**Manual Microsyringe Pump (MMP)**

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**Setting up:**

1. Assembling of the parts of the syringe pump is important. The parts are delicate and should be handled carefully during assembling. This procedure is described explicitly in the manual with the MMP.
2. The removal of the air bubbles is most significant for an increased performance of the syringe pump. The response time of the MMP and its precision while using the small injection volumes is related to the maximum removal of the air bubbles.
3. The 4 way stopcock is attached to the microsyringe, the 10ml syringe and the Teflon tubing.
4. Make sure to fill the microsyringe and the 10ml syringe before connecting to the stopcock. Also, fill the luer tips of the stopcock before connection. This allows minimum bubble formation.
5. The 10ml syringe is attached at one end of the side luer of the stopcock. The liquid is pushed through it to keep the valves of the stopcock filled with liquid to avoid any bubble formation.
6. The microsyringe should be held in position with the mount bracket and the non moveable end of the syringe should be kept in place on the syringe mount.
7. The three arrows on the stopcock show the direction of the liquid flow through it while blocking the flow on the other end.

**Operating the MMP:**

1. The MMP operation is divided into 3 different parts:
    a. The micrometer
    b. The microsyringe along the 4-way stopcock.
    c. Teflon tubing attached to the pipette holder.
2. First, the stopcock should block the flow in the Teflon tubing while allowing the liquid to flow from the 10ml syringe to fill the valves.
3. Second, block the flow from the 10ml syringe and open the valves for the flow from the microsyringe to the tubing.
4. The microsyringe is operated with the help of the micrometer. The micrometer has a resolution of 10 microns per division 500 micrometers per revolution. This helps to determine the total volume pumped through it.
5. The liquid pumped through the microsyringe passes through the Teflon tubing to the pipette holder. The pipette holder fits a glass pipette of 1.0 to 1.5mm OD pipettes.
6. While using the pipette holder care should be taken for inserting the glass pipette through the gasket. There is a tendency for the glass pipette to break while insertion. In such a case the pipette coupling tube should be disassembled and remove the gasket without breaking it.
7. The removal of the dead volume which can trap the air is also significant. In such a case the pipette holder can be disassembled. The coupling tube can be filled with the liquid and then reassembled.

Cleaning the MMP:

1. The syringe pump should be flushed out by removing liquid in each part of the pump.
2. The glass pipette should be disposed without breaking it in the pipette holder.
3. The extra gaskets for the coupling tube are also provided which can be replaced in case of breaking it while using the glass pipette.

**Calculation:**

Determination of the Total Volume pumped:

The micrometer advances 10 microns/division and 500 microns/turn. Measure the total distance traveled of the syringe with the calipers. Divide the total volume by the measured volume. Multiply this figure by the constants above to get nL/division and per turn.