

NATIONAL UNIVERSITY OF SINGAPORE

Experiment-Based Risk Assessment Form

Name of Department	Chemistry	Location of Lab	S7-04
Name of Laboratory	Advanced Teaching Lab	Name of PI	Dr Foo Maw Lin
Name of LO	Leng Zhi Jing, Dr Wong Ling Rong	Name of Activity/Experiment	GIST: Emulsion Polymerization of Polystyrene

Hazard Identification				Risk Evaluation and Controls						
No	Description/Details of Steps in Activity	Hazards	Possible Accident / Ill Health & Persons-at-Risk	Existing Risk Control (Mitigation)	Severity	Likelihood (Probability)	Risk Level	Additional Risk Control	Person Responsible	By (Date)
1	Adding 37 g purified (distilled) styrene and 1.5 g sodium dodecyl sulfate into a reaction kettle containing 150 mL distilled water.	Chemical hazards: 1. Sodium dodecyl sulfate highly reactive to oxidizing agents and acids. 2. Sodium dodecyl sulfate and styrene are irritant to skin and eyes.	1. Exposure to hazardous chemicals (sodium dodecyl sulfate and styrene). Irritation and burns if in contact with skin and eyes. 2. May be fatal if swallowed. 3. Harmful if inhaled.	1. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 2. Wash skin thoroughly after the experiment. 3. Perform reaction in a well-ventilated fumehood. 4. Reminder from lecturer or graduate teaching assistant or lab technicians. 5. Keep away from oxidising agents	1	2	2			
		Fire hazard: Styrene is flammable in air.	Possible fire when styrene is exposed to heat.	1. Perform reaction in a well-ventilated fumehood. 2. Keep away from ignition source.	2	1	2			
		Human factor: Spillage of chemicals and breakage of glassware.	1. Irritation if in contact with skin. 2. Skin cuts and exposure to hazardous chemicals (sodium dodecyl sulfate and styrene) from broken glassware.	1. Perform reaction in a well-ventilated fumehood. 2. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 3. Check glassware for cracks prior to use.	2	1	2			

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2	Flushing the reaction kettle with nitrogen and stabilize the water bath temperature at 55 degree Celsius before adding 0.3 g potassium peroxodisulfate under constant stirring.	Chemical hazards: Potassium peroxodisulfate (oxidising, irritant, harmful)	1. Exposure to hazardous chemicals (potassium peroxodisulfate). Irritation if in contact with skin and eyes. 2. May be harmful if swallowed. 3. Harmful if inhaled.	1. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 2. Wash skin thoroughly after the experiment. 3. Perform reaction in a well-ventilated fumehood. 4. Avoid chemical contact with ignition source 4. No eating or drinking in the lab	1	2	2			
		Pressure hazard: Compressed nitrogen gas.	Injury from explosion due to pressure build-up.	Perform reaction in a well-ventilated fumehood. Pull the fumehood slash down	2	1	2			
		Human factor: Spillage of chemicals and breakage of glassware.	1. Irritation if in contact with skin. 2. Skin cuts and exposure to hazardous chemicals (potassium peroxodisulfate) from broken glassware.	1. Perform reaction in a well-ventilated fumehood. 2. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 3. Check glassware for cracks prior to use.	2	1	2			
3	Draw 7 samples of 5 mL latex with a graduated pipette from the reaction kettle at a varying time intervals.	Chemical hazards: 1. Latex is combustible. 2. Latex is an irritant to skin and eyes.	1. Exposure to hazardous chemicals (Latex). Irritation and burns if in contact with skin and eyes. 2. May be harmful if swallowed. 3. Harmful if inhaled.	1. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 2. Wash skin thoroughly after the experiment. 3. Perform reaction in a well-ventilated fumehood. 4. Reminder from lecturer or graduate teaching assistant or lab technicians.	1	2	2			
		Fire hazard: Latex is flammable in air.	Explosion or catching of fire when latex is exposed to heat.	1. Perform reaction in a well-ventilated fumehood. 2. Keep away from ignition source.	2	1	2			
		Human factor: Spillage of chemicals and breakage of glassware, pipette.	1. Irritation if in contact with skin. 2. Skin cuts and exposure to hazardous chemicals (benzoyl peroxide and styrene) from broken glassware.	1. Perform reaction in a well-ventilated fumehood. 2. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 3. Check glassware for cracks prior to use.	2	1	2			

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4	Empty each of the withdrawn latex sample into 60 mL isopropanol in a beaker.	Chemical hazards: 1. Latex sample and isopropanol are combustible. 2. Latex sample and isopropanol are irritant to skin and eyes.	1. Exposure to hazardous chemicals (latex sample and isopropanol). Irritation and burns if in contact with skin and eyes. 2. May be harmful if swallowed. 3. Harmful if inhaled.	1. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 2. Wash skin thoroughly after the experiment. 3. Perform reaction in a well-ventilated fumehood. 4. No eating or drinking in the lab	1	2	2			
		Fire hazard: Latex sample and isopropanol are flammable in air.	Explosion or catching of fire when latex sample and isopropanol are exposed to heat.	1. Perform reaction in a well-ventilated fumehood. 2. Keep away from ignition source.	2	1	2			
		Human factor: Spillage of chemicals and breakage of glassware.	1. Irritation if in contact with skin. 2. Skin cuts and exposure to hazardous chemicals (latex sample and isopropanol) from broken glassware.	1. Perform reaction in a well-ventilated fumehood. 2. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 3. Check glassware for cracks prior to use.	2	1	2			
5	Filter under suction and wash the polystyrene polymer with deionized water, and dry in the oven at about 80 degree Celsius.	Chemical hazards: 1. The polystyrene polymer is combustible. 2. The polystyrene polymer is an irritant to skin and eyes.	1. Exposure to hazardous chemicals (polystyrene polymer). Irritation and burns if in contact with skin and eyes. 2. May be harmful if swallowed. 3. Harmful if inhaled.	1. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 2. Wash skin thoroughly after the experiment. 3. Perform reaction in a well-ventilated fumehood. 4. Reminder from lecturer or graduate teaching assistant or lab technicians.	1	2	2			
		Fire hazard: The polystyrene polymer is flammable.	Explosion or catching of fire when latex is exposed to heat (above 315 degree Celsius).	1. Perform reaction in a well-ventilated fumehood. 2. Keep away from ignition source. 3. When using the oven, check that the fan and control thermocouple are operating properly, do not leave the oven unattended. 4. Check the sample for dryness every 15 minutes.	2	1	2			
		Oven hazard: Glass breakage due to slippery surface, hot surface in the oven.	1. Injury from broken glass. 2. Burn from hot surface.	1. Ensure PPE (safety glasses, nitrile gloves and oven thick gloves, lab coat, covered shoes) are worn at all times. 2. Check glassware for cracks prior to use.	2	1	2			

