2025 Bi H1 Q19

Section: Sustainability and Interdependence

Topic: Food Supply

Question Summary:

Pigments were separated from plant leaves using thin layer chromatography. Distances from the line of origin to each pigment spot and to the solvent front were measured, and you are asked to identify which pigment is **xanthophyll** using Rf values and a table of known pigment Rf values.

Worked Solution:

The Rf value for a pigment is calculated using:
Rf = distance moved by pigment / distance moved by solvent

Corrected distances from the line of origin (in cm):
- Line of origin: 1.0
- Pigment D: 3.0
- Pigment C: 4.5
- Pigment B: 6.5
- Pigment A: 8.4
- Solvent front: 11.0

Distance moved by the solvent front:
11.0 – 1.0 = 10.0 cm

Distance moved and Rf for each pigment:
- Pigment D: 3.0 – 1.0 = 2.0 cm → Rf = 2.0 / 10.0 = 0.20
- Pigment C: 4.5 – 1.0 = 3.5 cm → Rf = 3.5 / 10.0 = 0.35
- Pigment B: 6.5 – 1.0 = 5.5 cm → Rf = 5.5 / 10.0 = 0.55
- Pigment A: 8.4 – 1.0 = 7.4 cm → Rf = 7.4 / 10.0 = 0.74

From the table of known pigments:

- Chlorophyll b: Rf 0.20
- Chlorophyll a: Rf 0.35
- Anthocyanin: Rf 0.45
- Xanthophyll: Rf 0.55
- Phaeophytin: Rf 0.59
- Carotene: Rf 0.74

Matching our calculated Rf values:
- Pigment D (0.20) $\rightarrow$ chlorophyll b
- Pigment C (0.35) $\rightarrow$ chlorophyll a
- Pigment B (0.55) $\rightarrow$ xanthophyll
- Pigment A (0.74) $\rightarrow$ carotene

Therefore, **pigment B** is xanthophyll.

Final Answer: B (pigment B is xanthophyll).

Revision Tips:

- Rf values are ratios and must be calculated using the **distance moved by the pigment** and the **distance moved by the solvent front** from the line of origin.
- When identifying pigments, choose the table value that is closest to your calculated Rf.
- Chromatography separates pigments based on their solubility in the solvent and their attraction to the stationary phase.