Advanced science has enabled the development of new "smart" materials that are stimuli-responsive polymers. They are used in various fields like: biomedicine, optics, electronics, diagnostics, and in the formulations of pharmaceuticals and cosmetics. The objective is to prepare membranes able to adapt their intrinsic characteristics thanks to the integration of polymer actuators. Polymer actuators are materials that change, in a reversible way, their shape and volume according to environmental modifications. Poly(methacrylic acid) is a water-soluble polymer which has very interesting physicochemical characteristics. This polyacid has a methyl group in alpha of the carboxylic acid group that undergoes reversible size changes in response to variations in pH and/or ionic strength. In aqueous solvent, with a low ionization rate and/or low pH, the synergy between the hydrophobic interactions from methyl groups and the intramolecular hydrogen bonds with the carboxylic acid groups are at the origin of the very compact conformation adopted by the polymer chain. Beyond a higher pH and/or ionic strength, the PMAA chain adopts an extended conformation. Taking into account an approximate pka value of 4.8 for PMAA, the conformation of the polymer (compact or extended conformation) could be controlled cyclically and autonomously thank to the Bromate-Sulfite-Ferrocyanide pH oscillator. This system shows large amplitude periodic changes in pH in a continuously stirred tank reactor (CSTR) over a wide range of experimental conditions.