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UNIVERSITI SAINS MALAYSIA

First Semester Examination  
2009/2010 Academic Session

November 2009

**IMK 421 – Primary Products Technology**  
***[Teknologi Produk Primer]***

Duration: 2 hours  
*[Masa: 2 jam]*

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

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi SEMBILAN muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

**Instructions:** Answer **FOUR** (4) questions. You may answer the questions either in Bahasa Malaysia or in English.

**Arahan:** *Jawab **EMPAT** (4) soalan. Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]*

In the event of any discrepancies, the English version shall be used.

*[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.]*

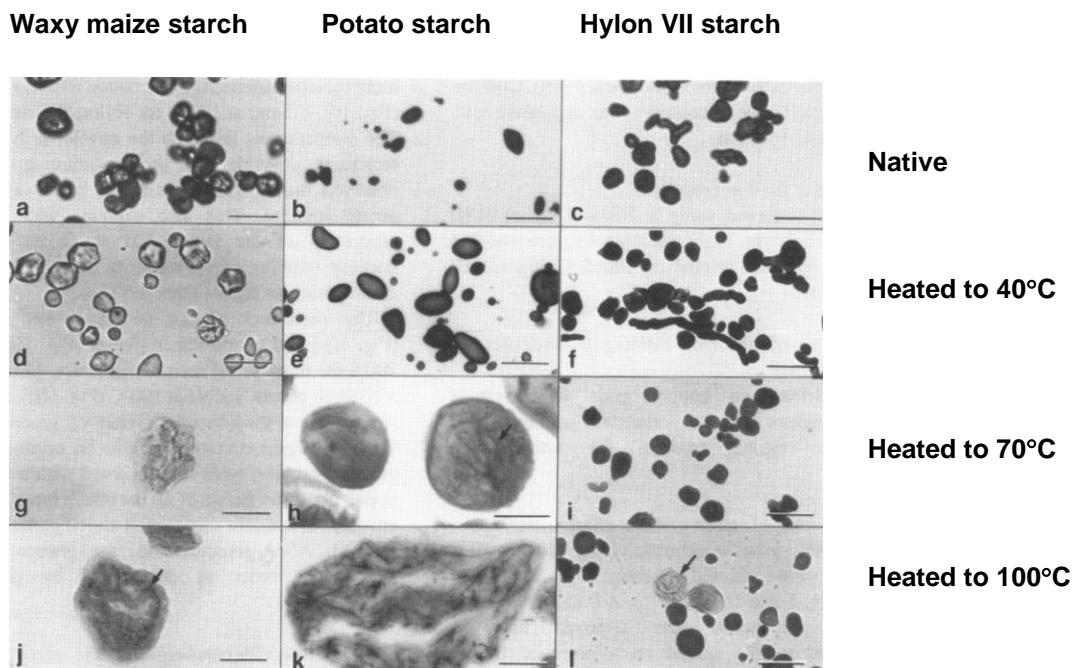
1. Answer all parts of the following question:

- (a) How do minor components such as protein, phosphorous and lipids influence the physical properties of a starch paste?

(5 marks)

- (b) Figure 1 shows the morphology of starch granules when waxy maize, potato, and Hylon VII starches were heated at different temperatures. Give a brief comment on the observed changes.

(6 marks)



**Figure 1.** Micrograph showing morphological changes of starch granules during heating.

- (c) By giving appropriate examples, explain the differences in starch gelatinization in limited water content and in excess water content systems.

(6 marks)

- (d) Table 1 shows the effect of sugar at different concentrations on the gelatinization temperature of starch. Why such trend is observed? If the sugar content in starch-based product is > 60%, explain how complete starch gelatinization can be achieved.

