Risk Assessment Form (3)

Must be completed before experimentation.

Student's Name(s) Emma G. Yeung

Title of Project Synthesis and Temperature-dependent Phase Behavior of a Dendritic Dipeptide

To be completed by the Student Researcher(s) in collaboration with Designated Supervisor/Qualified Scientist:
(All questions must be answered; additional page(s) may be attached.)

1. List all hazardous chemicals, activities, or devices that will be used; identify microorganisms exempt from pre-approval (see Potentially Hazardous Biological Agent rules).

   Hazardous chemicals: N,N-Dimethylformamide (DMF), tetrahydrofuran (THF), dichloromethane, methanol (MeOH), ethanol (EtOH), acetone, hexanes (hex), ethyl acetate (EtOAc), diethyl ether (Et2O), Nα-t-butyloxycarbonyl-Nε-(3,4,5-tri(n-dodecan-1-yloxy)benzoyl)-L-lysine, alanine methyl ester (Ala-OMe), 2',3',4',5',6'-pentafluorophenyl 3,4,5-tri(n-dodecan-1-yloxy)benzoate, Nα-t-butyloxycarbonyl-L-lysine (Boc-Lys-OH), 3,4,5-tri (n-dodecan-1-yloxy)benzoic acid, 2,3,4,5,6-pentafluorophenol, O-(benzotriazol-1-yl)-N,N,N',N'-tetramethyluronium hexafluorophosphate (HBTU), hydroxybenzotriazole (HOBt), diisopropylethylamine (DIEA), N,N'dicyclohexylcarbodiimide (DCC), pyridinium p-toluenesulfonate (DPTS), potassium hydroxide, 1-bromododecane, propyl 3,4,5-trihydroxybenzoate, potassium carbonate, hydrochloric acid, silica.
   Hazardous equipment: Schlenk line, rotary evaporator, heating stir plates, vacuum pumps, vacuum filters, separatory funnels, vacuum dewar, syringes, needles, razor blades, thin layer chromatography (TLC) plates (silica).

2. Identify and assess the risks involved in this project.

   Fire hazard: The most significant fire hazards are presented by the solvents with flash points at or below room temperature (THF, MeOH, EtOH, acetone, hexanes, and Et2O). The solvents are the largest components of the chemical reactions and purification processes. In chemical reactions and recrystallization steps, these solvents will be heated on a stirrer hot plate.
   Physical hazard: The Schlenk line, rotary evaporator, vacuum filters, and vacuum dewar present risks of implosion as glassware is subjected to vacuum. All glassware, but especially glassware used with the rotary evaporator, presents a risk of laceration if the glassware breaks during assembly/disassembly of apparatuses. Needles (attached to syringes) and razor blades are laceration risks. The heating stage for the optical microscope presents a burn hazard.
   Health hazard: All of the chemicals present health hazards. The most significant health hazards are presented by HBTU (skin sensitization), DCC (skin sensitization), and hydrochloric acid (skin corrosion and eye hazard). Thin layer chromatography (TLC) plates are coated with silica. Loose silica particles are a respiratory hazard.

3. Describe the safety precautions and procedures that will be used to reduce the risks.

   Fire hazard: All operations involving solvents, including heating of solutions in organic solvents, will be performed in a chemical fume hood to ensure that vapors are efficiently removed. Any fire or explosion will be contained in the fume hood away from other flammable materials and laboratory workers. In the event of a fire, the fire department will be contacted to resolve the fire.
   Physical hazard: The Schlenk line, vacuum filters, and vacuum dewar are all operated in a chemical fume hood behind a safety glass sash. Only glassware that is free of cracks or scratches will be used for operations involving reduced pressure (e.g., rotary evaporation). All glassware, will be handled with care during assembly/disassembly of apparatuses. Needles (attached to syringes) and razor blades will be handled with care.
   Health hazard: All liquid reagents and solvents will be handled in a chemical fume hood. Solid reagents will be weighed out in a balance enclosure to reduce the risk of exposure to particles in the air. All reactions will be performed in a chemical fume hood. Silver Shield heavy-duty gloves will be used when handling HBTU, DCC, and hydrochloric acid. Care will be taken when handling TLC plate to avoid contact with the silica coating.

4. Describe the disposal procedures that will be used (when applicable). - check attached sheet (next page)

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5. List the source(s) of safety information.

   The health, physical, and fire hazards of all chemicals (including solvents) are available in Safety Data Sheets from Millipore Sigma (sigmaaldrich.com). Protocols for handling chemicals, reactions, and equipment in the Rudick lab are available from group members. Protocols for running the reactions are based on published procedures from the Rudick lab (J. Am. Chem. Soc. 2017, 139. 15977-15983). Safety information about the rotary evaporator, segregation and disposal of chemicals, and TLC plates are available in CHE 327 Organic Chemistry Laboratory Manual 2018-2019 edition by Rong Chen, Marjorie Kandel and Zachary Katsamanis (Hayden-McNeil, 2018).

To be completed and signed by the Designated Supervisor (or Qualified Scientist, when applicable):
I agree with the risk assessment and safety precautions and procedures described above. I certify that I have reviewed the Research Plan/Project Summary and will provide direct supervision.

Jonathan G. Rudick	[signature]	07/14/19
Designated Supervisor's Printed Name	Signature	Date of Review (mm/dd/yy)

Associate Professor, Stony Brook University	jon.rudick@stonybrook.edu
Position & Institution	Phone or email contact information

20 years of research in synthetic organic chemistry

Experience/Training as relates to the student's area of research

4. Disposal Procedures

All used organic solvents will be poured into a 20L organic waste bottle and any aqueous solution will be emptied into a 20L aqueous waste bottle. The waste bottles are emptied once a week by the janitorial staff. Broken glassware will be handled with gloves and placed into a cardboard broken glassware container. There is a sharps container for used needles.