

Department of Chemistry

## Molecular probes in membrane processes

Biochemical and Process Engineering Group



**Sergio Santoro**

PhD Student since 2013

Master's Degree in Materials Science since 2010;  
Scientific collaborator at the Institute on Membrane Technology (ITM-CNR) from 2010 to 2012.

Author of 1 scientific paper.

## Objectives

The main objective of the research activity is the use of molecular probes for monitoring membrane processes.

A fluorophore is a fluorescent chemical compound that can re-emit light upon light excitation. The fluorescent activity of the fluorophores depends on the temperature and the oxygen concentration of the environmental. The use of fluorophores as molecular probes is an attractive technology for non-invasive, non-toxic and online detection of several parameters, such as temperature and oxygen concentration.

Two general approaches will be followed to address the above objective:

1. Probing temperature on membrane surface by means of molecular thermometers;
2. Monitoring oxygen concentration in membrane process by means of molecular probes.

## Methodology

Optical sensors for oxygen rely upon collisional quenching of luminescence by oxygen. The sensors response is directly related to oxygen partial pressure in a gas or in a liquid. Higher oxygen levels result in lower intensity and luminescence lifetime. Fluorophores could be dispersed in polymeric matrix to prepare an intelligent food packaging material enable to detect the oxygen concentration of atmosphere enclosed.

The increase of the temperature favors non-radiative decay (vibrational relaxation and internal conversion) and, as a consequence, the decrease of the intensity of the fluorescence emission. Molecular probes dispersed or adsorbed on the surface of porous membranes could be used in Membrane Distillation to detect the temperature profiles in the limit layers of membrane contactors by measuring the intensity of the fluorescence of the fluorophore and to evaluate the thermal polarization.

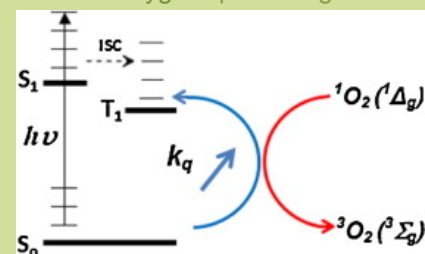
## Expected Results

The expected results are:

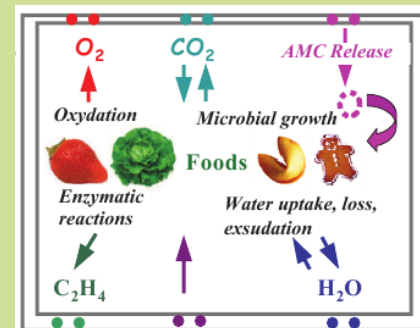
- Preparation of sensitive membranes to temperature and oxygen concentration by the dispersion or the adsorption of molecular probes in polymeric matrix;
- Evaluation of the effect of temperature and oxygen concentration on the fluorescence of the molecular probes dispersed in the membrane;
- Monitoring of temperature and oxygen concentration in membrane process by means of sensitive membrane.

Funding: Erasmus Mundus Doctorate in Membrane Engineering (EUDIME)

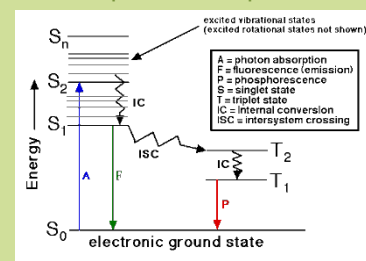
### Oxygen quenching



### Food packaging



### Temperature dependence



### Thermal polarization

