DIY flow heat reactor for protein nanoparticle synthesis

Intro

Results

**Hardware setup**

The system consists of 3 principal parts: heating module, cooling module and a pumping unit.

Pumping can be achieved using any commercially available pump. The requirements are (1)   
Pumping was achieved using difference in height of sample reservoir and system outlet. The unit delivers reaction mixture successively through the heating module and cooling module to the collection tube. Flow rate determines the time the mixture resides in the heating module, and thus contributes to the size control of resulting nanoparticles.

Heating module consists of a flat aluminum tube housing, sandwiched between two heating tables. The tables are powered with 24V voltage supply and controlled with Arduino Nano board through MOSFET transistors. The board is programmed to reach and hold preset temperature (30~95C) via PID regulator. Temperature is measured with two DS18B20 sensors, located in the middle and on the edge of tube housing.

Plastic heat insulation and metal tube housing together provide even and reproducible heating of the reaction mixture.

After the heating liquid travels along aluminum radiator cooled down by Peltier element. The distance along the radiator and power supplied to the Peltier element are optimized so as to obtain liquid temperature at the outlet of the system below 20C.

Synthesis of protein nanoparticles via heating is a kinetic process with characteristic times of the order of minutes. For gaining precise control over resulting nanoparticles physiochemical properties, it is essential to accurately regulate duration of the reaction, minimizing transitional processes. We investigated temperature distribution along the tube using IR imaging. Solution of a dye was pumped through the system for 10 minutes to achieve a steady state. Next, upper cover was quickly removed and the tube was imaged using FLIR camera and further analyzed with ImageJ software.

**BSA nanoparticles synthesis**

Discussion

Рисунки

Тезисы

Введение

наночастицы хороши для опухолей

В последнее время наночастицы активно разиваются material science

Это происходит из за свойств таких как бла бла

Или начать с методов синтеза

Несколько вариантов, на одном экране, увидеть стратегию

Discusion

Что может позволить

Limitations

Автоматизация

Conclusion необычный

Та же автоматизация замкнутый цикл синтеза

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