



# Development of a ternary mobile phase in thin layer chromatography testing for distinctions between hemp and marijuana

Kaitlyn Lovell, Sara Selvidge, Courtney LaPointe, Dr. Jeffrey Boles  
Tennessee Technological University, Cookeville, TN 38505



## Introduction

Tetrahydrocannabinol (THC, marijuana) is considered a Schedule I drug by the United States Drug Enforcement Agency (DEA) (1). Some states have legalized this drug for personal, recreational, and medicinal use. The partial legality of the drug has led to problems for law enforcement. Previous presumptive testing used in the field can be faulty and there is a need for improvement to distinguish between Cannabis and other related substances. A simple and efficient presumptive testing kit using thin layer chromatography has been assembled. This kit provides qualitative evidence that differentiates between hemp and marijuana. The objective is to create a ternary mobile phase by adding new solvents to the current mobile phase to reduce the acid streaking on the TLC plates and improve the distinction between these two components. The solvents being added are based on polarity (2). These additives include very polar, moderately polar, and nonpolar compounds. The reduction of the streaks will create clearer results that will be useful to officers in the field in making more accurate arrests.

## Methods

The original mobile phase is 70:30 v/v Chloroform: 1,2 dichloroethane. To make the ternary mobile phases the ratio was scaled down to 63:27:10 v/v. The nonpolar, polar, and moderately polar compounds were then added to the original mobile phase solution. Three trials were run for each solvent

- Pipet 0.3mL of the mobile phase into vial one
- Pipet 1.0mL of the mobile phase into vial two
- Pipet 0.6mL of the stain in vial three
- Roughly ~1.0mL of the plant material should be put in vial one then shaken
- Use the yellow pipette to transfer the solution in vial one onto the stationary phase
- Use tweezers and place the stationary phase into vial two and leave for 90 seconds
- Take the stationary phase out and leave undisturbed for an additional 60 seconds
- Put the stationary phase into the third vial and shake until the strip is colored
- Take out the strip and allow to develop with the colored side face up



Figure 1 is an example of marijuana (left) and hemp (right) stained on TLC plates from the current mobile phase including streaking

Figure 2 (on left) and Figure 3 (on right) display differentiation between hemp and marijuana from a very polar solvent (acetone) and a moderately polar solvent (acetonitrile)

Figure 2 (acetone)



Figure 3 (acetonitrile)

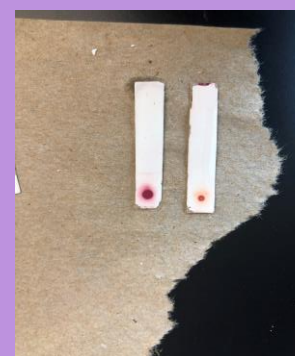


Figure 4 (hexane)



Figure 5 (petroleum ether)

Figure 4 (left) and Figure 5 (right) both show effects from nonpolar solvents

## Results

Figure 1 shows how the hemp and marijuana stain are affected by the original mobile phase containing only chloroform and 1,2 dichloroethane. There is some noticeable streaking on the TLC plates. Figures 2,3,4 and 5 are observed to have little to no effect on the staining. The lack of stain movement down the TLC plates shows that the ternary mobile phases did not interact with the cannabinoids and acids the way they had been anticipated.

## Conclusion

From this research, it can be concluded that the original mobile phase gives the best results. With the modified mobile phases, the extractant did not seem to travel up the stationary phase with the mobile phase. The goal was to reduce streaking; however, the cannabinoids still need to be separated up the plate for the clearest results. The ternary mobile phases tested in this experiment did not give better results when compared to the original chloroform: 1,2 dichloroethane 70:30 v/v mobile phase.

## References

- (1). Drug Scheduling <https://www.dea.gov/drug-scheduling> (Accessed March 30, 2021).
- (2). Franz, K.; Shea, K.; *5.301 Chemistry Laboratory Techniques*; Massachusetts Institute of Technology; **2013**, 56-57
- (3). Galand, N.; Pothier, J.; Ernouf, D.; Montigny, F.; Dollet, J. Separation and Identification of Cannabis Components by Different Planar Chromatography Techniques. *Journal of Chromatographic Science* **2004**, 5–6.
- (4). Galand, N.; Pothier, J.; Viel, C. Plant Drug Analysis by Planar Chromatography. *Journal of Chromatographic Science* **2002**, vol 40, 10–11.

## Acknowledgements

Special thanks to Dr. Amanda Carroll's research class for allowing the opportunity to work with faculty. We also thank Courtney LaPointe for her help and production on the kit. TN Department of Agriculture (hemp samples) and TBI forensic lab (marijuana samples.)