

## TLC Visualization Laboratory Data Guide

Visualizing Method	Functional/Structural Groups Detected	Concentration/Formulation/Specs	Development Techniques and Storage Suggestions	
UV	Aryls, conjugated systems, chromophore-containing molecules	• N/A	• If toluene used to develop, dry with heat gun before visualizing	
Iodine-sand mixture	Alcohols, unsaturated compounds, and general reagents	• 25 g of sand/silica or sand layer (6 mm deep) • 0.5 g of iodine	• Make sure TLC is dry before visualizing • Shake the visualizing chamber charged with sand/silica and iodine to mix evenly before adding TLC plate • Can also shake the chamber with the TLC plate inside so the I <sub>2</sub> -saturated sand/silica touches the plate and develops more rapidly • Produces brown or dark purple spots	
Phosphomolybdic acid (PMA)	Alcohols and general reagents	• Range of 10-40% solution of PMA in ethanol	• Submerge in solution • TLC plate turns to light green • TLC plate must be heat-dried (ca. 60° C) after PMA application to visualize • TLC plate turns to light yellow and spots of analyzed materials (reactants and products) will turn to dark green spots	
Sulfuric acid vapor/spray	Alcohols, amines, and general reagents	• 1:1 mixture of conc. H <sub>2</sub> SO <sub>4</sub> and water	• Heat if necessary • Produces black spots on beige background	
Potassium permanganate solution	Alcohols, aldehydes, amines, sulfides, or unsaturated compounds	• 1.5 g KMnO <sub>4</sub> • 10 g K <sub>2</sub> CO <sub>3</sub> • 1.25 mL 10% aq NaOH • 200 mL water	• Apply gentle heat if necessary • Should circle spots after visualization, as background darkens over time • Produces yellow or light brown spots on pink to purple background	
Cerium-ammonium-molybdate	General reagents	• 0.2 g Ce <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> • 5 g (NH <sub>4</sub> ) <sub>2</sub> MoO <sub>4</sub> • 100 mL 5% aq H <sub>2</sub> SO <sub>4</sub>	• Need to heat to visualize blue-black spots	
Anisaldehyde	Nucleophilic groups and general reagents	• 15 g anisaldehyde • 250 mL EtOH • 2.5 to 5 mL conc. H <sub>2</sub> SO <sub>4</sub> (add slowly) • (optional) 1 to 2 mL AcOH (good for visualizing terpenes)	• Store solution in the refrigerator • Light and oxidation sensitive • Heating produces a range of colored spots on pink background • Can use different colored spots to distinguish multiple compounds with similar R <sub>f</sub> value	
Ninhydrin	Primary and secondary amines, amino sugars, and amino acids	• 5 g ninhydrin • 150 mL EtOH	OR • 0.3 to 1.5 g ninhydrin • 100 mL <i>n</i> -BuOH • 3 mL AcOH	• Produces blue spots • Boc-amines and secondary amines may require heating to visualize
2,4-Dinitrophenylhydrazine (DNPH)	Aldehydes and ketones	• 3 g DNPH • 750 mL 2M HCl	OR • 12 g DNPH • 60 mL conc. H <sub>2</sub> SO <sub>4</sub> • 80 mL water • 200 mL EtOH	• Produces yellow to red spots on orange background without heating
Dragendorff Reagent	Amines, phosphines, and basic nitrogen-containing heterocycles	<b>Solution A:</b> • 1.7 g Bi(NO <sub>3</sub> ) <sub>3</sub> • 20 mL AcOH • 80 mL water	<b>Solution B:</b> • 40 g KI • 100 mL water	• Combine two solutions before use • Solution A and Solution B can be stored separately for about 1 week with refrigeration • Produces brown-orange spots without heating
Vanillin	Alcohols, amines, carbonyls, and general reagents	• 15 g vanillin • 250 mL EtOH • 2.5 mL conc. H <sub>2</sub> SO <sub>4</sub>		• Heating produces colored spots on pink/beige background
Iron(III) chloride solution	Phenols and enolizable products	• 1% (w/w) solution FeCl <sub>3</sub> in water	OR • 1% (w/v) solution FeCl <sub>3</sub> in 50% aq MeOH	• Produces colored spots
Cerium(IV) sulfate solution	General reagents	• Saturated solution of Ce(SO <sub>4</sub> ) <sub>2</sub> in 15% aq H <sub>2</sub> SO <sub>4</sub>		• Need to heat to visualize a range of colored spots
Bromocresol green	Carboxylic acids	• 0.04 g bromocresol green • 100 mL EtOH • Add 0.1 M aq NaOH dropwise until blue color just appears		• Produces yellow spots on a blue background, usually without heating

