Actuation force determination for different medical syringes

EQUIPEMENT

| TX-700 | Syringes test bench | Software (optional) |

A small cup is used to collect water from the syringes.

Compression speed: 2mm/s
Compression distance: variable
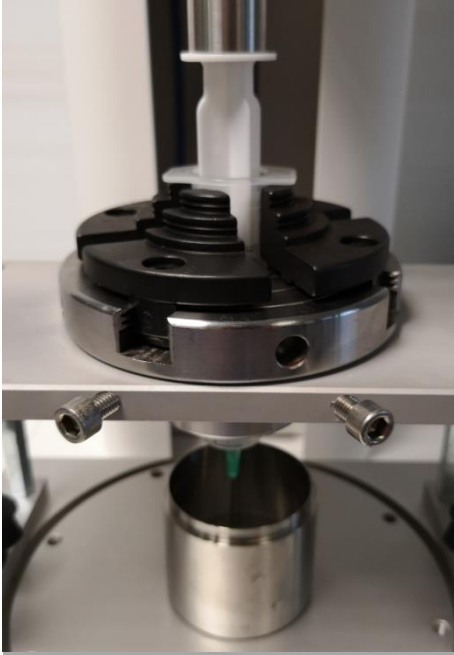Detection level: 0.1N

USE

The compression test used allows us to assess the actuation force needed to push liquid outside the syringe. Thanks to the adjustable workbench, it can be used for syringes with a diameter between 0.9cm and 2.9cm in diameter.

METHOD

For this test, 4 different syringes from the same manufacturer are used (5mL, 10mL, 20mL and a special for insulin). The syringes are placed inside the workbench. Syringes are filled to the maximum with water to simulate an injectable liquid. A 20mm cylindrical probe is used to mimic the pressure of the finger on the plunger. The plunger is compressed all along the syringe body.

The special insulin syringes are very small. Therefore, they only require around 0.4N to be activated. So they are very easy to manipulate for everyone. The TX-700 is able to assess this kind of comportment.

20mL syringe during bench with needle

Insuline Syringes
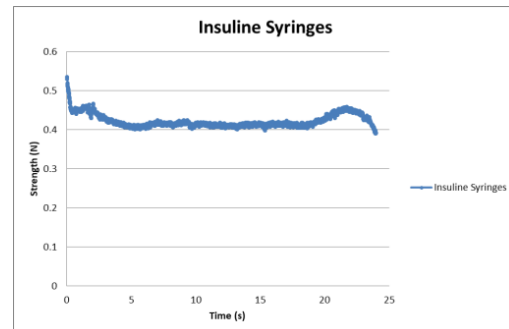
RESULTS

The determination of the actuation force via a compression test allows us to characterize the response of the syringes toward pushing.

In this case, the maximal strength (F_{max}) can be correlated to the actuation force needed to push liquid through the syringe. As expected the presence of a small diameter needle (0.9mm) (red curve) at the end of the syringe increases the needed actuation force needed compared to syringes without needles (blue curve).

We can observe that, except for the 5mL syringe without needle, the others are quite linear all along the push. The final bump is due to the lack of volume inside the syringe when the plunger arrives at the end of its course.

We can see that there is no significant difference of comportment between the 10mL and the 20ml syringes when the needle is on (around 9N).

A linear course during injection is the guarantee of precision.

Using the TX-700 and the syringe test bench, we are able to verify the characteristics of the products.

5 mL

10 mL

20 mL