

Preparation of Benzoic Acid by Ester Hydrolysis

Practical 14 | Pharmaceutical Organic Chemistry II

Aim

To prepare Benzoic Acid by Ester Hydrolysis, and interpret the recorded observations.

Principle

- Hydrolysis breaks an alkyl benzoate ester into a benzoic-acid component and an alcohol; the isolation conditions determine whether the acid or a benzoate salt is recovered.
- A chemical transformation changes selected functional groups while retaining or constructing the required molecular skeleton.
- Product identity and purity require analytical evidence; appearance alone cannot establish either.
- Reaction record: draw starting material and product structures, mark the functional-group change, and retain the assigned stoichiometry.
- Characterization record: compare the assigned melting range, TLC or spectral evidence. A narrow melting interval can support purity but cannot alone establish complete identity.

Materials and Apparatus

- Assigned alkyl benzoate and hydrolysis reagents.
- Assigned starting materials and instructor-selected reagents.
- Balance, reaction glassware, stirring/heating arrangement, condenser where required, filtration equipment and identity/purity test apparatus.

Method

- Write the assigned reaction scheme and balance the transformation before calculating reagent requirements.
- Identify the limiting reactant and document the approved reaction scale, solvent and conditions.
- Observe the instructor-directed reaction sequence and record changes without substituting reagents or conditions.
- Complete the prescribed work-up to separate the product from reaction liquids and by-products.
- Purify the product by the assigned method, dry it appropriately and determine the recovered mass.
- Record the assigned identity and purity observations and compare them with the expected product.

Observation Record

Complete this record using actual laboratory findings or the provided teaching data.

Observation / parameter	Record / finding
Starting-material amounts	_____
Limiting reactant	_____
Reaction observations	_____
Dry product mass	_____
Identity and purity observations	_____

Calculations and Interpretation

- Theoretical product mass = limiting-reactant amount (mol) $\times$ product stoichiometric ratio $\times$ product molar mass.
- Percentage yield = dry product mass / theoretical product mass $\times$ 100.

Worked Illustration

Illustration: a theoretical product mass of 2.00 g and dry recovery of 1.50 g give 75.0% yield.

The values in this illustration are for calculation practice.

Result

Record the actual finding, calculated value with units where relevant, and a conclusion supported by the observations.

Finding: _____

Conclusion: _____

Precautions

- Use the approved reaction conditions and suitable ventilation.
- Keep product, starting material and waste streams separately labelled.
- Calculate yield from dry product and the limiting reactant; never use wet mass as pure-product mass.

Viva Questions

1. What is the limiting reactant?

The reactant whose available amount permits the smallest theoretical amount of product.

2. Does a high yield establish purity?

No. Residual solvent, impurities and unreacted material can increase recovered mass.

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