## Aldrich® Chemistry Reagents to Formulate TLC Dips

Reagents	Purity/Grade	Cat. No.
<b>Iodine-sand mixture</b>		
Sand	50-70 mesh particle size	274739
Iodine	ACS reagent, ≥99.8%, solid	207772
<b>Phosphomolybdic acid (PMA) solution</b>		
Phosphomolybdic acid solution	20 wt. % in ethanol	319279
Phosphomolybdic acid solution	Spray reagent, 10% in ethanol	P4869
Phosphomolybdic acid hydrate	ACS reagent	221856
Ethanol	ACS reagent, ≥99.5% (200 proof), absolute	459844
<b>Sulfuric acid vapor/spray</b>		
Sulfuric acid	ACS reagent, 95.0-98.0%	320501
<b>Potassium permanganate solution</b>		
Potassium permanganate	ACS reagent, ≥99.0%	223468
Potassium carbonate	ACS reagent, ≥99.0%	209619
Sodium hydroxide	ACS reagent, ≥97.0%, pellets	221465
<b>Cerium-ammonium-molybdate solution</b>		
Cerium(III) sulfate	97%	307688
Ammonium molybdate	99.98% trace metals basis	277908
Sulfuric acid	ACS reagent, 95.0-98.0%	320501
<b>Anisaldehyde solution</b>		
Anisaldehyde solution		SRA1
<i>p</i> -Anisaldehyde	98%	A88107
Ethanol	ACS reagent, ≥99.5% (200 proof), absolute	459844
Sulfuric acid	ACS reagent, 95.0-98.0%	320501
Acetic acid	ACS reagent, ≥99.7%	320099
<b>Ninhydrin solution</b>		
Ninhydrin	ACS reagent	151173
Ethanol	ACS reagent, ≥99.5% (200 proof), absolute	459844
Ninhydrin	ACS reagent	151173
1-Butanol	ACS reagent, ≥99.4%	360465
Acetic acid	ACS reagent, ≥99.7%	320099

Reagents	Purity/Grade	Cat. No.
<b>2,4-Dinitrophenylhydrazine (DNPH) solution</b>		
2,4-Dinitrophenylhydrazine	Reagent grade, 97%	D199303
Hydrochloric acid	ACS reagent, 37%	320331
2,4-Dinitrophenylhydrazine	Reagent grade, 97%	D199303
Sulfuric acid	ACS reagent, 95.0-98.0%	320501
Ethanol	ACS reagent, ≥99.5% (200 proof), absolute	459844
<b>Dragendorff reagent</b>		
Bismuth(III) nitrate pentahydrate	ACS reagent, ≥98.0%	383074
Acetic acid	ACS reagent, ≥99.7%	320099
Potassium iodide	Puriss. p.a., ACS reagent, ≥99.0%	60400
<b>Vanillin solution</b>		
Vanillin	ReagentPlus®, 99%	V1104
Ethanol	ACS reagent, ≥99.5% (200 proof), absolute	459844
Sulfuric acid	ACS reagent, 95.0-98.0%	320501
<b>Iron(III) chloride solution</b>		
Iron(III) chloride	Reagent grade, 97%	157740
Methanol	Puriss. p.a., ACS reagent, reag. ISO, reag. Ph. Eur., ≥99.8%	32213
<b>Cerium(IV) sulfate solution</b>		
Cerium(IV) sulfate		359009
Sulfuric acid	ACS reagent, 95.0-98.0%	320501
<b>Bromocresol green solution</b>		
Bromocresol green	ACS reagent, dye content 95%	114359
Ethanol	ACS reagent, ≥99.5% (200 proof), absolute	459844
Sodium hydroxide	ACS reagent, ≥97.0%, pellets	221465

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