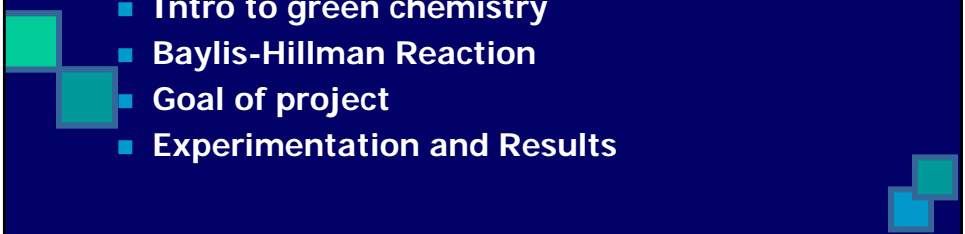


# A Tandem Baylis-Hillman Condensation/ Cyclization Reaction for the Preparation of Aromatic Heterocycles

Amy Roberts  
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## Outline

- Intro to green chemistry
  - Baylis-Hillman Reaction
  - Goal of project
  - Experimentation and Results
- 

## What is Green Chemistry ?

- "Defined as the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture, and application of chemical products."

- Doxsee, K.M. and Hutchison, J.E. *Green Organic Chemistry Strategies, Tools, and Laboratory Experiments*. Thomson, Brooks, and Cole. 2004.

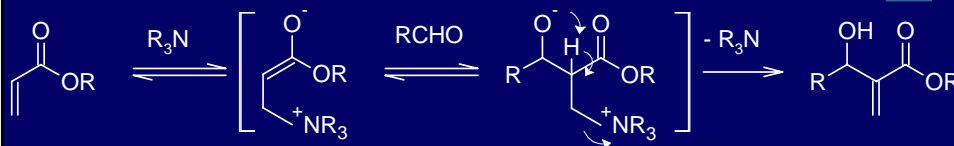
## Green Chemistry is:

- An emerging field within organic chemistry
- Pollution prevention at the most fundamental level, atoms and molecules
- Focuses on reducing intrinsic hazards of reactions and making them more efficient

## Properties of Green Reactions

- Mild reaction conditions
- Very little waste formed
- Atom efficient
- No need for solvent
- No aqueous quench
- Easily recovered catalysts
- Reagents and products low in toxicity

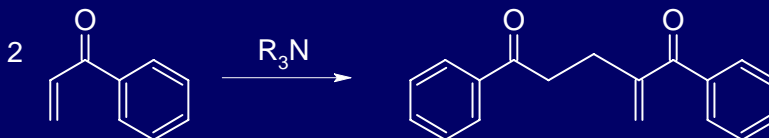
## Baylis Hillman Reaction



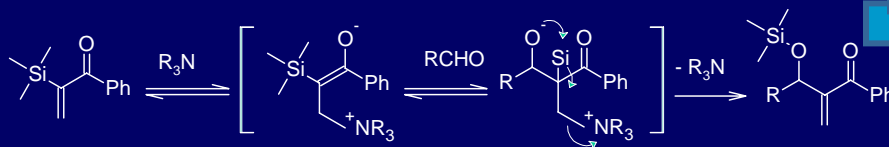
## Limitations of the Baylis-Hillman Reaction

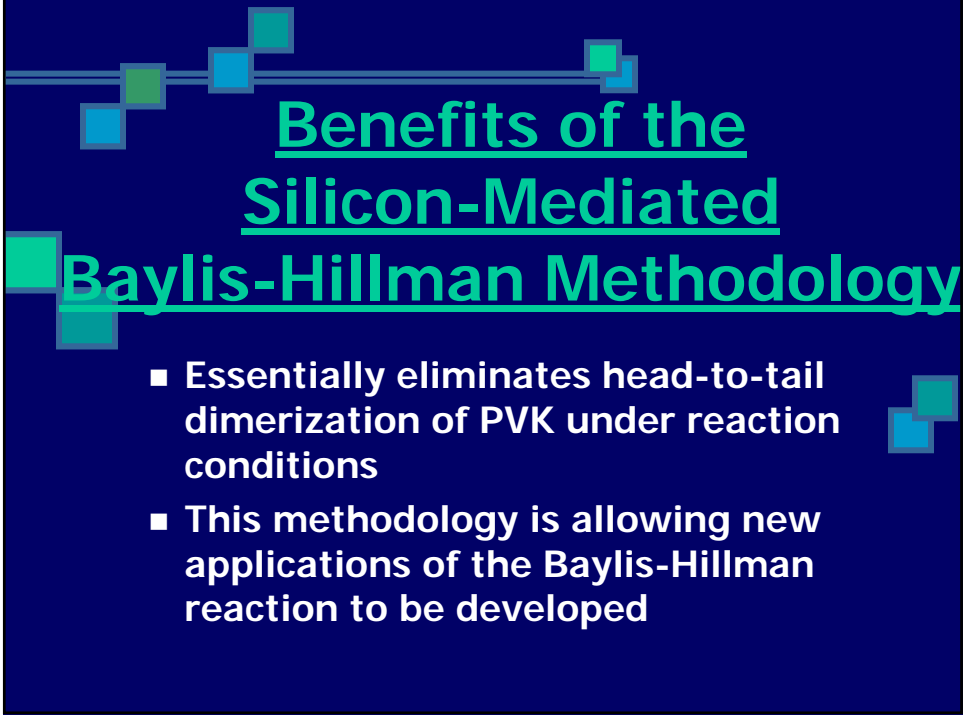
- Limited number of activated olefins suitable for the reaction due to competitive dimerization.
- Phenyl vinyl ketone (PVK), which dimerizes rapidly under Baylis-Hillman conditions, is essentially unsuitable as a substrate.

