M.SC Semester III
Core Course XII
Environmental Chemistry

TOPIC:- Unit IV, Green Chemistry Microwave assisted Reaction: An approach to green Chemistry

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Microwave assisted Reaction: An approach to green Chemistry

- Microwave assisted organic synthesis is defined as the preparation of desired organic compound from available starting material via some procedure involving microwave irradiation.
- As it is less hazardous it is a potential tool of green chemistry.
- Microwave Synthesis opens up new opportunities to the synthetic chemist in the form of new reaction that are not possible by conventional heating.
- It is an enabling technology for accelerating drug discovery and development processes.

MICROWAVE IRRADIATION

- Microwave radiation is non-ionizing form of energy that does not alter the molecular structure of compounds and provides only thermal activation.
- This phenomenon is dependent on the ability of a specific material to absorb microwave energy and convert into heat.
- The principle of microwave heating is that the energy can be applied directly to the sample rather than conductively via the vessel. heating can be started or stopped instantly

WHAT MICROWAVES ARE?

- A Microwave is a form of electromagnetic energy that falls at lower
- frequency at the end of electromagnetic spectrum(300 to 300000MHz).
- It is present between infrared radiation and radio waves.
- Microwave uses EMR that passes through material and causes oscillation of molecules which produces heat.

MECHANISM OF MICROWAVE

- **DI ELECTRIC HEATING:**
- Generation of thermal energy in a non conducting material by the application of an electromagnetic force.
- wasted energy appears as heat called di- electric loss .
- The non-metallic material with poor thermal conductivity can be very effectively heated by dielectric heating.
- Dielectric loss is proportional to frequency and square of the supply voltage.
- Microwave dielectric heating mechanisms are of 2 types

