Name(s)	Project Number
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Project Title

Dealing with Diabetes: Building an Artificial Pancreas Model

Abstract

Objectives/Goals

The objective is to design, build, and test a model of an artificial pancreas to investigate the challenges of getting such a device to work and to examine how accurate the model is compared to an ideal model.

Methods/Materials

I built an artificial pancreas model which I tested with 3 acidic solutions vinegar, powerade and lemonade to mimic #Insulin# and a base solution of baking soda to neutralize acidic solution. I used different electronic components and a conductance sensor for the pump to detect the acidity in the solution. Firstly, I calculated how much baking soda needed for the base. Then, I pumped the base solution in to the 3 acidic solutions at different trials to neutralize them. Afterwards, I measured how much baking soda I had left and compared with ideal of 100mL. I recorded my results and found out that my model is very accurate as an artificial pancreas

Results

After running 3 trials with different Acid Solutions, my results came close to ideal remaining solution level of 100mL.

Result for Vinegar solution neutralizing with Baking soda came around 115mL and pH scale around 0.99 and difference is 0.0061 ~ 0.07 from the ideal case.

Result for Powerade solution neutralizing with Baking soda came around 78mL and pH scale around 2.47 and difference is -0.108 ~0.11 from the ideal case.

Result for Lemonade solution neutralizing with Baking soda came around 138mL and pH scale around 1.63 and difference is 0.13 from the ideal case.

Conclusions/Discussion

After observing all data points and my results, my artificial pancreas model works very accurately. The accuracy also depends what kind of acid + base solution is used to neutralize the solution. In all 3 trials, it came very close to ideal case. The ideal case is 100mL of baking sodas solution remaining after being neutralized with the acidic solution. I had 115ml left for the first try, 78ml for the 2nd try, and 138 ml for the 3rd try. Even though there were not exactly 100ml of baking soda left, my results are very close to the ideal in Log scale. My model will pave the way for finding the cost effective artificial pancreas device that any type I diabetic patient can use. The Cost of my model was $39 and could be used to develop a low cost device compared to a real artificial pancreas which is about $7000

Summary Statement

To design, build, and test an artificial pancreas model and examine the accuracy of the model

Help Received

From my father Sajjad Ibrahim