### PVK Dimer Formation



## Silicon-Mediated Baylis-Hillman Reaction





## Benefits of the Silicon-Mediated Baylis-Hillman Methodology

- Essentially eliminates head-to-tail dimerization of PVK under reaction conditions
- This methodology is allowing new applications of the Baylis-Hillman reaction to be developed



## Goal of Project

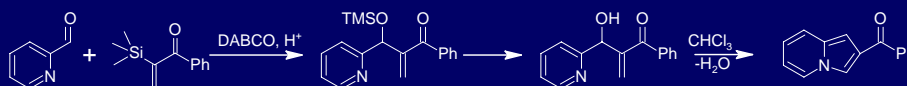
- To develop synthetic applications of Silicon-Mediated Baylis-Hillman reaction.

## Utilization of Reaction

2H-1-Benzopyran via Tandem Baylis-Hillman Condensation / Cyclization Sequence

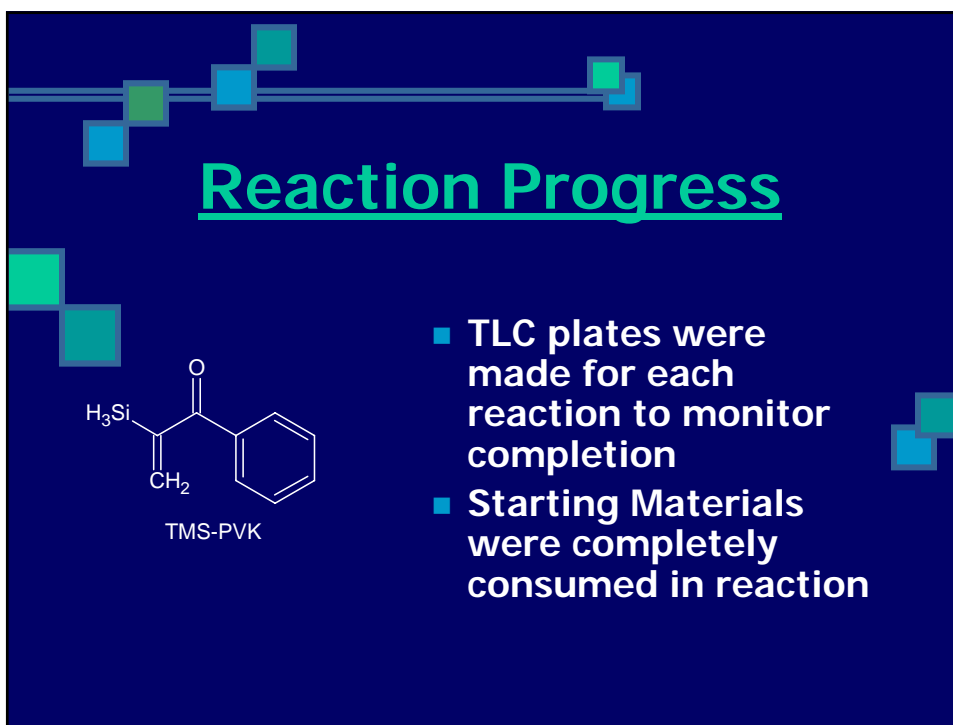
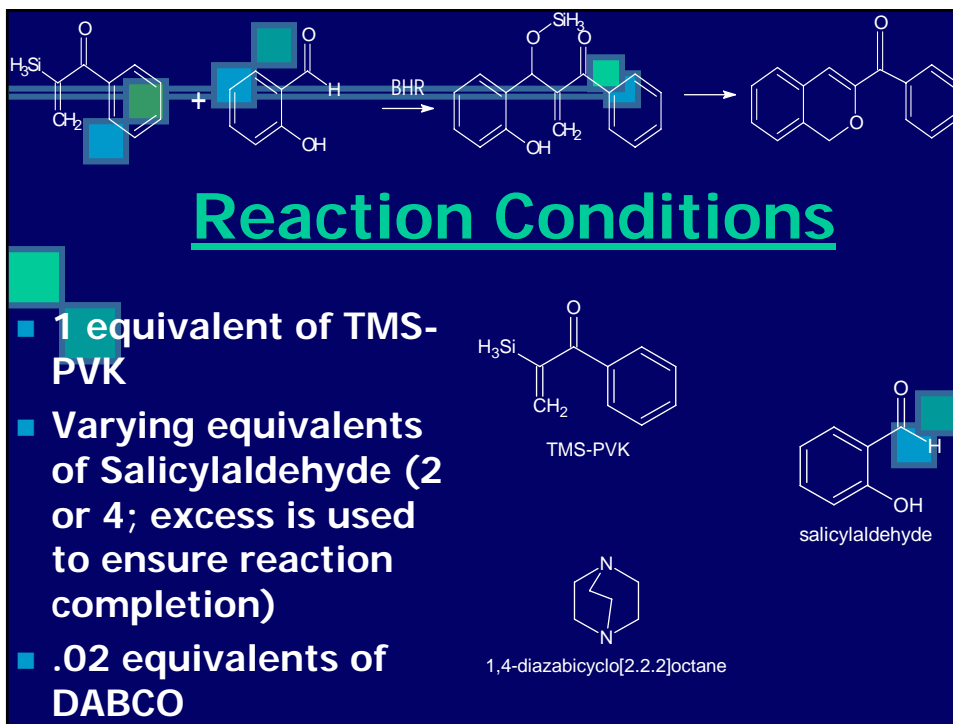


