on the heat exchanger shell; the upper spigot being connected to drain.
- (2) The feed inlet of the pump was connected to the feed tank of process fluid.
- (3) The following things were checked;
 - The feed isolating valve in the feed tank was open.
 - Feed pressure to the plant is 2 Bar and not greater than 3 Bar.
 - Feed lines to the plant were not kinked or pinched otherwise the pump would starve and damage might occur.
- (4) The $\frac{1}{2}$ " permeate spigot on the module shell was connected to a suitable holding tank.
- (5) The pressure control valve was fully open.

- (6) The green start button was pressed, and allowed 1.5 minutes for air to clear the system, then the module was pressurised by turning the pressure control valve clockwise. Continue until the desired operating pressure was reached.
- (7) The low pressure contact was adjusted to a position just below the operating pressure, and the high pressure contact to just above the operating pressure.
- (8) The permeate was collected and its flow rates was measured in every period of time by means of stopwatch and volumetric cylinder.
- (9) The feed concentration was measured in every period of time by means of hand refractometer.
- (10) After the final feed concentration was reached the module was depressurised by gradually opening the pressure control valve.
- (11) The red stop button was pressed when the pressure control valve was fully open.
- (12) The concentrated solution was collected.
- (13) After each run the module was flushed again with clean water and detergent water for 30 minutes to preserve the membrane. The procedure was the same as Flushing the new membrane.
- (14) If the membranes were not to be used for 3 or 4 days, the module must be filled with an aqueous solution of 17% glycerol/1% formaldehyde. Then all the fluid inlets and outlets were sealed so that the solution cannot drain out.

5.2.2 Ultrafiltration plant

The procedure was just the same as Reverse Osmosis.

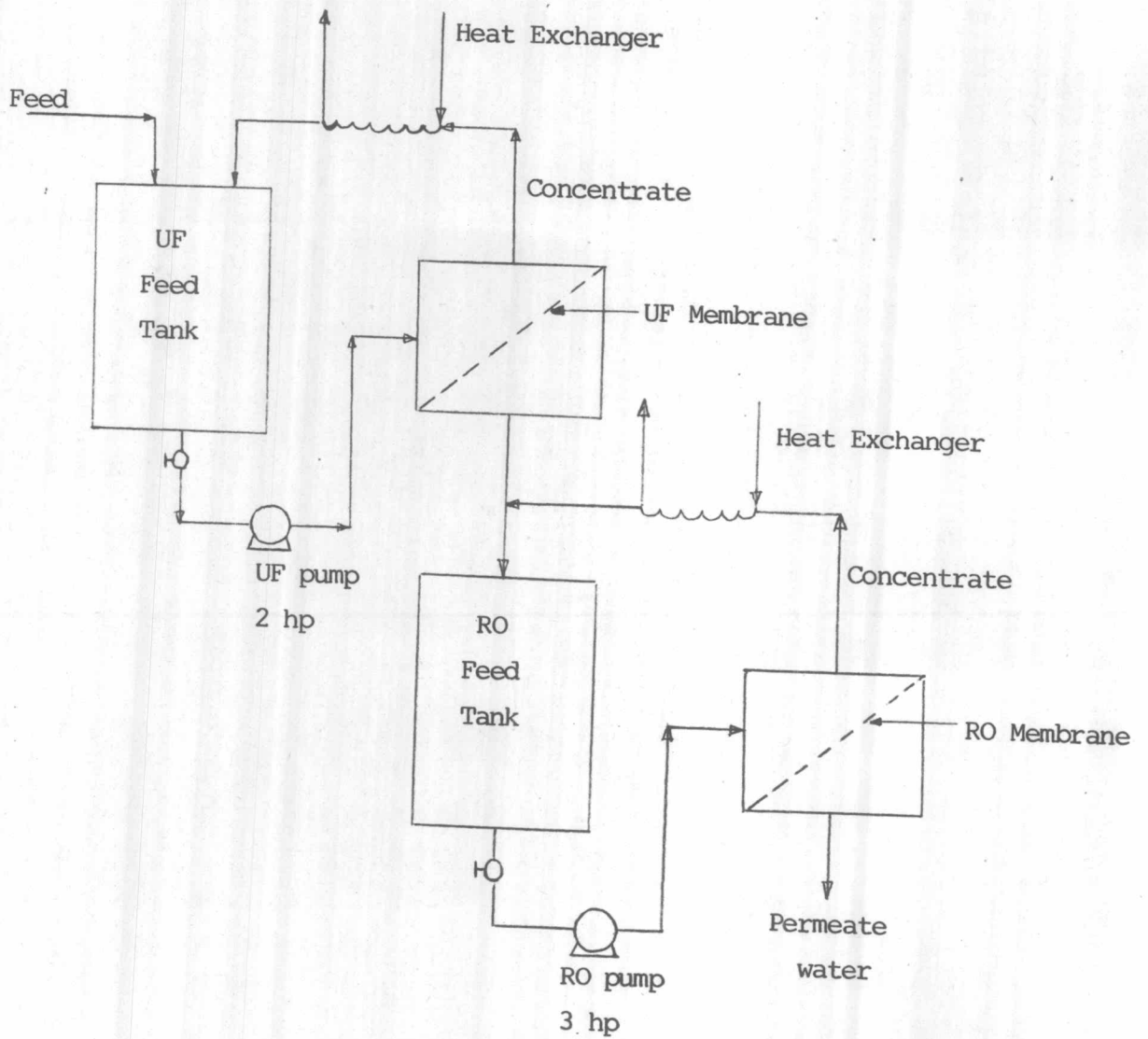


Figure 5.1 Ultrafiltration-Reverse Osmosis system