



Laura Paltrinieri

l.paltrinieri@tudelft.nl

Motivation

Phosphorus (P) is a fundamental natural compound; it is essential to all living organisms and it is largely used as fertilizer for crop production. The increase in growth population has raised the P demand, respect to its non-renewable and limited recourse. Since years, the scientific community is looking for a significant breakthrough technology to recover P from water.

This study provides an alternative approach that involves the use and the modification of anion exchange membrane (AEM) to be able to remove phosphate from water. This approach is based on the investigation of specific receptors that can reversibly bind phosphate and recover it.

Concept

The use of AEM for the selective separation and recovery of anions from waste water is extensively studied for various applications, including electrodialysis (ED) and capacitive deionization (CDI). In our approach we focus on the removal of phosphate ion by using phosphate-selective transport through membranes.

Due to the presence of a hydration shell, the Stokes radius of phosphate ions is higher and the diffusion rate in water is lower compared to those of other common anions^[1]. All these properties make the selective transport of phosphate highly challenging.

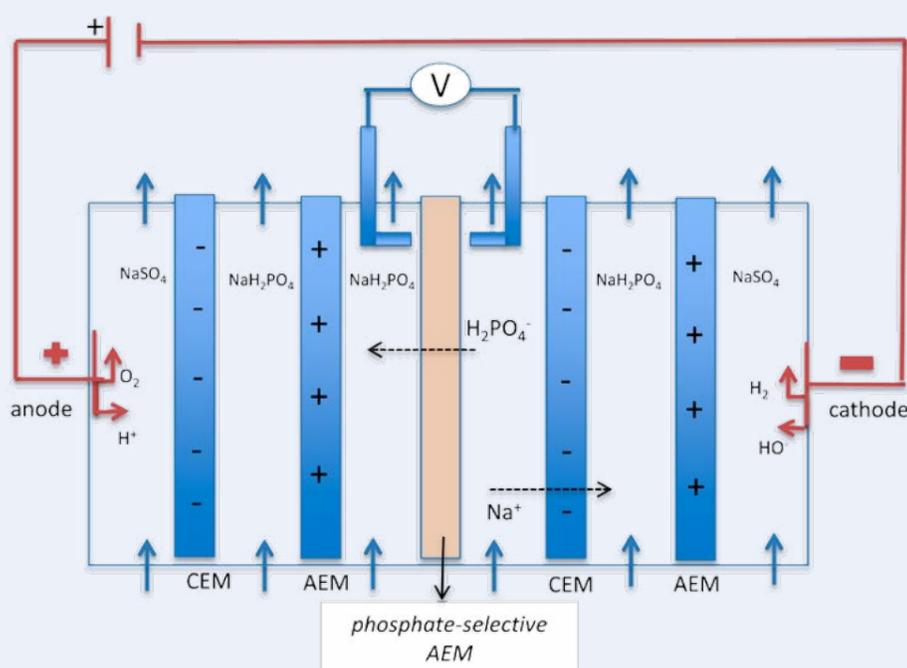
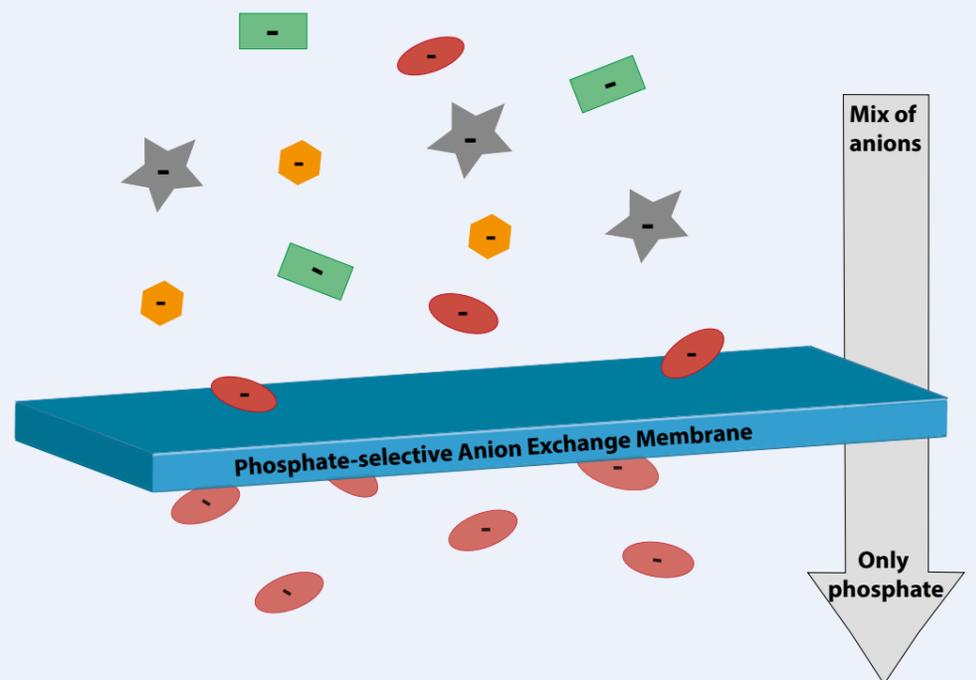


Fig. 1. Schematic representation ED system with functionalized AEM



In this project phosphate receptors will be designed and used in membrane preparation.

The receptors are introduced in the membrane: physically, covalently bonded or mixed in the matrix. Once the membrane is functionalized, the properties of the membrane and its selectivity are investigated in an ED system (Fig. 1).

Technological challenge

The main challenge of the project is to find a combination of materials (receptor and membrane) and methods that allows to selective binding and recovery of phosphate. The receptor should create a reversible/tunable binding with the anion; at the same time the receptor should not leached out from the membrane.

Research goals

- Investigation of new phosphate-receptors
- Functionalization of anion-exchange membranes: surface and bulk modification
- Correlation of membrane structure-properties with phosphate transport

[1] N. Pismenskaya et al., J. Membr. Sci. 189 (2001) 129-140.