Lecture 5.2 – Important Dye Intermediates

Learning Objectives

• Understand the role and synthesis of dye intermediates: H-acid, Koch acid, Vinyl sulphone.

• Recognize their industrial significance and environmental impacts.

1. Introduction to Dye Intermediates

• Dye intermediates are key organic compounds involved in the synthesis of final dye products.

• They help to introduce chromophores and enhance reactivity in the dye molecule.

2. H-Acid

• Full name: 1-Amino-8-naphthol-3,6-disulfonic acid.

• Synthesized from naphthalene via sulfonation, nitration, and reduction.

• Widely used in azo and reactive dye synthesis.

3. Koch Acid

• A sulfonated naphthalene derivative.

• Intermediate for acid dyes.

• Useful due to high water solubility and active functional groups.

4. Vinyl Sulphone

• A highly reactive intermediate used in reactive dyes.

• Forms covalent bonds with cellulose fibers in alkaline conditions.

• Provides high fastness and wash-resistance.

5. Environmental Aspects

• Many intermediates are toxic and environmentally hazardous.

• Safe handling, proper effluent treatment and waste management are essential.

Key Reactions

H-Acid Synthesis: Naphthalene → Sulfonation → Nitration → Reduction → H-Acid

Vinyl Sulphone Reactive Dye: Dye–$SO_2CH=CH_2$ + Cellulose–OH → Dye–O–Cellulose + $CH_2=CH_2$

References

1. Dryden's Outlines of Chemical Technology

2. Groggins, Unit Processes in Organic Synthesis

3. NPTEL Module: Industrial Chemistry – Dye Intermediates

Assignment Questions

1. Describe the synthesis steps involved in H-Acid production.

2. Why is Vinyl Sulphone preferred in reactive dye manufacture?

3. What are the industrial safety concerns in dye intermediate handling?