**Table 1.** Effect of sugar (sucrose) on starch pasting temperature.

Sugar (% w/w)	10	20	30	40	50	60
Pasting temperature (°C)	72	80	86	90	98	110

(8 marks)

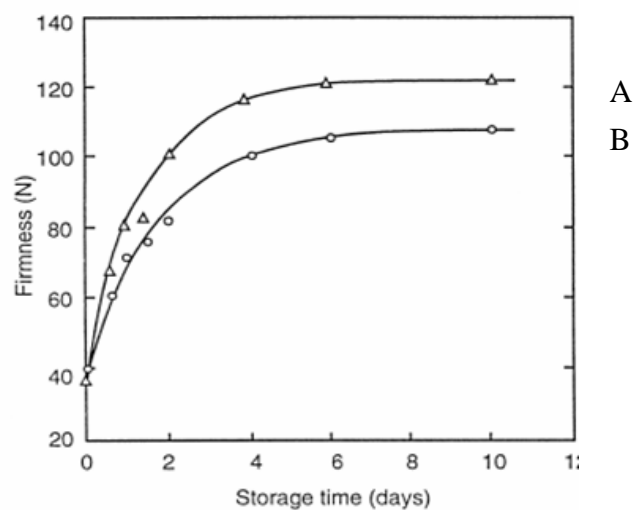
2. Answer all parts of the following question:

- (a) Briefly explain the effect of following factors on the rate and extent of starch gelatinization

- (i) starch concentration
- (ii) temperature
- (iii) sucrose
- (iv) emulsifiers

(10 marks)

- (b) Figure 2 shows the changes in the firmness of bread (bread A and B) during storage. Briefly explain the changes with respect to the starch component and why such profile was observed. Why is different profile in bread firmness observed for bread A and B?



**Figure 2.** The changes in the firmness of bread (bread A and B) during storage.

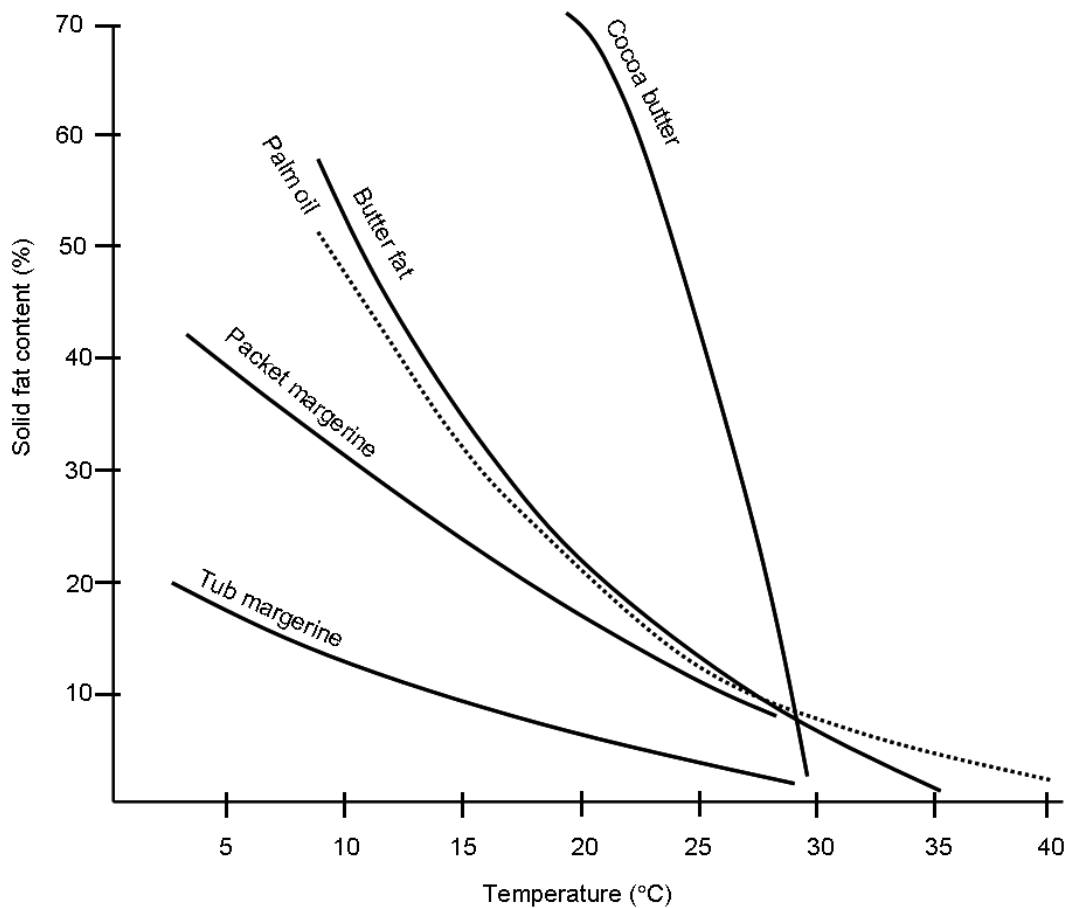
(5 marks)

