A Novel Osmotic Pressure Sensor for Interstitial Glucose Assessment: Results from a Laboratory Interference Feasibility Test

Andreas Pfützner[1,2], Rita Smajda[3], Guy Voirin[3], Gaëlle Andreatta[3], Sanja Ramljak[2], Rune Frisvold[4], Martha Liley[3]

[1]Sciema – Science & Marketing, Mainz, Germany, [2] Pfützner Science & Health Institute, Mainz, Germany, [3]CSEM, Neufchatel, Switzerland, [4]Lifecare, Bergen, Norway

Introduction

It has been shown that an osmotic pressure sensor based on a lectin/Concanvalin A binding reaction is capable to track glucose changes in an outside environment. An implantable interstitial fluid sensor is currently under development by Lifecare, Bergen, Norway (Sencell). A working laboratory sensor prototype model was used for chemistry optimization experiments and further developmental tasks. One goal was to evaluate the stability of the glucose sensor signal against other interfering substances.

Methods

A working laboratory model of the core sensor technology was developed to perform the interference experiments. For each test, the sensor was equilibrated with 2 mmol/l glucose prior to addition of the potentially interfering substances in high physiological concentrations. The following carbohydrates and concentrations were tested: α-D-Mannose (100 µmol/l), xylose (1.5 mmol/l), maltose (10.5 mmol/l), fructose (120 µmol/l), transferrin (5g/L). In case of a measurable impact of the carbohydrate on the sensor signal, at least one more carbohydrate concentration below the initial concentration was to be tested.

Results

No impact on the sensor signal was seen by mannose, xylose, fructose, and transferrin in the tested concentration. A detectable interference was observed with maltose at concentrations of 10.5 mmol/l and 5 mmol/l. With 5 mmol/l maltose, the observed increase in the osmotic pressure signal amounted to ~9 % (10.5 mmol/l: ~17 %). However, such maltose concentrations are unlikely to be seen in the interstitial fluid under physiological conditions in human subjects.

Fig.1: Pictures of the laboratory working pressure cell chamber

Fig.2: Addition of mannose in a concentration of 100 µM did not influence the sensor signal