1. Dipolar polarization mechanism
2. Conduction mechanism

Comparison between Microwave and Conventional Method

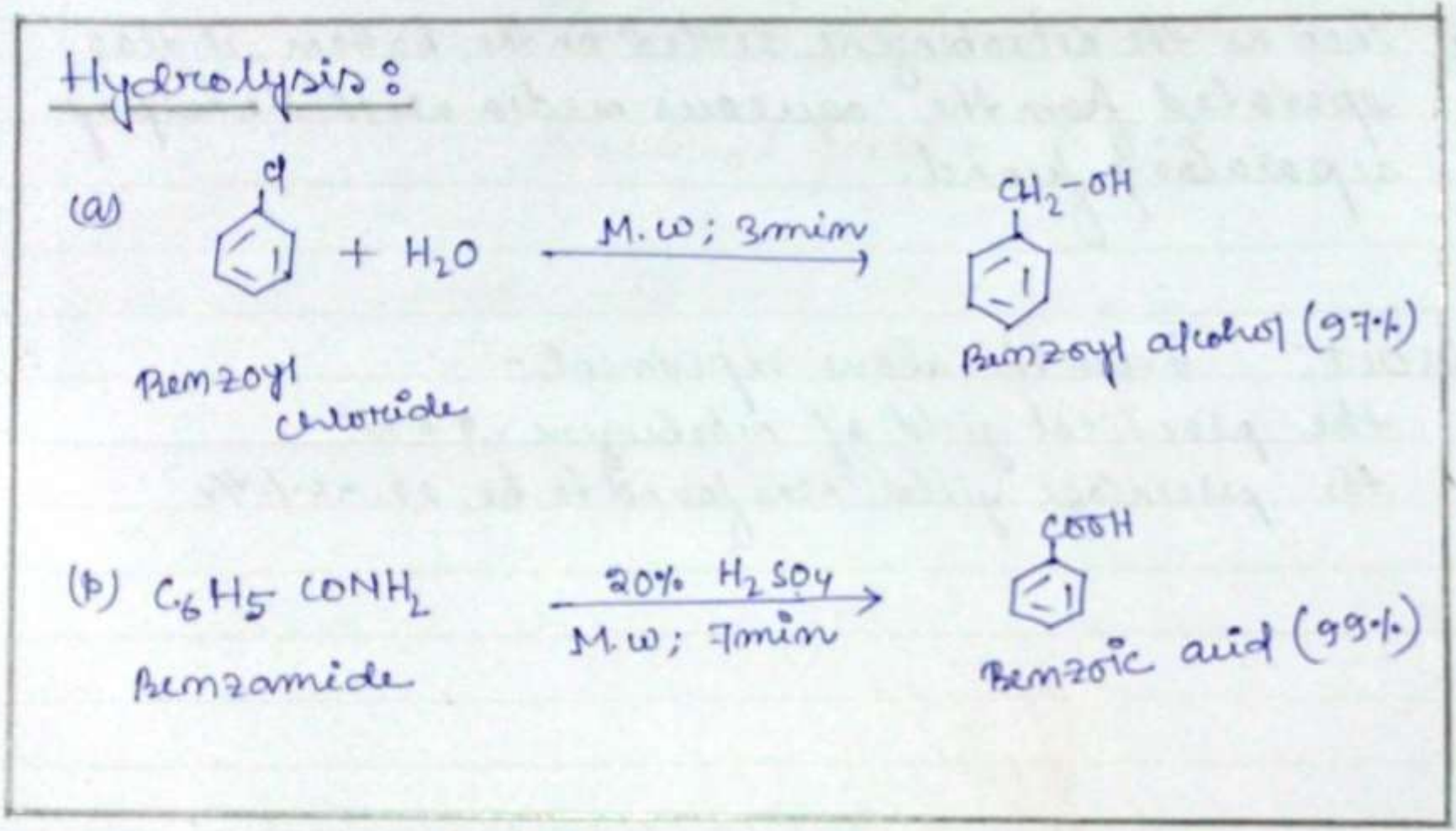
MICROWAVE

- Increase in reaction rate
- Specific material is heated
- Specific temperature
- Less solvent
- Efficient internal heating
- Heat flow: inside to out side

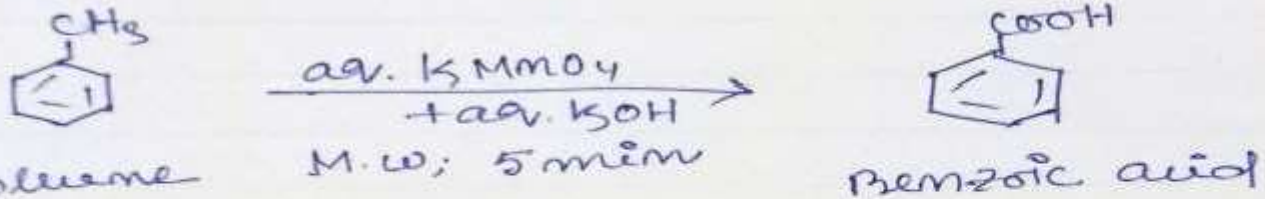
CONVENTIONAL

- Decrease in reaction rate
- Compounds in the mixture heated equally
- No specific temperature
- More solvent
- Efficient external heating
- Heat flow: outside to inside

Examples of Microwave assisted Reaction:

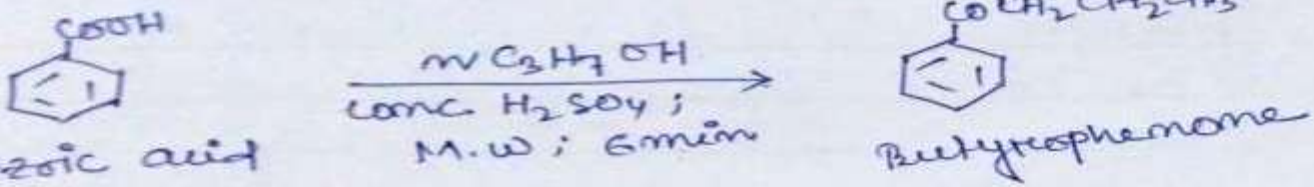


Oxydation :



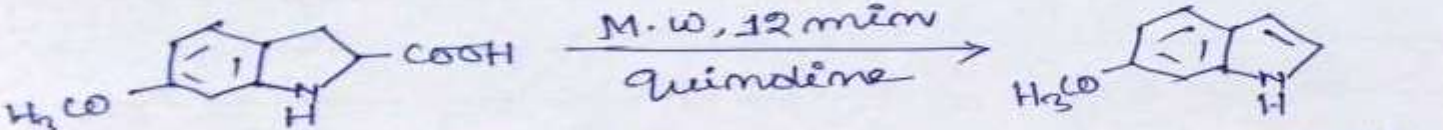
Toluene → Benzoic acid

Esterification :



Benzoic acid → Butyrophenone

Decarboxylation :



6 methoxy-1H-Indole-2-carboxylic acid → 6 methoxy-1H-Indole