Waste Generation

- **What is the reason why we have high E-factor in fine chemicals than bulk chemicals**
- **High margins :- People don't care much about waste**
- **Lower Process efficiency and more importance is given to new products**
- **Complicated molecular Structure**

Molecular structure

- **Suppose we have a molecule and we want a functional group on one of the carbon or particular chirality**
- **If we do any uncontrolled reaction we can get many undesired molecules**
- **For this we can use selective catalysts**
- **These things bring complexity to the process for fine chemicals which add to waste generation**
- **Suppose there's a policy change that we cannot produce this much amount of waste**
- **So we look for alternate catalyst**
- **And selectivity :-**
- **Example we have acetophenone**
- **One particular route uses H2so4 and Cr+6 and ketone forms and Cr2so4+3 forms**
- **Another route is simply H2O2 and ketone is formed along with water**

- **Therefore we have E-factor for second route to be zero or 100% atom efficiency**
- **One of the reasons for waste generation is homogenous catalyst**
- **Some of the people use H2so4 or hcl as homogenous catalyst and the products are dissolved along with h2so4 / hcl**
- **This is cheap but more steps are involved in separation and other processing therefore more waste is produced**
- **We can use solid catalyst like zeolites which can be separated easily**
- **Chemoselectivity selectivity among two reactions**
- **Regioselectivity selectivity among positions**
- **Stereoselectivity Bond angles can be different**
- **How do we make selection for better alternatives**
- **Reaction path has E factor E1 and reaction path has E factor E2**
- **Along with E factor something else must be accounted for**
- **Like toxicity associated with that waste**
- **Environmental Quotient(Q)**
- **For Hcl Q is 1**
- **Therefore we multiply E by Q to decide which path to choose**

Environmental Impact

- **The impact that we are making to the society through technological intervention through process efficiency**

- **It is proportional to process inefficieny * consumption per capita* population**

Life cycle analysis

- **Cradle to grave**
- **Mining(Cradle) -> transportation -> Process -> transportation -> disposed (grave)**