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6	Remove the samples from the oven and weigh them	Oven hazard: Glass breakage due to slippery surface, hot surface on the oven.	1. Injury from broken glass. 2. Burn from hot surface.	1. Ensure PPE (safety glasses, nitrile gloves and oven thick gloves, lab coat, covered shoes) are worn at all times. 2. Check glassware for cracks prior to use.	1	2	2		
		Broken glassware	1. Cuts from broken glass.	1. Visual inspection of glassware before use. 2. Wear gloves when handling glassware	1	1	1		
		Human factor: Lack of skill / concentration / did not pay attention to the technique handling of glassware in the experiment.	1. Burn from hot surface. 2. Holding the hot glassware.	1. Keep away from ignition sources. 2. Proper PPE (safety glasses, nitrile gloves, lab coat, covered shoes) to be worn. 3. Reaction system done in a ventilated fumehood. 4. Keep the latex sample away from any oxidising agents such as nitric acid, sulfuric acid, nitrates.	1	2	2		
7	Dissolve 0.20 g of each sample in 20 mL toluene in a 25 mL volumetric flask.	Chemical hazards: Toluene is an irritant to skin and eyes.	1. Exposure to hazardous chemicals (toluene). Irritation and burns if in contact with skin and eyes. 2. May be fatal if swallowed. 3. Harmful if inhaled.	1. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 2. Wash skin thoroughly after the experiment. 3. Perform reaction in a well-ventilated fumehood.	1	2	2		
		Fire hazard: Toluene and its vapour are flammable in air.	Explosion or catching of fire when toluene is exposed to heat.	Perform reaction in a well-ventilated fumehood. Keep toluene away from ignition source.	2	1	2		
		Human factor: Spillage of chemicals and breakage of glassware, volumetric flask.	1. Irritation if in contact with skin. 2. Skin cuts and exposure to hazardous chemicals (toluene) from broken glassware.	1. Perform reaction in a well-ventilated fumehood. 2. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 3. Check glassware for cracks prior to use.	2	1	2		

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8	Filter the polymer solution with a cotton wool for the polymer solution with a glass funnel.	Chemical hazards: The polymer solution is an irritant to skin and eyes.	1. Exposure to hazardous chemicals. Irritation if the polymer solution is in contact with skin and eyes. 2. May be harmful if swallowed. 3. Harmful if inhaled.	1. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 3. Perform reaction in a well-ventilated fumehood. 4. No eating or drinking in the lab	1	2	2		
		Fire hazard: The polymer solution and its vapour are flammable in air.	Explosion or catching of fire when the polymer solution is exposed to heat.	Perform reaction in a well-ventilated fumehood. Keep polymer away from ignition source.	2	1	2		
		Human factor: Spillage of chemicals and breakage of glassware, glass funnel.	1. Irritation if in contact with skin. 2. Skin cuts and exposure to hazardous chemicals (The polymer solution) from broken glassware.	1. Perform reaction in a well-ventilated fumehood. 2. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 3. Check glassware for cracks prior to use. 4. Read the lab manual on the technical knowhow, how to conduct simple filtration properly.	2	1	2		
9	Evaporate 10 mL of sample polymer solutions over a hot water bath and weigh the deposited polymer.	Chemical hazards: The polymer solution is an irritant to skin and eyes.	1. Exposure to hazardous chemicals. Irritation and burns if the polymer solution is in contact with skin and eyes. 2. May be harmful if swallowed. 3. Harmful if inhaled.	1. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 3. Perform reaction in a well-ventilated fumehood. 4. No eating or drinking in the lab	1	2	2		
		Fire hazard: The polymer solution and its vapour are flammable in air.	Explosion or catching of fire when the polymer solution is exposed to hot air.	Perform reaction in a well-ventilated fumehood.	2	1	2		
		Human factor: 1. Spillage of chemicals (polymer solution) and breakage of glassware. 2. Lack of skill concentrations, did not pay attention to the hot water bath.	1. Irritation if hot water and polymer solution are in contact with skin. 2. Skin cuts and exposure to hazardous chemicals (the polymer solution) from broken glassware.	1. Perform reaction in a well-ventilated fumehood. 2. Ensure PPE (safety glasses, nitrile gloves, lab coat, covered shoes) are worn at all times. 3. Check glassware for cracks prior to use.	2	1	2		

Next Revision date
(Maximum 3 years) 19/5/2025

Name Dr Foo Maw Lin

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Signature _____

Signature 

Approval date 20/5/2022

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