Title	**pH Colorimetric Sensor Arrays: Preparation, Characterization and, Applications**
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Project description:

Recently, several new Colorimetric Sensor Arrays (CSAs) have been developed. The interest in this field is growing owing to the easy construction and the detection system based on color variations measured with CCD cameras or scanners. In particular, pH CSAs have drawn much attention since the potentiometric measurements are characterized by slow response time, alkaline, and acidic errors, and the variation of the liquid junction potential. The previously proposed pH CSAs suffer from at least one of these issues: leaching at pH > 9, slow response time, short shelf-life, large prediction errors (>> 0.02 pH units) and, limited working interval. We recently focused our attention on the improvement of this kind of sensor. The first step of our study is represented by the choice of the color space. The H (Hue) coordinate from the HSV color space is more suitable as the detection signal is more robust and stable towards variations of indicator concentration and lighting conditions. Then the development of the new device passed through the study of the polymer matrix. The use of precursors with organic moieties in the sol-gel matrix can reduce the leaching of the entrapped sensing dyes. The widening of the pH working interval with a single indicator can be achieved by modulating the concentration of suitable surfactants which alter the pK_a value of the indicator. Indeed, surfactants play an important role in reducing the pH prediction error. The evident improvements together with the homogeneity and repeatability enhancement in pH CSAs system led to a patent proposal in 2019, four published research papers and, three more under review.
The **general objective** of this research in the Pastore's group is the further improvement of the sensing membranes, their characterization and, the applications to specific fields such as pH measurements in seawater and, on-off sensors. Moreover, these sensors will be tested for the detection of other analytes like carbon dioxide, biogenic amines, and, ethylene (indirectly). This will be done by modifying the polymer matrix precursors and adding suitable additives.

Publications

[1] A. Pastore, D. Badocco, L. Cappellin, P. Pastore, Enhancement of the pH Measurement of a PVDF-supported Colorimetric Sensor by Tailoring Hue Changes with the Addition of a Second Dye, Microchem. J. (2019) 104552. https://doi.org/10.1016/j.microc.2019.104552.
[2] A. Pastore, D. Badocco, P. Pastore, Influence of surfactant chain length, counterion, and OrMoSil precursors on reversibility and working interval of pH colorimetric sensors, Talanta. 212 (2020). https://doi.org/10.1016/j.talanta.2020.120739.
[3] A. Pastore, D. Badocco, P. Pastore, High accuracy OrMoSil (Polyvinylidene Fluoride)-supported colorimetric sensor: Novel approach for the calculation of the pH prediction error, Talanta. 213 (2020) 120840. https://doi.org/10.1016/j.talanta.2020.120840.
[4] A. Pastore, D. Badocco, P. Pastore, Kinetic response of pH colorimetric sensors: Role of the cationic surfactant concentration and amount and type of solvent used in the preparation of the sensing spot, Microchem. J. 157 (2020) 104891. https://doi.org/10.1016/j.microc.2020.104891.

[5] A. Pastore, D. Badocco, L. Cappellin, P. Pastore, Colorimetric Sensor Array for pH measurements, 30/07/2019, Priority Number IT102019000013878, International License.

Collaborations/Network:

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Prof. Paolo Pastore