Green Chemistry

Slide -4

Principles of Green Chemistry (Cont.)

9. Catalysis

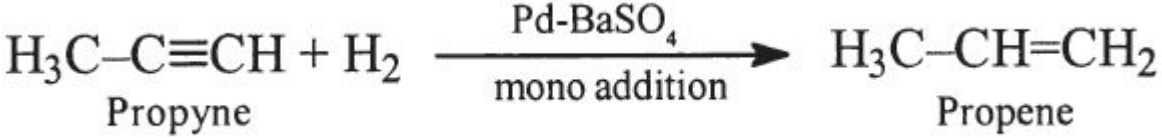
Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.

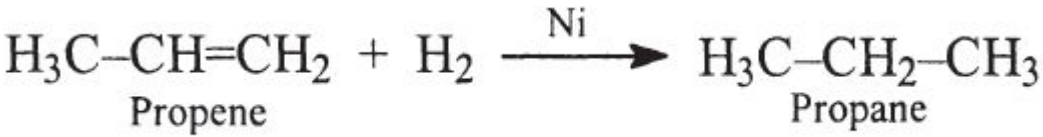
Possible cases with stoichiometric reactions

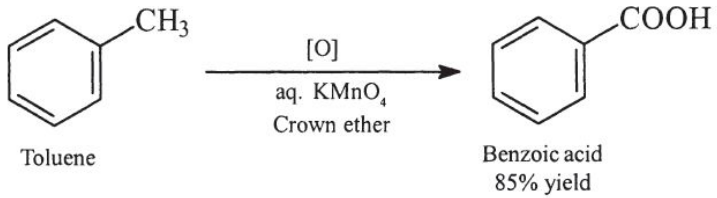
1. One of the starting material is a **limiting reagent** and therefore there will be unreacted starting material left over even in a reaction with 100% yield.
2. One or both the starting materials are **only partially** needed in the end product (atom economy).
3. Additional reagents are required to carry out the reaction and those reagents will need to be discarded in the waste stream.

Role of catalyst

1. It gives better yields
2. It increases selectivity of the reaction
3. Better utilization of starting material
4. Increases the feasibility of a reaction

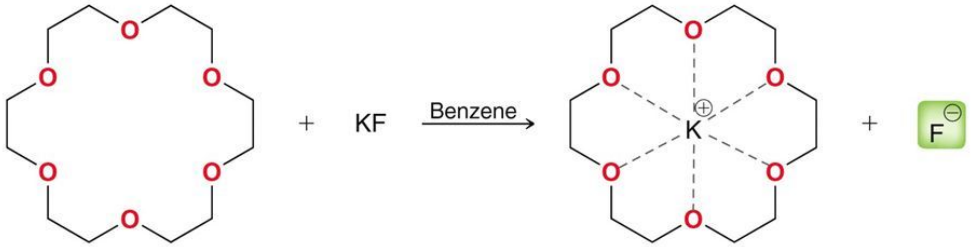






14.4 Crown Ethers

- The F^- ion below is ready to react because the K^+ ion is sequestered by the crown ether



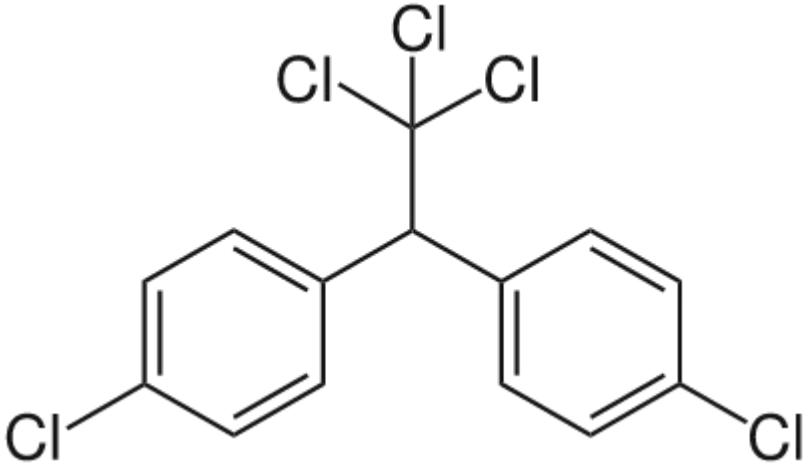
- Without the crown ether, the solubility of KF in benzene is miniscule

10. Design for Degradation

Chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.

