



CALIFORNIA STATE SCIENCE FAIR  
2005 PROJECT SUMMARY

<b>Name(s)</b> Amber I. Hess	<b>Project Number</b> <b>S0505</b>
<b>Project Title</b> <b>Digitally-Enhanced Thin-Layer Chromatography: An Inexpensive New Technique for Qualitative and Quantitative Analysis</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Thin-layer chromatography (TLC) is a widely used method for qualitative analysis to determine the number of components in a mixture, to determine the identity of two substances, or to monitor the progress of a reaction. The more accurate high-performance TLC (HPTLC) is better suited for quantitative analysis. Unfortunately, HPTLC requires expensive equipment which most high schools and colleges cannot afford.</p> <p>I demonstrate that if digital photography is combined with regular TLC, it can perform highly improved qualitative analysis as well as make accurate quantitative analysis possible.</p> <p><b>Methods/Materials</b> This novel, "digitally-enhanced" TLC (DE TLC) is very easy to use. A fluorescent TLC plate is illuminated with UV light and a picture of the plate is taken with a digital camera. Then, on a computer, using either TLC Analyzer, the public domain software I wrote, or common photo-editing software, one can quickly produce multi-spectral scans, densitograms, and calibration curves--output previously available only from more expensive equipment or complex procedures.</p> <p><b>Results</b> With high linearity (<math>R^2 \sim 0.97 - 0.99</math>), good repeatability (<math>RSD &lt; 5\%</math>), and detection limits approaching those of HPTLC, DE TLC produces surprisingly good results for such inexpensive equipment.</p> <p><b>Conclusions/Discussion</b> Digitally-Enhanced TLC is a valuable tool that can be added to every chemist's TLC toolbox. Since this technique is much less expensive than other quantitative chromatographic methods, DE TLC is ideal for high school and college labs.</p>	
<b>Summary Statement</b> I developed an inexpensive technique using digital photography that is an alternative to a \$30,000 piece of equipment for chemical analysis.	
<b>Help Received</b> Dr. Kimberley Cousins gave advice by email when needed. Dr. Armando Galindo lent some of his equipment.	