(c) By giving appropriate examples, discuss how you would select suitable types of modified starch for

- (i) frozen starch-based food products
- (ii) canned foods.

(10 marks)

3. Answer all parts of this question:



**Figure 3.** The solid fat content profiles of several fat products at different temperatures.

(a) Define “solid fat content” (SFC) and “solid fat index”. List four (4) methods that can be used to achieve the desired SFC profile.

(6 marks)

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- (b) Oils/fats blending is frequently used in the fats and oils industries. By giving appropriate examples, discuss the rationale of this operation.  
(6 marks)
- (c) Figure 3 shows the solid fat content profiles of several fat products. Explain why such profile was observed. How does it relate to plasticity?  
(8 marks)
- (d) Why palm oil and palm kernel oil are suitable raw material for producing cocoa butter equivalents?  
(5 marks)
4. Answer all parts of this question:
- (a) Give two (2) principal reasons for fractionating oils/fats. Explain the principles of physical fractionation of oils/fats.  
(7 marks)
- (b) Explain the differences between hydrogenation and interesterification for oils/fats modification. Explain the meaning of “selectivity” in the hydrogenation process.  
(10 marks)
- (c) Discuss the physical and chemical changes during deep fat frying.  
(8 marks)
5. Write short notes on the followings:
- (a) Low viscosity modified starches and their applications  
(10 marks)
- (b)  $\beta'$ - and  $\beta$ -tending fats  
(5 marks)
- (c) Cocoa butter equivalent (CBE) and cocoa butter substitutes (CBS)  
(10 marks)

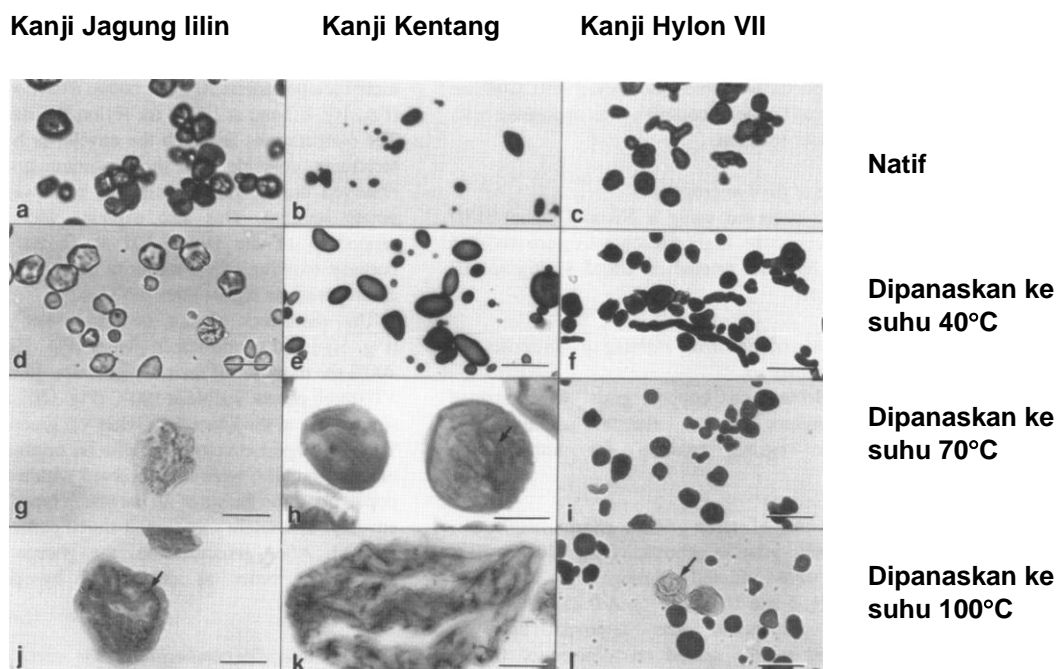
1. Jawab semua bahagian soalan berikut:

