COURSE NAME: MME – 102 **GROUP NO.:** A1

EXPERIMENT NO.: 01

NAME OF THE EXPERIMENT:

1(c). Identification of polymers using chemical methods
1(d): Quantitative Gross Density Measurements of Polymers

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Table 01: Experimental outputs of the laboratory tests for the Identification of polymers using chemical methods

Polymer Identification Sample No.	Name of the Laboratory Tests						
	Approximate Density in Various Medium				Flame Test		
	Water	Vegetable Oil	Acetone	Isopropyl Alcohol	Color	Elasticity	Residue
01	Sink	Sink	Sink	Sink	Yellow	Elastic (Paste)	Black
02	Float	Submerge	Sink	Sink	Blue + Yellow	Elastic (Paste)	Transparent
03	Sink	Sink	Sink (Reactive)	Sink	Yellow No Flammability	Non-elastic Powder	Black
04	Float	Submerge	Sink	Sink	Blue + Yellow	Elastic	Transparent
05	Float	Float	Sink	Sink	Blue + Yellow	Elastic (Low)	Black
06	Sink	Sink	Sink (Reactive)	Sink	Yellow	Elastic (Low)	Black

Table 02: Identified Polymers

Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06
PETE: Polyethylene Terephthalate	HDPE: High Density Polyethylene	PVC: Polyvinyl Chloride	LDPE: Low Density Polyethylene	PP: Polypropylene	PS: Polystyrene

Example photographs of the polymer samples used in the experiment:

Sample 01: PETE

Sample 02: HDPE

Sample 03: PVC

Sample 04: LDPE

Sample 05: PP

Sample 06: PS

Calculation:

Weight of the empty pycnometer, W_p = 28.82 g
Weight of the pycnometer with almost half-filled sample, W_p+W_s= 34.3 g
Weight of the pycnometer with sample and filled reference liquid, $W_p+W_s+W_{pw}$= 80.5g

Weight of the reference liquid, W_{pw}= 80.5g - 34.3g = 46.2g
Weight of the solid, W_s= 34.3g - 28.82g = 5.48g
Weight of the reference liquid filled in pycnometer, W_{fw}= 78.8g - 28.82g = 49.98g

Density of liquid, $\rho_w = W_{fw} / V_p$ = 49.98g/ 50mL = 0.9996 g/mL
Volume of the liquid used to immerse the solid sample, $V_{pw} = W_{pw} / \rho_w$ = (46.2/0.9996) mL = 46.218 mL
Volume of the solid sample, $V_s = V_p - V_{pw}$= 50mL - 46.218mL = 3.782mL

Therefore, density of the solid sample, $\rho_s = W_s / V_s$ = 1.44896 g/mL

Discussion:

1. We were given the sample no. 01 during the experiment for the density calculation.

2. From the laboratory experiments followed by sinking tests in various liquids (water, oil, alcohol & acetone) and the flame tests to understand the sample's flammability, elasticity and residue properties— we were able to determine that out polymer sample was PETE (Polyethylene Terephthalate).

3. By following the calculation steps, we were able to determine the density of the solid polymer sample (PETE) which we found ρ_s = 1.44896 g/mL.

4. If we compare the determined density of PETE and the actual density of PETE, we will find a slight change in density. Which we took as an experimental error.
    a. Error analysis:
    Highest possible density of PETE, ρ = 1.39 g/mL
    Density of the solid sample, ρ_s = 1.44896 g/mL
    Error = $(\rho_s - \rho) / \rho$ = (1.44896 – 1.39) / 1.39 = 4.24%

5. Scientific reasoning of the error: As we got 4.24% error in the density calculation of the given solid polymer. We were able to predict the causes of this error:
    a. Human Error: We were supposed to follow certain instructions such as i. Filling the pycnometer almost half with the sample polymer ii. Fully fill the pycnometer with the reference liquid (water). We anticipate that, while conducting the experiment, mistakes were made.
    b. Mechanical error: We also cannot deny the probability of mechanical errors built with the weight machine.