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 peristaltic pump.

Peristaltic pump 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.

Heating module consists of a flat aluminum tube housing, sandwiched between two heating tables. The tables are powered with 12V voltage supply and controlled with Arduino Nano board via MOSFET transistors. The board is programmed to reach and hold preset temperature (30~120C) 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 heating of the reaction mixture. The uniformity is monitored by the difference between the two sensors and is reaches no more than 0.2C at 70C and 1C at 120C.

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. For these reasons, cooling module is used, as it accounts for rapid and reproducible reaction quenching.

**BSA nanoparticles synthesis**

Discussion