

---

UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama  
Sidang Akademik 2004/2005

Oktober 2004

**IWK 301 – Proses dan Peralatan Penglitupan**  
***[Coatings Process and Equipment]***

Masa: 3 jam  
*[Duration: 3 hours]*

---

Sila pastikan bahawa kertas peperiksaan ini mengandungi TUJUH muka surat yang bercetak sebelum anda memulakan peperiksaan ini.

*Please check that this examination paper consists of SEVEN pages of printed material before you begin the examination.*

**Arahan:** Jawab **LIMA** (5) soalan.

**[Instructions:** Answer **FIVE** (5) questions.]

2. Komposisi berat untuk suatu filem alkid datar diberikan di bawah, bersama dengan data ketumpatan terguna. Keliangan keseluruhan filem adalah 5.0%V, yang berasaskan kepada filem berliang dipigmenkan. Hitungkan kepekatan isipadu pigmen (PVC), faktor terisi pigmen ( $\phi$ ), kepekatan isipadu pigmen genting (CPVC), dan kepekatan isipadu pigmen terturun ( $\Lambda$ ) untuk filem alkid datar ini, dengan menganggap keadaan unggul.

	W/g	$\rho(\text{g/cm}^3)$	V/ $\text{cm}^3$
Alkid (100% NV)	12.5	1.05	11.9
TiO <sub>2</sub> (rutil)	40.0	3.95	10.1
Talkum	7.5	2.84	2.6
CaCO <sub>3</sub> (witing)	40.0	2.71	14.8

(20 markah)

2. *The weight composition of a flat alkyd film is given below, together with applicable density data. The overall porosity of the film is 5.0% v, based on the pigmented porous film. Calculate the pigment volume concentration (PVC), pigment packing factor ( $\phi$ ), critical pigment volume concentration (CPVC), and reduced pigment volume concentration ( $\Lambda$ ) for this flat alkyd film, assuming idealized condition.*

	W/g	$\rho(\text{g/cm}^3)$	V/ $\text{cm}^3$
<i>Alkyd (100% NV)</i>	<i>12.5</i>	<i>1.05</i>	<i>11.9</i>
<i>TiO<sub>2</sub> (rutile)</i>	<i>40.0</i>	<i>3.95</i>	<i>10.1</i>
<i>Talc</i>	<i>7.5</i>	<i>2.84</i>	<i>2.6</i>
<i>CaCO<sub>3</sub> (whiting)</i>	<i>40.0</i>	<i>2.71</i>	<i>14.8</i>

(20 marks)

...4/-

3. Diberikan formulasi Alkid berikut:-

Bahan	W	E	F
Minyak soya	146	293	1
PAH	37	74	2
Gliserol	19	31	3

- Hitungkan:
- (a) Nilai-R (lebihn kumpulan -OH)
  - (b) Berat air yang dilepaskan
  - (c) Nilai  $P_{gel}$
  - (d) Berat molekul Alkid apabila  $AN = 8$

(20 markah)

3. *Given the following Alkyd formulation.*

<i>Material</i>	<i>W</i>	<i>E</i>	<i>F</i>
<i>Soya oil</i>	<i>146</i>	<i>293</i>	<i>1</i>
<i>PAH</i>	<i>37</i>	<i>74</i>	<i>2</i>
<i>Glycerol</i>	<i>19</i>	<i>31</i>	<i>3</i>

- Calculate:*
- (a) *R-value (excess of - OH group).*
  - (b) *Weight of water released.*
  - (c)  *$P_{gel}$  value.*
  - (d) *Molecular weight of Alkyd when  $AN=8$ .*

(20 marks)

...5/-

4. (a) Jelaskan SALAH SATU berikut:
- (i) Sistem warna Munsell
  - (ii) Penyardunan celup-panas
- (10 markah)
- (b) Kepantulan untuk suatu sampel cat piawai adalah 0.40 dan untuk suatu sampel bandingan adalah 0.36. Bandingkan kekuatan mewarnai untuk kedua-dua sampel ini.
- (10 markah)
4. (a) *Explain ONE of the following:*
- (i) *Munsell color system.*
  - (ii) *Hot-dip galvanizing.*
- (10 marks)
- (b) *The reflectivity of a standard paint sample is 0.40, and that of a comparison sample is 0.36. Compare their tinting strengths.*
- (10 marks)

5. Diberikan data berikut:

Resin	$\delta_1$	$\delta_2$	$\delta_3$
Polimetil metakrilat	8.9-12.7	8.5-13.3	0
Polikarbonat	9.5-10.6	9.3-9.9	0

Pelarut	Kumpulan pengikatan hidrogen	$\delta$
Etanol	3	12.7
Toluena	1	8.9
Aseton	2	9.9
Dietilformamida	2	10.6

- (i) Tentukan pelarut-pelarut untuk polimetil metakrilat dan polikarbonat.
- (ii) Cadangkan pelarut-pelarut sepunya untuk campuran resin tersebut.
- (iii) Tentukan keserasian untuk campuran kedua-dua resin.
- (iv) Jika etanol ditambahkan kepada larutan polimetil metakrilat dalam toluena, tentukan isipadu maksimum etanol yang boleh ditambah sebelum polimer memendak.

(20 markah)

5. Given the following data.

Resin	$\delta_1$	$\delta_2$	$\delta_3$
Polymethyl methacrylate	8.9-12.7	8.5-13.3	0
Polycarbonate	9.5-10.6	9.3-9.9	0

Solvent	Hydrogen bonding group	$\delta$
Ethanol	3	12.7
Toluene	1	8.9
Acetone	2	9.9
Diethylformamide	2	10.6

- (i) Determine the solvents for polymethyl methacrylate and polycarbonate.
- (ii) Suggest the common solvents for the mixture of the above resins.
- (iii) Determine the compatibility of the mixture of the two resins.
- (iv) If ethanol is going to be added to a solution of polymethyl methacrylate in toluene, determine the maximum volume of ethanol that can be added before the polymer precipitates.

(20 marks)