ORAL VACCINE DELIVERY SYSTEM

Modifying an inhaler to administer painless vaccines

INTRODUCTION

Reinventing the vaccine delivery method: making it quick, effortless, and painless. The only comfortable, non-invasive method that can also be self-administered.

Our inhaler addresses the problem of the fear of needles, which is the main cause why hundreds of thousands of Americans do not get vaccinated. Simultaneously, our inhaler generates less waste and causes fewer accidental injuries

Oral inhalable vaccines are as effective as any other type of vaccines. In fact, many vaccines already have an oral inhalable counterparts, especially vaccines against respiratory diseases like the flu

Financially accessible to the general public with an expected cost of $50.00. And an expected profit of $7.50 per device

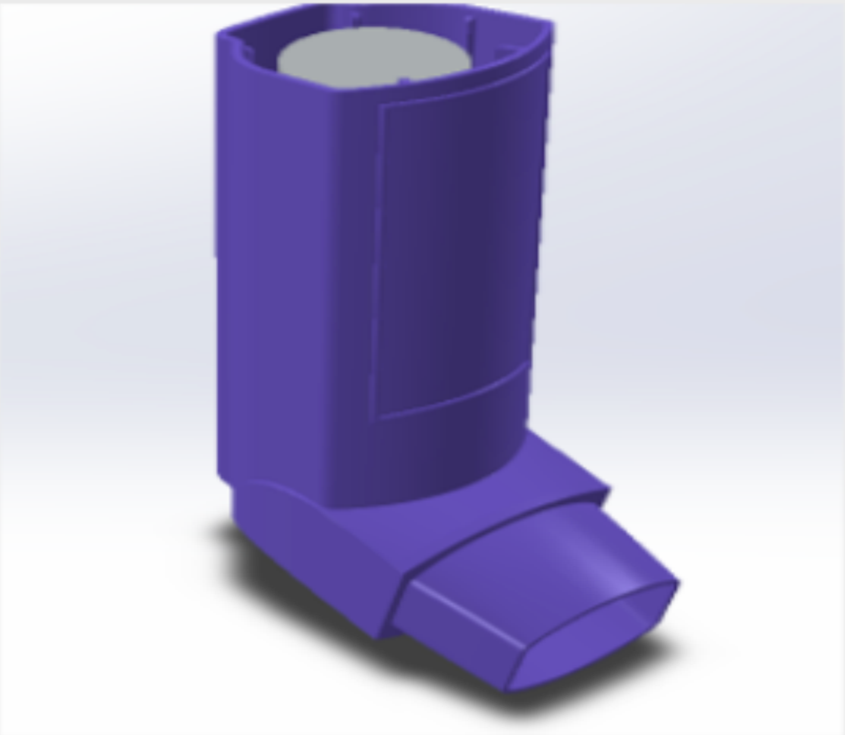
We believe our design could be potentially very useful for mass vaccination campaigns and even disease eradication because a single canister can contain multiple doses of the vaccine and it is extremely quick to perform the immunization

CANISTER MODEL

The team began working on this model by making the assumption that it would be most likely to burst in the radial direction and could therefore be treated like a pipe. As such, Barlow's Formula was used to calculate a bursting pressure of 335 atm, meaning that any pressure less than this would be unable to burst or permanently deform the canister.

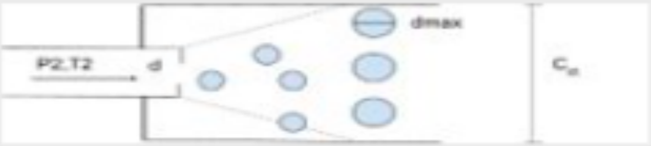
Additional simulations were conducted in COMSOL to confirm that the canister would be safe to use, and once this was proven true by the stress profile, the team moved forward with measuring the changes in internal pressure and volumetric flow rate as each of the 15 doses were administered. As expected, these tests confirm that the canister can safely and effectively administer all 15 doses without suffering a significant decrease in performance.

Oregon State University



DROPLET SIZE

- As can be seen in the figure to the right, the ideal droplet size to ensure enough drug is adsorbed is about 1-10 microns, which is also small enough to carry the viral components to the respiratory tract.
- Using an objective of 4x and a magnification of 10x, the diameter of the field of view is 4 mm. The droplets can be estimated to be approximately 10 microns, which is reasonably close to our desired size of 5 microns
- The nozzle size and the propellant ensure that the droplets are consistent and dispersed for each dose.



SHELL AND ACTUATOR

- The actuator is integrated into the shell which reduces manufacturing costs and reduces the risk for potential damage that could be done to the actuator.
- The shell has a comfortable curvature to fit to the user's hand and reduce the risk of injury.
- The canister plugs into the actuator inside of the shell and the vaccine is delivered when the canister is pressed down into the actuator.

- The specification of the shell are described below:
  - 80mm in height
  - 28mm in diameter
  - 3mm in thickness
- The nozzle size is approximately 0.3mm.
- The shell is made of a cellulose based polymer that provides stability and protection for the other components.

- The actuator works as an effervescent atomizer that disperses the droplets of the vaccine and propellant mixture.
- The Hydrofluoroalkane (HFA) propellant will allow the actuator to deploy the appropriate size droplets.
- A live-attenuated virus will be in a solution including sucrose, dipotassium phosphate, potassium dihydrogen phosphate, gelatin (porcine, Type A), arginine hydrochloride, monosodium glutamate monohydrate, and water.