Indolizine via Cyclization of Baylis-Hillman adduct



## Importance of Synthetic Route

- Many naturally occurring pharmacologically active compounds contain the 2H-1-benzopyran nucleus
- Synthetic route makes these medicinally important compounds more readily available

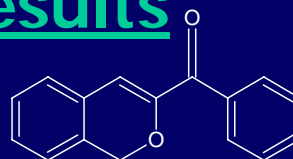


## Aqueous Workup

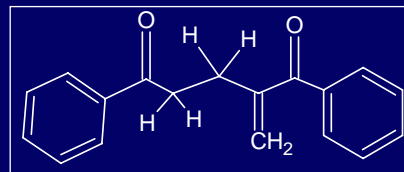
- Add Ethyl Acetate and Sodium Hydroxide
- Extract Aqueous layer with Ethyl Acetate X3
- Wash with brine
- Dry with Magnesium Sulfate
- Vacuum filter
- Rotary Evaporation

## HNMR Results

- No starting material left
- Product is forming
- Dimer is also forming



3-benzoyl-2H-1-benzopyran

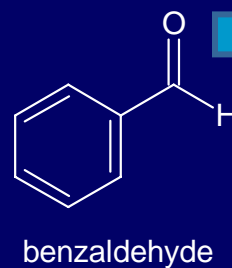


## How Dimer is Forming



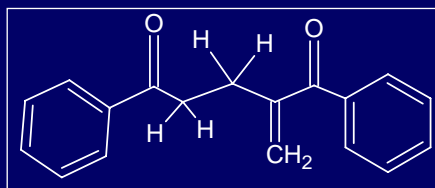
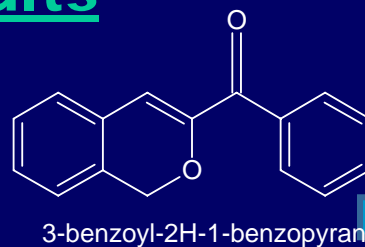
## Continued Research

- Adding varying equivalents of benzoic acid to try to suppress dimer from forming
  - Lab evidence shows that benzoic acid does suppress dimer formation



## Results

- No starting material in product
- Product is formed
- Dimer still present



## Success?

- Product is formed, however the dimer is a waste product making the reaction less green
- Procedure needs to be modified to suppress dimer formation



## Proposed Solutions

- Use more benzoic acid
- Using a different solvent



## Acknowledgements

- Marian College Department of Natural and Behavioral Sciences
- Dr. Carl Lecher

