

Title: **Characterization of industrial membranes by imaging and chemometrics.**

Student: Laia Vanacloy Garcia

Date: January, 2020

Supervisor/s: Dr. Anna de Juan Capdevila

Departament d'Enginyeria Química i Química Analítica.

1. SUMMARY

In the last years the use of membranes in the industry has increased significantly. Among the types of membranes used, there exist the ionic exchange membranes, which are used in many cases, such as the production of wine and the valorisation of acidic liquid wastes. During their usage, it is possible to have an accumulation of solid material on the surface of the membranes known as fouling.

The physicochemical characterization of the membranes and the fouling is very important to understand and improve the performance of membranes in industrial processes. For that reason, the potential of mid-Infrared (mid-IR) and Near Infrared (NIR) spectroscopy was tested in the characterization of two commercial membranes, Fujifilm and Neosepta, by using single-point spectroscopy and hyperspectral images. The spectroscopic measurements were done in reflectance mode to characterize the surface of the membranes, and in transmission mode, to characterize the membrane cross-section and obtain information about the composition of the fouling and the membrane. In the case of hyperspectral images, the chemometric method Multivariate Curve Resolution-Alternating Least Squares (MCR-ALS) was used to interpret the data and to obtain information about the composition and spatial structure of the fouling and membrane components.

Finally, it has been demonstrated that the determination of the composition and the distribution of the components of the membranes is possible combining spectroscopic techniques with the suitable chemometric tools. For each membrane studied, the right characterization was done with a different technique (NIR for Neosepta and mid-IR for Fujifilm) due to the natural characteristics of the membranes and their fouling.

Keywords: industrial membranes, hyperspectral images, Chemometrics, Near infrared (NIR) spectroscopy, Mid-infrared (mid-IR) spectroscopy.