

073206T4CHE

CHEMICAL ENGINEERING LEVEL 6

ENG/OS/CE/CR/02/6/A

Perform Process Quality Control

Nov/Dec 2024



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

PRACTICE

MENT

Time: 3 HOURS

INSTRUCTIONS TO CANDIDATE:

- a) *Do not write on the question paper.*
- b) *A separate plain paper will be provided.*
- c) *Return this paper to assessor at the end of the assessment*

This paper consists of FIVE (5) printed pages

Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing

1. You are required to perform the following tasks

Task 1: Determine the acid value of the given oil sample.

Task 2: Determine percentage of insoluble impurities in the oil sample

2. You have been provided with the following resources for the practical tasks:

a) Apparatus

- Weighing balance
- Two 250 ml conical flasks with stoppers
- 150 ml conical flask with stopper
- Two 100 ml volumetric flasks
- Measuring cylinder
- Dropper or pipette
- Burette
- Burette stand and clamp
- Hot plate
- Oven
- Glass dish with lid
- Desiccator
- Funnel
- Stopwatch
- Thermometer
- Whatman filter paper
- Labels
- Paper towel

b) Reagents

- Oil sample
- Sodium hydroxide pellets
- Ethanol
- Phenolphthalein indicator
- Distilled water
- n-hexane

c) PPE

- Pair of leather gloves
- Pair of latex gloves
- Dust mask
- Clear eye goggles

PROCEDURES

1. Task 1: Determine the acid value of the given oil sample.

a) Reagent preparation

- i) Preparation of Phenolphthalein indicator: Dissolve 2 g of Phenolphthalein indicator into 100 ml of Ethanol and mix well by shaking
- ii) Preparation of 0.1 N Sodium Hydroxide: Dissolve 0.4 g of Sodium Hydroxide Pellets into 90 ml of distilled water, allow it to cool to room temperature and top up to a final volume of 100 ml with distilled water.

b) Sample preparation

- i) Weigh 20 g of oil sample into a 250 ml conical flask
- ii) Measure 50 ml ethanol into a 150 ml conical flask
- iii) Add 2-3 drops of phenolphthalein indicator to the flask containing ethanol
- iv) Add drops of 0.1 N NaOH to the flask containing ethanol until the light pink colour solution is formed. This is to neutralize the ethanol.
- v) Add the neutralized ethanol to the flask containing the oil sample and shake to mix the solution.
- vi) Boil the mixture by placing the flask on a water bath until the sample dissolves completely.
- vii) Shake the flask periodically to facilitate the rapid dissolving of the sample in ethanol

c) Titration

- i) Fill the burette with 0.1 N NaOH solution
- ii) Note the initial burette reading
- iii) Add a 2-3 drops of phenolphthalein indicator in the prepared oil sample
- iv) Titrate the prepared oil sample with constant swirling using NaOH
- v) Stop the titration when the solution colour changes to light pink
- vi) Note the final burette reading

d) Calculation

Calculate the acid value using the formula in equation 1

N : normality of NaOH solution

2. Task 2: Determine the percentage of insoluble impurities in the oil sample

- i) Fold a Whatman filter paper, place it in a glass dish and cover with a well-fitting lid
- ii) Dry the filter paper in the hot air oven at 103 °C for 20 mins
- iii) Take out the filter paper from the oven and cool in a desiccator for 10 mins
- iv) Weigh the blank filter paper with glass dish and lid and note down the mass

- i) Shake the oil sample to make it
- ii) Weigh 20 g of oil sample into a
- iii) Add 200 ml of n-hexane to the _____ ing the test portion
- iv) Stopper the flask and shake it to mix the contents well
- v) Allow the flask to stand for 30 minutes

- i) Shake the flask containing the sample vigorously to mix the contents well
- ii) Filter the sample solution using the filter paper dried previously
- iii) Wash the residual contents of the sample flask with n-hexane into the filter paper
- iv) Warm n-hexane to 60 °C and use small amounts of it to wash any oil residue on the filter paper
- v) Ensure no oil residue is left on the filter paper except the impurities
- vi) Remove the filter paper from the funnel and place it in the glass dish
- vii) Cover the dish with a lid

d) Drying of filter paper

- i) Dry the filter paper in hot air oven at 103 °C for 20 minutes
- ii) Take out the filter paper containing the impurities from the oven and cool it in the desiccator for 10 minutes
- iii) Weigh the filter paper containing impurities with glass dish and lid

e) Calculation

Calculate the percentage insoluble impurities using the formula in equation 2.

$$\text{insoluble impurities} = \frac{m_2 - m_1}{m_s} \times 100 \quad (2)$$

m_1 : mass of blank filter paper (with dish and lid)

m_2 : mass of filter paper containing impurities (with dish and lid)

m_s : mass of the oil sample in grams

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