

073206T4CHE

CHEMICAL ENGINEERING TECHNOLOGY LEVEL 6

ENG/OS/CE/CR/05/6

Operate Process Equipment

July/August 2025



**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION
COUNCIL (TVET CDACC)**

PRACTICAL ASSESSMENT

Time: 3 HOURS

INSTRUCTIONS TO CANDIDATE:

1. You are required to perform the following tasks:
 - i. **Task 1:** Determine the efficiency of the separation process of Acetic Acid from water using Ethyl Acetate.
 - ii. **Task 2:** Maintain housekeeping as per SOP.
2. You have been provided with the following resources for the practical tasks:
 - 250 mL separating funnel
 - 2 Conical flasks
 - 2 Beakers

- Measuring cylinders
- Acetic acid solution (10% g/g in water equivalent to 2.27M)
- Ethyl acetate (solvent)
- Indicator (phenolphthalein)
- 0.1M NaOH for titration
- Burette (50mL)
- Pipette (25mL)
- Retort stand and clamp
- Glass rods
- plain paper
- stop watch
- Funnel
- Cleaning towels
- Latex gloves

Procedure:

1. Measure 50 mL of 10% acetic acid solution and pour into a separating funnel.
2. Add 50 mL of ethyl acetate to the separating funnel.
3. Shake gently and vent regularly to release pressure.
4. Allow the layers to separate completely.
5. Carefully collect both aqueous and organic phases in separate containers.
6. Measure and record the volumes collected for each layer in the table.
7. Pipette 10 mL from each phase into separate conical flasks.
8. Titrate each sample with standard NaOH using phenolphthalein as the indicator.
9. Record the volume of NaOH used to titrate the acetic acid concentration in each phase in table 1 below.
10. Calculate the distribution coefficient (K_D).
11. Determine the efficiency of the separation process

Phase	Volume of Sample (mL)	NaOH Used (mL)	Moles of NaOH used (0.1 M × volume of NaOH)	Acetic Acid Concentration (mol/L)
Aqueous				
Organic				

$$\text{Acetic Acid Concentration:} = \frac{\text{moles of NaOH used}}{\text{Volume of sample}}$$

Volume of Sample = volume of extracted layer titrated

$$\text{Distribution Coefficient (K}_D\text{): } \frac{C_a}{C_o}$$

Extraction efficiency

$$= \frac{C_o \times V_o}{(C_o \times V_o) + (C_a \times V_a)} \times 100$$

12. Maintain housekeeping accordi

Where:

- C_o = Concentration of acetic acid in **organic layer** (mol/L)
- V_o = Volume of organic layer (L)
- C_a = Concentration of acetic acid in **aqueous layer** (mol/L)
- V_a = Volume of aqueous layer (L)