Convection Enhanced Delivery Brain Phantom Gel by Agnes Arrinda | Kacie Kaile | Glen Saunders | Jose Garduno | Nashra Phanor

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Methods for Convection Enhanced Delivery (CED) of pharmaceuticals directly into brain tissue need to be verified for market approval. Current in-vitro testing is conducted on hydrogels that commonly results in mechanical failure and compromises data. In order to design a new hydrogel capable of providing desired results, a model that relates monomer properties to overall brittle fracture strength within hydrogels was developed. Known hydrogel materials were examined individually for their ability to improve the hydrogel fracture, and to observe the general trend of fracture mechanics. Two important monomer features were found from the model: smaller Van der Waals volume and longer backbone length increase gel strength. Poly-ethylene glycol (PEG) hydrogels were found optimal since it can yield up to an 87% increase in fracture strength compared to the standard gel (agarose). The team is currently working on optimizing the preparation procedure. UV methods will be employed to photocrosslink the gel in an easy to prepare manner with varying low concentrations (~0.5%-4%) and varying crosslinking percentages (~2%-20%). Initial results on PEG testing using a CED infusion system show improved characteristics of the gel in terms of mechanical failure. The analysis is based on the shape of the infusion cloud: a spherical infusion cloud indicates no significant cracking. The infusion cloud is affected by the catheter insertion rate and the infusion rate so these two variables were changed across the trials. PEG did not show significant cracking at rates in which agarose had shown catastrophic failures. Another variable that will be analyzed to understand the effectiveness of the hydrogel is the ratio of volume delivered to volume infused but this is still in the process of being analyzed. A more efficient brain phantom can lead to optimized CED systems and a reduction in time and money spent on the testing phase.