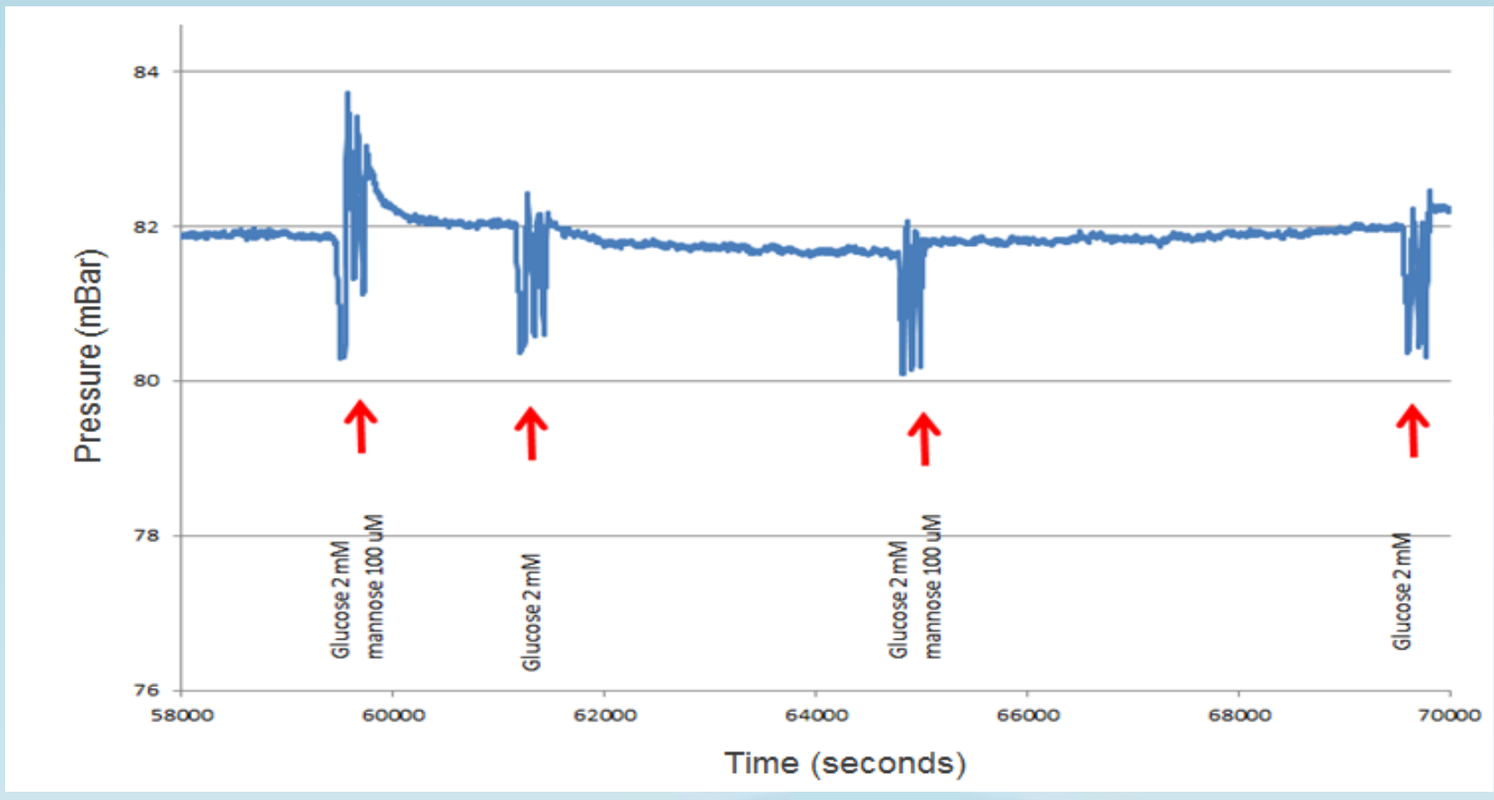
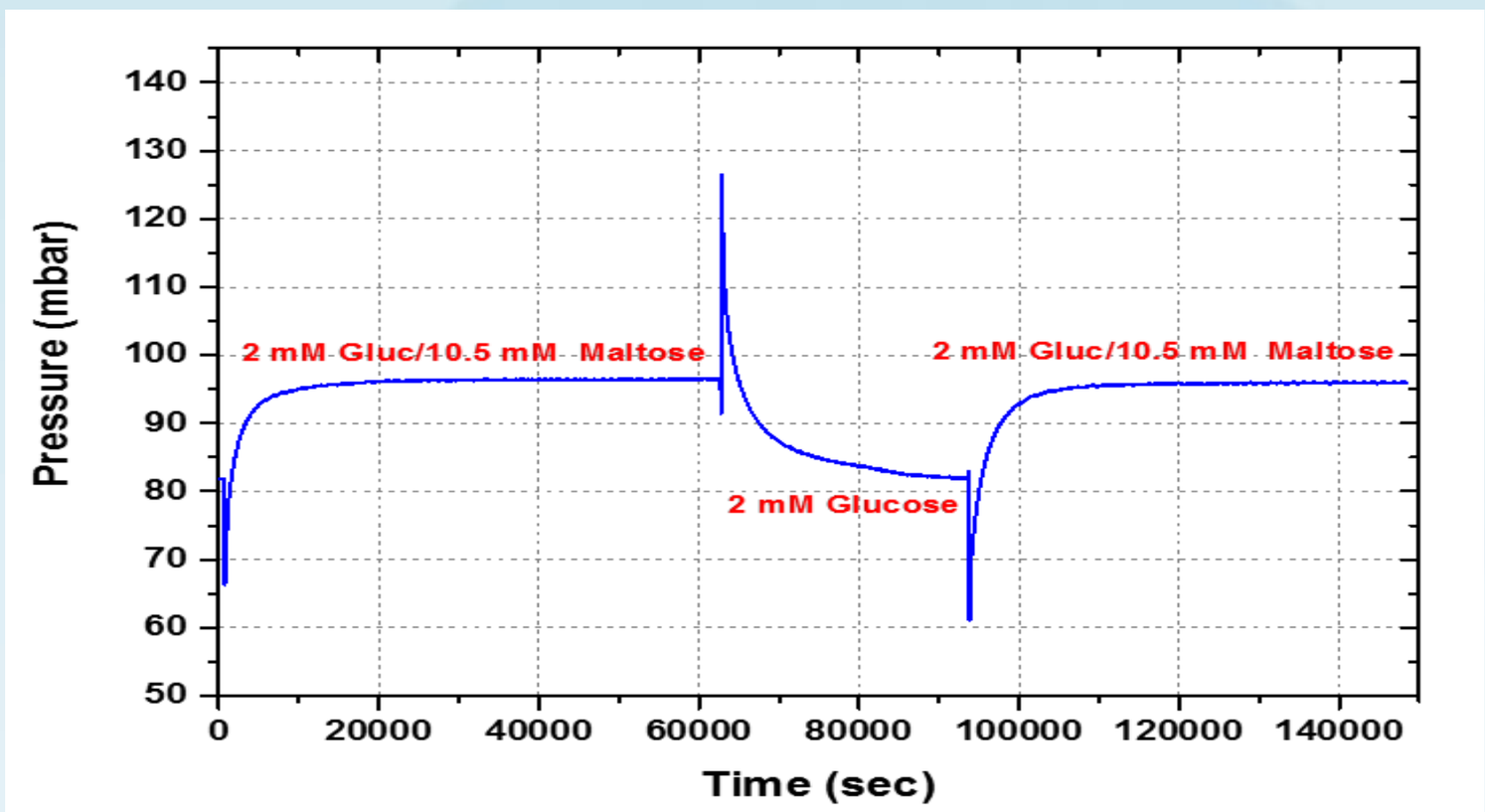


Fig.3: Addition of 10.5 mM maltose had an additive effect to glucose on the sensor signal



Conclusions

The results of our pilot experiments show that the osmotic sensor technology employing the competitive binding of glucose to Concanvalin A vs. dextrane in a core sensor chamber is not influenced by the majority of the tested potentially interfering carbohydrate molecules. The only interfering carbohydrate was maltose in high supra-physiological concentrations. Further tests with the final sensor product will have to confirm these results in a clinical or laboratory setting.

Pfützner Science & Health Institute, Diabetes Center and Practice, Parcusstr. 8, 55116 Mainz, Germany, Tel: +49 6131 5884640, Fax: +49 6131 5884644, www.pfuetzner-mainz.com