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Introduction
Increasing focus on the role of pH signaling and proton flow in different plant physiological processes rises a demand for expansion of the repertoire of protein-based pH sensors with respect to pKa values and working ranges for in vivo, non-invasive pH measurements in different cellular compartments. We are working with the development and characterization of a new pH sensor for pH measurements in the apoplast. The sensor consists of a pH sensitive green fluorescent protein, GFP, fused to the less pH sensitive red fluorescent protein, mRFP1. This makes the sensor usefull for ratiometric measurements in vivo, which can be carried out without concern of sensor distribution and concentration.

Characterization of a new GFP based nanosensor for pH measurements in plants

A buffered solution containing the GFP-mRFP1 sensor was stepwise acidified as indicated in the top bar by addition of small amounts of 1M HCl and NaOH. Fluorescence was measured on a spectrofluorometer.

Applications
This GFP-mRFP1 pH sensor is usefull within the pH range of 5 to 7 with a pKa value of approx. 6.1. With the plant apoplast being acidic relative to the cytosol this sensor is ideal for measurements of pH and proton fluxes in this extracellular compartment. With the appropriate promoter and/or targeting signal, a tissue or the entire plant body can be transformed to synthesize the sensor itself, avoiding any problematic loading procedures. Alternatively the protein sensor can be infiltrated into plant tissues. Using GFP variants originating from two different organisms (GFP: A. victoria; mRFP1: Discosoma sp.) should enhance expression by minimizing silencing.

References