Simultaneous Chromatography and Electrophoresis: Apparatus Design and Development
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Introduction
Since the era of "-omics", the need for more efficient and powerful separation of biological molecules in complex mixtures has been on the rise. Repeatable two-dimensional separations of amino acids, vitamins, and dyes have been performed on thin layer chromatography (TLC) plates using the novel technique of simultaneous chromatography and electrophoresis (SCE). Past apparatus designs relied on modified TLC plates and capillary action to run separations (Figure 1); the new apparatus injects the mobile phase via syringe pump (Figures 2 and 3) which introduces a number of benefits and new complications.

Current work has been focused on improving the chromatographic separation by generating a uniform solvent front. This work focuses on efforts to optimize parameters affecting flow, flow rate, seal, and applied pressure.

Results and Discussion

Key Findings
- The malleability of the seal affects the uniformity of the solvent front (Figures 4-8).
- @Silly Putty seals formed to the size of the TLC plate and produced the most uniform solvent fronts (Figures 4 and 7).
- Solvent channels began to form in the @Silly Putty seals (Figure 4) due to the pressure of the system.
- The results suggest that uniform pressure application may improve solvent front uniformity (Figure 9).

Materials
- @Silly Putty
- Plumber’s Putty
- Toilet bowl wax
- C-clamps

Methods
- Filled O-ring groove and electrode channels with putty
- Compressed putty with clamps
- Applied plates and fastened clamps
- Filled tubes with solution before connecting to apparatus
- Set flow rate and began run

Conclusions
Based upon key findings, SCE solvent front uniformity and chromatographic separations may be improved by the quality of the seal as well as the uniformity of the pressure application. Current and future work consists of the design of a new apparatus that will improve chromatographic separations by minimizing the need for putty seals and improving the application of uniform pressure.

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