Mobile In-Vitro Neurovascular Cast System

Agarose Gel Analytical Analyses III Memo

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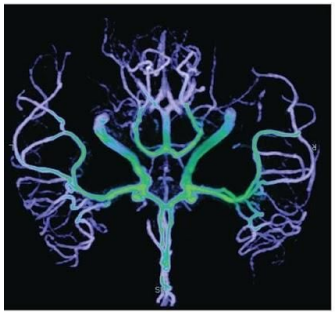

Mobile In-Vitro Neurovascular Cast System

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Introduction

The in vitro model of the circle of willis our team is designing and manufacturing will require a support material which will assist in vessel compliance. More specifically, the compliance related to moving within the skull, where space is limited and so is movement. One solution to this is to suspend the circle in a hydrogel which closely mimics brain density. The hydrogel examined here is Agarose gel.

About The Material

Agarose gel is commonly used in biochemistry for electrophoresis, the separation of DNA strands. The molecular structure of Agarose is shown if figure 1 below. To create the gel, mix the Agarose powered with a buffer. To make .1% Agarose gel, the mixture is .1g with 100ml of the buffer solution. Once the gel has been formed it is clear and closely matches the density of the brain. The analysis performed was to determine at what percentage the gel most closely matches the density of the brain. The specific gravity of the brain has been found to be 1.045 ±0.014. Which means that the density is roughly 1.04291 ±0.014 g/ml.

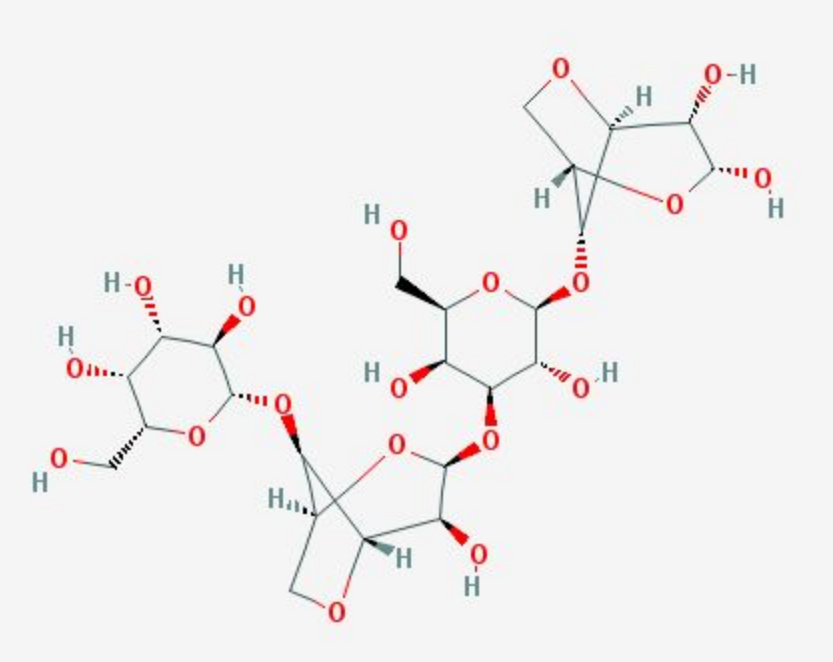

Figure 1 - Molecular Structure of Agarose

Analysis

The analysis used the rule of mixing to determine the density of the mixture. Eq. (1) below shows the equation used to solve for the density.

$$\rho_{mix} = (\rho_{buffer} \times buffer\%) + (\rho_{Agarose} \times Agarose\%) \quad (1)$$

Table 1 below shows the calculations performed for each Agarose percentage.

Table 1 - Calculation Table with Gel Density and Percent Difference

Percent Agarose	Percent TBE	Gel Density	Percent Difference
0.01%	99.99%	1.070057	2.60%
0.02%	99.98%	1.070114	2.61%
0.03%	99.97%	1.070171	2.61%
0.04%	99.96%	1.070228	2.62%
0.05%	99.95%	1.070285	2.62%
0.06%	99.94%	1.070342	2.63%
0.07%	99.93%	1.070399	2.64%
0.08%	99.92%	1.070456	2.64%
0.09%	99.91%	1.070513	2.65%
0.10%	99.90%	1.07057	2.65%
0.11%	99.89%	1.070627	2.66%
0.12%	99.88%	1.070684	2.66%
0.13%	99.87%	1.070741	2.67%
0.14%	99.86%	1.070798	2.67%
0.15%	99.85%	1.070855	2.68%
0.16%	99.84%	1.070912	2.68%
0.17%	99.83%	1.070969	2.69%
0.18%	99.82%	1.071026	2.70%
0.19%	99.81%	1.071083	2.70%
0.20%	99.80%	1.07114	2.71%

Table 1 also shows the percent difference between the gel density and the density of the brain. The percent difference calculation did not take into account the variation in brain densities so the difference can be assumed to be smaller. Looking at the calculations it appear that 0.01% agarose gel most closely matches the density of the brain. Table 1 also shows the differences between mixture compositions are extremely small and any of the mixtures should model the brain well. When the deviation in brain density is taken into account the percent differences drop to less than 1.5% for all of the values.

Conclusions

The analysis shows that any mixture up to .2% Agarose has a density extremely close to that of the brain and should provide excellent vessel support and compliance. When considering that

all of them match closely any of them could be used, however, the 0.01% Agarose gel matches more closely and should be used as the vessel support material.

Works Cited

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