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Experiment-Based Risk Assessment Form

Name of Department	Chemistry	Location of Lab	S7-04
Name of Laboratory	Advanced Chemistry Teaching Lab	Name of PI (lecturer-in-charge)	Dr. Chng Yong Sheng
Name of Lab Officer	Leng Zhi Jin, Wong Ling Rong	Name of Activity/Experiment	CM5176 GIST (Sem 1) Preparation of Silver NHC Complex

Hazard Identification				Risk Evaluation & Control						
No	Description / Details of Steps in Activity	Hazard(s)	Possible Accident(s) or ill Health, and Persons-at-Risk	Existing Risk Control (Mitigation)	Severity	Likelihood (probability)	Risk Level	Additional Risk Control	Person Responsible	By (Date)
1	Add 20 mmol 2,4,6-trimethylaniline and 10 mmol of glyoxal (40% in water) into 10 ml of methanol in a 25 ml RBF with stir bar.	trimethylaniline: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2			
		trimethylaniline: irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	1	1	1			
		glyoxal: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2			
		glyoxal: irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	1	1	1			
		methanol: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2			
		methanol: flammable	Causes fire	Keep away from open flames/heat sources	2	1	2			
		stirrer: electrical hazard	electrocution	Ensure there are no exposed wires present	2	1	2			
2	Add 0.5 ml HCOOH, formic acid and stir for 2 hr at room temperature with stopper	formic acid: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2			
		formic acid: corrosive	corrosive to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	2	1	2			
3	Filter by suction and wash with (5 ml x 2) cold methanol	Broken glassware from unsecured vacuum flask	Cuts from broken glassware	Clamp buchner flask securely	2	1	2			
		methanol: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2			
		methanol: flammable	Causes fire	Keep away from open flames/heat sources	2	1	2			
4	Dry under low vacuum to obtain N, N'-bis(2,4,6-trimethylphenyl)-1,4-diazabutadiene (AZB)	AZB: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2			
		AZB: irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	2	1	2			
5	Measure 1H NMR of AZB with deuterated chloroform, CDCl ₃ as solvent. Measuring melting point using melting point apparatus.	CDCl ₃ : toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2			
		CDCl ₃ : irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	1	1	1			
		CDCl ₃ : flammable	Causes fire	Keep away from open flames/heat sources	2	1	2			
		Melting point apparatus: electrical hazard	electrocution	Ensure there are no exposed wires present	2	1	2			
		Melting point apparatus: hot surfaces	causes burns	do not touch hot surfaces	2	1	2			
		Melting point tubes: broken glassware	Cuts from broken glassware	Check glassware, use tubes carefully	2	1	2			

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6	Take 5 mmol of AZB, put into 2-neck 250 ml RBF with stir bar and condenser attached. Add 50 ml of ethylacetate. Heat to 70°C using oil bath	AZB: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		AZB: irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	2	1	2		
		ethyl acetate : toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		ethyl acetate : irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	1	1	1		
		ethyl acetate : flammable	Causes fire	Keep away from open flames/heat sources	2	1	2		
		oil bath and hotplate: hot surfaces	Causes burn	Do not touch hot surfaces	2	1	2		
7	Add 5.5 mmol paraformaldehyde	paraformaldehyde: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		paraformaldehyde: corrosive	corrosive to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	2	1	2		
8	Add trimethylchlorosilane, TMSCl in ethyl acetate (5.5 mmol/1 ml) dropwise with vigorous stirring. Heat at 70°C for 3 hr.	TMSCl: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		TMSCl: corrosive	Corrosive to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	2	1	2		
		ethyl acetate : toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		ethyl acetate : irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	1	1	1		
		ethyl acetate : flammable	Causes fire	Keep away from open flames/heat sources	2	1	2		
9	Cool via ice-bath for 20 min, collect the solid via suction filtration and wash with ethyl acetate (5 ml x 2) and dry under low vacuum.	Broken glassware from unsecured vacuum flask	Cuts from broken glassware	Clamp buchner flask securely	2	1	2		
		ethyl acetate: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		ethyl acetate: flammable	Causes fire	Keep away from open flames/heat sources	2	1	2		
10	Dry under low vacuum to obtain 1,3-bis(mesityl)imidazolium chloride (BIC)	BIC: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		BIC: irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	2	1	2		
11	Measure 1H NMR with CDCl ₃ as solvent	CDCl ₃ : toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		CDCl ₃ : irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	1	1	1		
		CDCl ₃ : flammable	Causes fire	Keep away from open flames/heat sources	2	1	2		

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12	Dissolve 1,3-bis(mesityl)imidazolium chloride in 30 ml dichloromethane in a 100 ml dichloromethane.	BIC: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		BIC: irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	2	1	2		
		dichloromethane : toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		dichloromethane : irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	1	1	1		
		dichloromethane : flammable	Causes fire	Keep away from open flames/heat sources	2	1	2		
13	Add 0.8 mmol silver oxide, Ag ₂ O and stir for 3 hrs. Cool reaction to room temperature, Filter the mixture over Celite (diatomaceous earth) by suction filtration.	Ag ₂ O: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		Ag ₂ O: irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	1	1	1		
		Ag ₂ O: oxidizing agent	may cause fires in contact with strong reducing agents	Do not allow contact with strong reducing agents	2	1	2		
		Celite: toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		Celite: irritant	irritant to eyes and skins	Wear gloves, safety glasses, long pants, covered shoes and lab coat	2	1	2		
14	Collect filtrate in 100 ml RBF and remove solvent under rotary evaporator to obtain bis(mesityl)imidazolium silver N-heterocyclic carbene. Measure its ¹ H NMR with CDCl ₃ as solvent	rotary evaporator: electrical hazard	electrocution	Ensure there are no exposed wires present	2	1	2		
		rotary evaporator: evacuated system	Potential implosion risk: cuts from broken glassware.	Inspect all glassware visually, do not use any with cracks	2	1	2		
		CDCl ₃ : toxic	Harmful if swallowed or inhaled	No eating or drinking in lab, use in fume hood	2	1	2		
		CDCl ₃ : irritant	Irritating to eyes and skin	Wear gloves, safety glasses, long pants, covered shoes and lab coat	1	1	1		
		CDCl ₃ : flammable	Causes fire	Keep away from open flames/heat sources	2	1	2		

Conducted By

Name Dr. Chng Yong Sheng

Signature 

Date 1/6/2022

Approved By

Name Assoc Prof Yeo Boon Siang

Signature 

Approval date 1-Jun-22

Next Revision date 31-May-25
(Maximum 3 years)