



Effects of High pH Cleaning On Salt Rejection Performance of LFC and CPA Membranes

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Introduction

High pH cleaning is a common procedure used to clean RO elements that have been fouled by dissolved organic material or biological growth. There has been some concern about its effect on the performance of polyamide composite membranes. Hydranautics has carried out tests to characterize the effect of high pH cleaning on the CPA and LFC membranes, used in many high fouling brackish water applications. The results of the study define safe pH and temperature levels which can be used for chemical clean. The study also defines pH and temperature limits that, when exceeded, may have detrimental effects to the membranes' performance.

Test Description

RO elements were first tested with a 1500 mg/L sodium chloride solution at standard test conditions. (See product literature for details.) After the initial performance test, the element was cleaned for one hour using a high pH solution at an elevated temperature. Elements were cleaned at pH levels of 10, 11, and 12, and at temperatures of 30, 40 and 45 C. Following the cleaning, the element was flushed with clean water for five minutes, and then performance tested with a standard sodium chloride solution. The performance test was run until the flux and rejection stabilized, typically, two hours.

Results

The CPA2 element had an initial rejection of 99.72%. After the cleaning procedure the rejection was between 99.66 and 99.70% for almost all pH and temperature conditions (Figure 1). There was a slight increase in salt passage following the most extreme cleaning, **45 C and pH 12**. The rejection dropped to 99.58%, corresponding to a 40% increase in salt passage. The competitor element, which started with a much lower initial rejection, experienced a similar trend in salt passage increase at 45 C and pH 12.

The LFC1 element had an initial salt rejection of 99.72%. After the various cleaning treatments, the resulting salt rejection of the LFC varied between 99.50 and 99.70% (Figure 2). However, after the **45 C, pH 12** cleaning, the rejection fell to 99.1%. This indicates that the LFC element is adversely affected by the combination of very high pH and very high temperature. However, stable performance was seen for commonly used cleaning conditions (pH 10-11, Temp 30-45 C).

Summary

The CPA and LFC elements have shown stable performance after normal high pH cleaning procedures. During normal high pH cleanings, there can be a temporary increase in salt passage due to membrane swelling. This effect is reversible, and the membrane will usually return to normal salt rejection values within a few hours or a few days at most. A combination of very high temperature and pH during cleaning can cause increased salt passage, particularly for the LFC membrane. We recommend that customers use the mildest conditions that effectively clean the membrane for their application. Many users are able to satisfactorily clean the membrane with a cleaning solution at pH10 and 30-40 C. However, there are a number of sites that have excessive membrane fouling, which may require more aggressive cleaning. Customers with such applications can use cleaning solutions up to pH 11.0 and 45 C to effectively clean the membrane without causing immediate damage to the membrane. (However, please note that repeated use of these high pH, high temperature cleaning solutions will result in shorter membrane life.) The customer may also want to consider using intermediate conditions such as pH 10 at 45 C or pH 11 at 40 C.