Plastics

Pesticides



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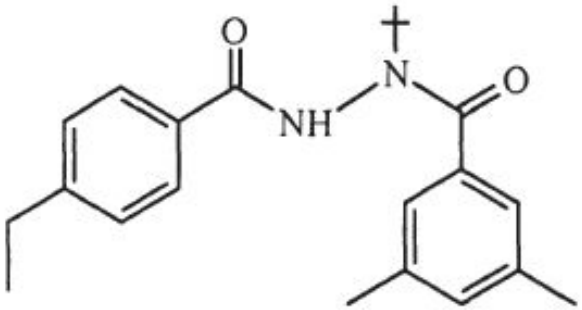
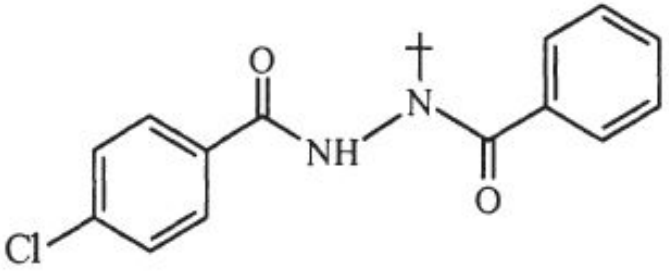
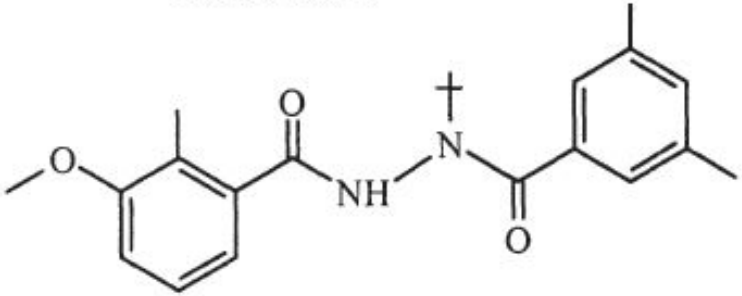


Tebufenozide



Halofenozide



Methoxyfenozide

DESIGNING A BIODEGRADABLE SUBSTANCE

1. Functionally the compound must be susceptible to hydrolysis, photolysis or other cleavage.
2. It must be assessed that to what components the parent compound will break into.
3. Degradation should include the effects on human health, ecosystems, wildlife and the overall pollution load.

11. Real-time Analysis for Pollution Prevention

Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.

YOU CANNOT CONTROL WHAT YOU CANNOT MEASURE

1. Accurate sensors, monitors, and analytical techniques to assess the hazards present in process team must be employed.
2. Detection of toxic materials generated at earliest
3. Monitoring the reaction till completion, if monitored correctly use of excess reagents may be avoided.

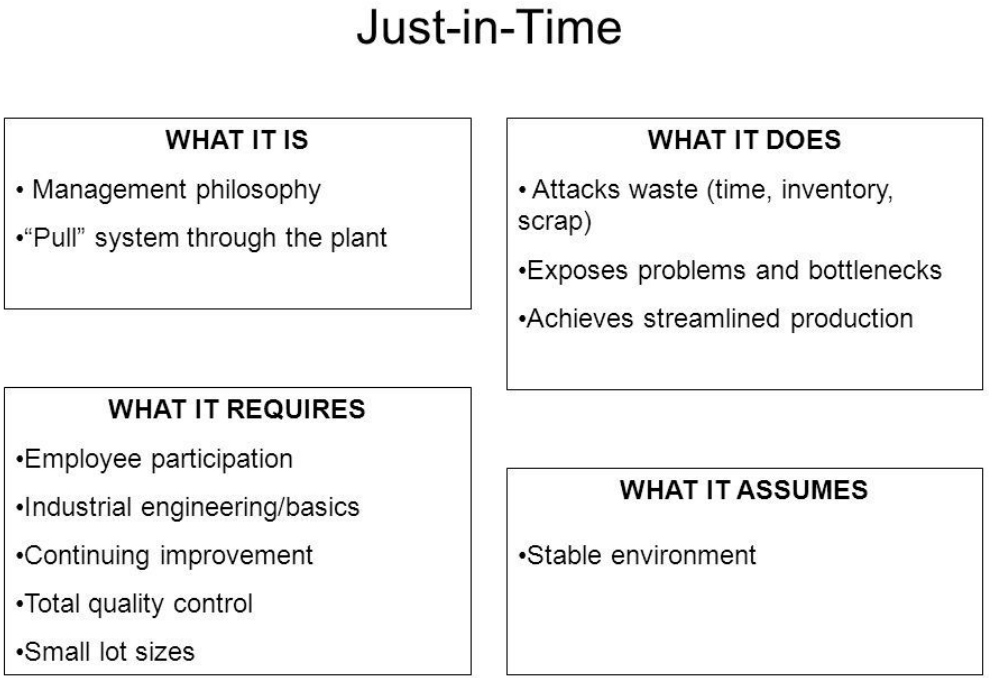
Inherently Safer Chemistry for Accident Prevention

Substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions, and fires.

The importance of prevention of accidents in manufacturing units cannot be overemphasized. A number of accidents have been found to occur in industrial units. The gas tragedy in Bhopal (December 1984) and several other places has resulted not only in loss of thousands of human lives but also rendered many persons disabled for the rest of their lives. The hazards posed by toxicity, explosions, fire etc. must be looked into and the manufacturing plants should be so designed to eliminate the possibility of accidents during operation.

How to avoid disaster

1. Use of solid or low vapour pressure substances in place of non volatile liquids
2. Avoiding molecular halogen by using reagents that carry halogen to be transfered.
3. Use of Just in time techniques



Thank You