- (a) Bagaimanakah komponen minor seperti protein, fosforus dan lipid boleh mempengaruhi sifat-sifat fizikal pes kanji?

(5 markah)

- (b) Figure 1 menunjukkan perubahan morfologi granul kanji jagung lilin, kentang dan Hylon VII apabila dipanaskan pada suhu yang berbeza. Beri ulasan ringkas mengenai perubahan yang diperhatikan.

(6 markah)



**Rajah 2.** Mikrograf yang menunjukkan perubahan morfologi granul kanji semasa pemanasan.

- (c) Dengan memberikan contoh-contoh yang sesuai, terangkan perbezaan antara gelatinisasi kanji di dalam air yang terhad dan air yang berlebihan.

(6 markah)

- (d) *Jadual 1 menunjukkan kesan kepekatan gula (sukrosa) terhadap suhu pempesan kanji. Mengapakah tren sedemikian diperhatikan? Jika kandungan gula dalam produk berasaskan kanji > 60%, bagaimanakah tahap gelatinisasi yang lengkap dapat dicapai?*

**Jadual 1.** *Kesan kepekatan gula (sukrosa) terhadap suhu pempesan kanji.*

<i>Gula (% w/w)</i>	10	20	30	40	50	60
<i>Suhu pempesan (°C)</i>	72	80	86	90	98	110

(8 markah)

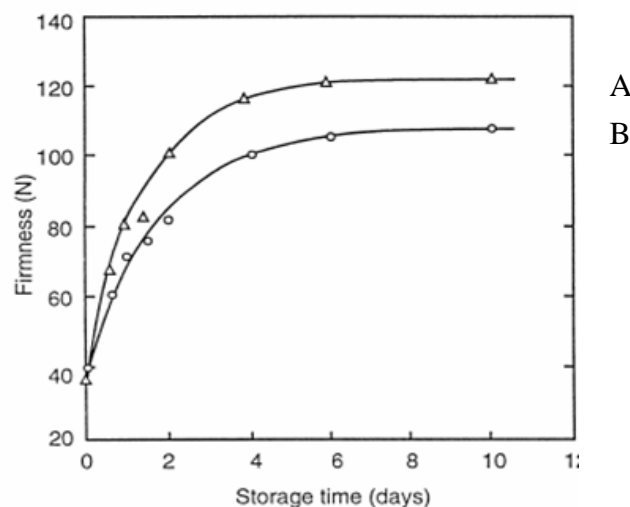
2. *Jawab semua bahagian soalan berikut:*

- (a) *Terangkan secara ringkas pengaruh faktor-faktor berikut terhadap kadar dan tahap retrogradasi kanji*

- (i) *kepekatan kanji*
- (ii) *suhu*
- (iii) *sukrosa*
- (iv) *pengemulsi*

(10 markah)

- (b) *Rajah 2 menunjukkan perubahan dalam kekerasan roti (roti A dan B) semasa penstoran. Jelaskan perubahan yang berlaku terhadap komponen kanji dan mengapa profil sedemikian diperhatikan. Mengapa terdapat perbezaan profil kekerasan bagi roti A dan roti B?*



**Rajah 2.** *Perubahan dalam kekerasan roti (roti A dan B) semasa penstoran.*

(5 markah)

