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Ion-selective membranes for the recovery of ammonium and potassium

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Ion-selective membranes for the recovery of ammonium and potassium

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Ion-selective membranes for the recovery of ammonium and potassium

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Ion-selective membranes for the recovery of ammonium and potassium

PhD thesis

to obtain the degree of PhD at the
 University of Groningen
 on the authority of the
 Rector Magnificus Prof. E. Sterken
 and in accordance with
 the decision by the College of Deans.

This thesis will be defended in public on

Friday 1 April 2016 at 11.00 hours

by

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Si busques noves respostes, formula noves preguntes

The scope of the thesis

Our planet is expecting a population growth in the coming years creating a higher demand of food production (i.e., crops) that will require higher crop yields. Therefore, the demand of fertilizers (chemical or natural) is going to increase as they contain one or more of the essential elements (nutrients) necessary for plant growth: phosphorus, nitrogen, and potassium. However, these essential nutrients are not always available or their production is expensive. A possible natural source of these nutrients is urine because of its composition rich in phosphorus, nitrogen and potassium. Considering this, the development of technologies to recover these nutrients from urine is important, as it can lead to a chain of use and re-use of resources. In other words, recovery of nutrients closes a chain based on the use of fertilizers, the human uptake and discharge of nutrients (alimentation and excretion) and the further nutrient reuse in fertilizers.

It is known that ionophores are a tool for the selective binding of organic molecules and ions and that zeolites are vastly used for the removal of ammonium in wastewater. However, none of these two processes are suitable for recovery of the essential elements.

Membrane-based technologies allow the separation of two phases and can operate in continuous systems as well as the possibility to incorporate selective phases (zeolites and ionophores) to a polymeric matrix.

This research is based on the development and characterization of membranes selective for the recovery of potassium and ammonium - two of the essential nutrients.

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