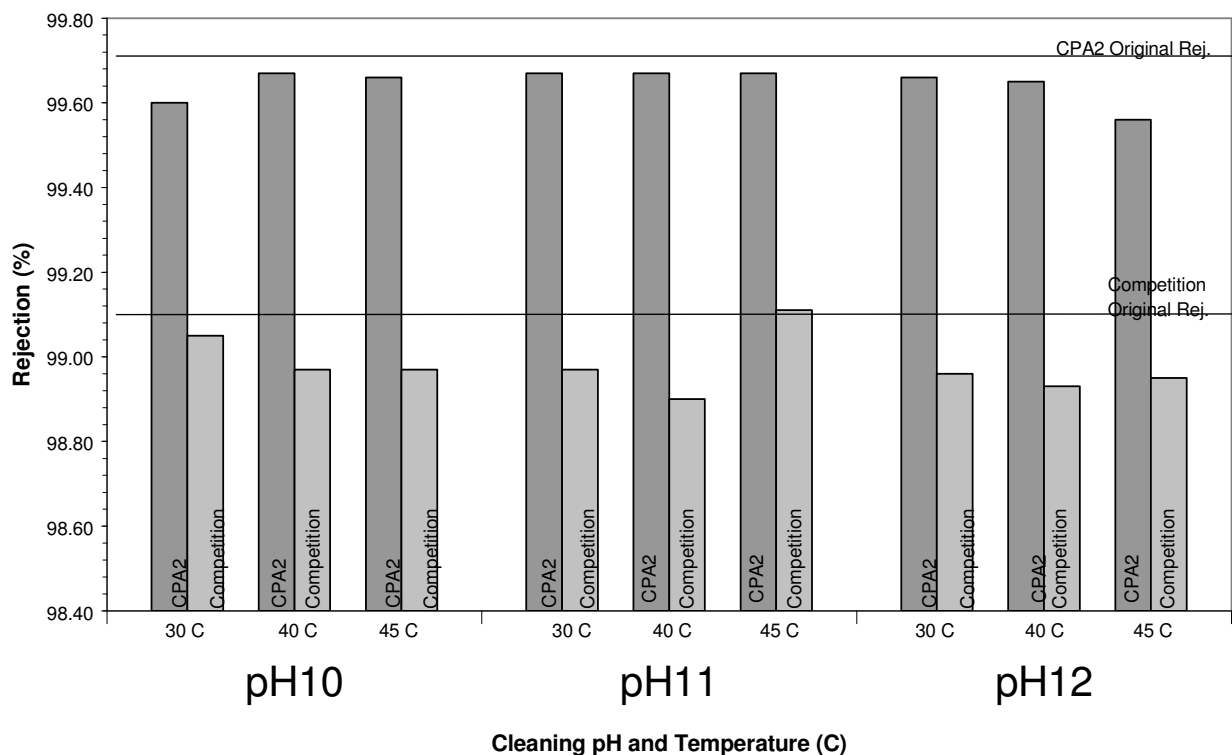
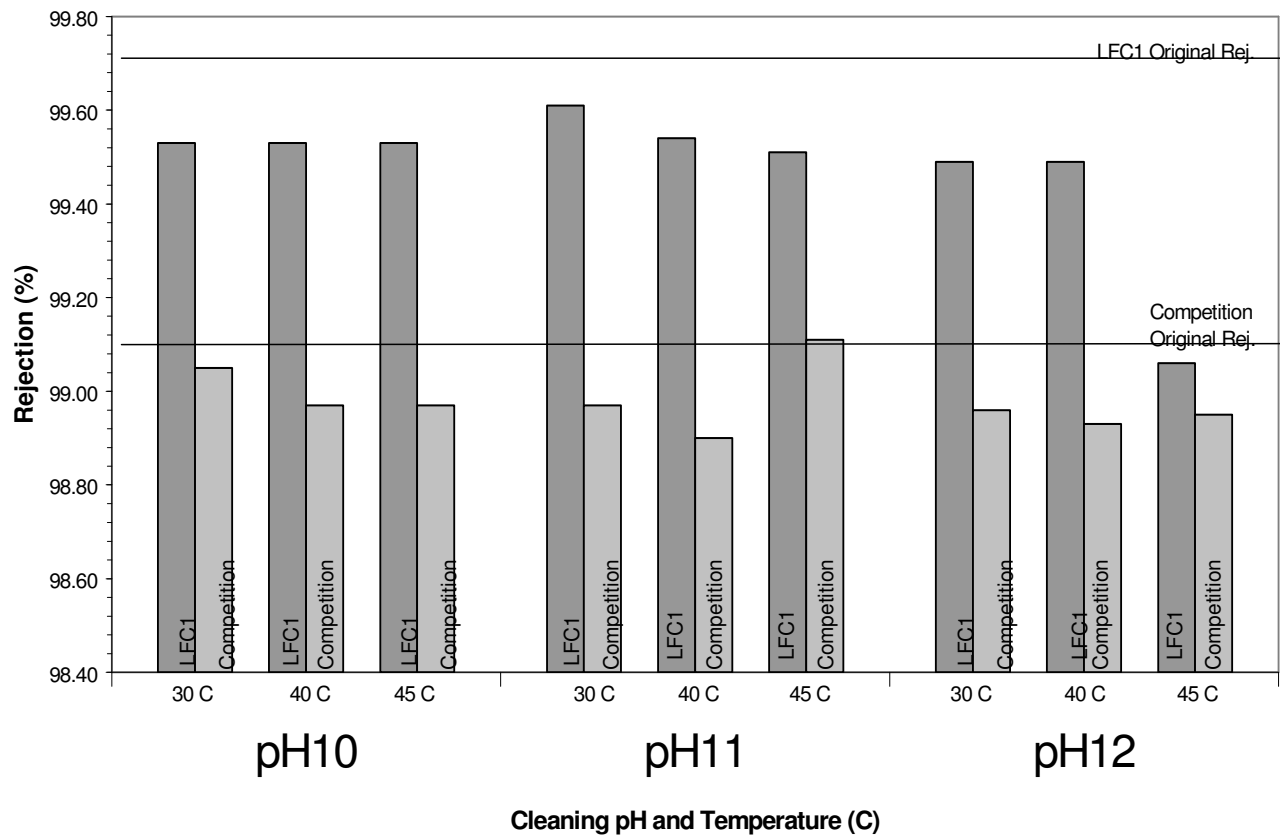


FIGURE 1: Rejection of CPA2 and Competitor Elements after High pH/High Temperature Cleaning.

FIGURE 2 Rejection of **LFC1** and Competitor Elements After High pH/High Temperature Cleaning.



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