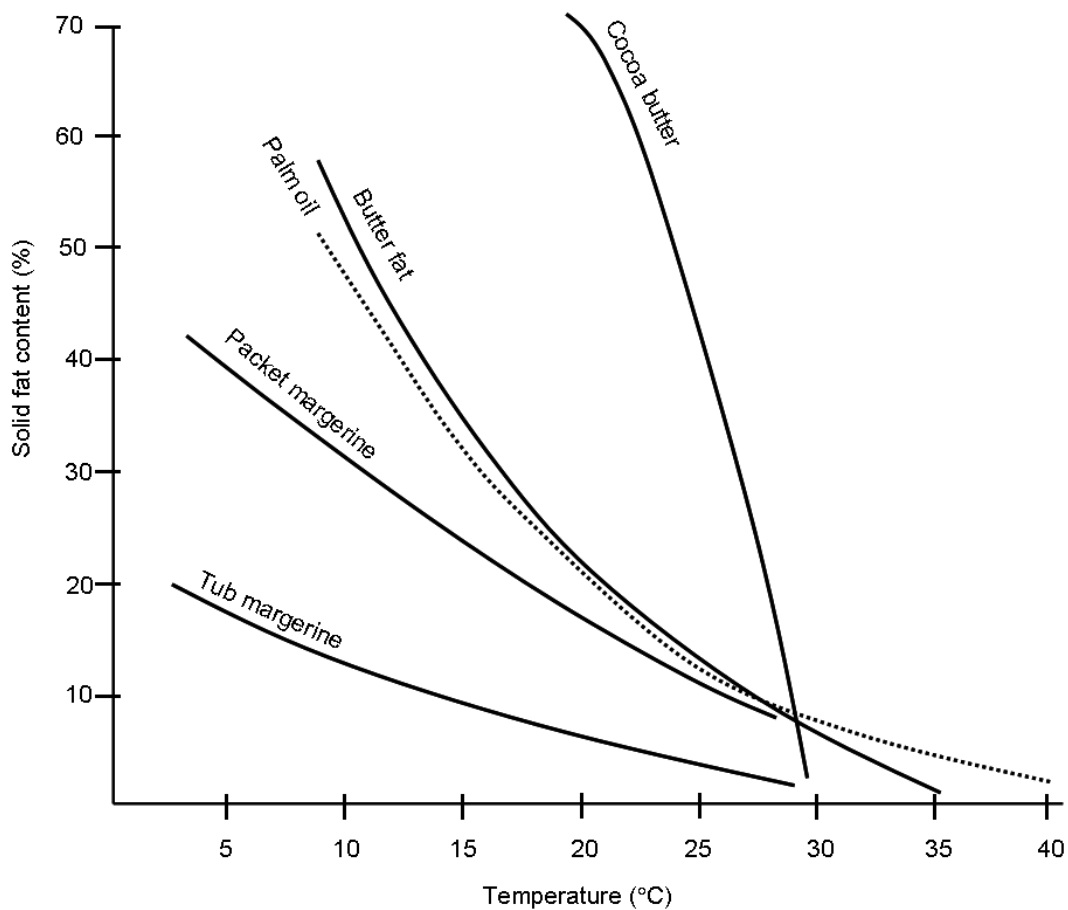
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(c) Dengan memberikan contoh-contoh yang sesuai bincangkan kriteria pemilihan kanji terubahsuai yang sesuai bagi

- (i) produk makanan berasas kanji tersejukkbeu
- (ii) makanan berkaleng.

(10 markah)

3. Jawab semua bahagian soalan berikut:



**Rajah 3.** Kandungan lemak pepejal dalam beberapa jenis produk lemak pada suhu yang berlainan.

(a) Takrifkan “kandungan lemak pepejal” (SFC) dan “indeks lemak pepejal” (SFI). Senaraikan empat (4) kaedah yang boleh digunakan untuk mencapai profil SFC yang diinginkan.

(6 markah)

(b) Percampuran minyak kerap digunakan dalam industri minyak dan lemak. Dengan memberikan contoh-contoh yang sesuai, bincangkan rasional operasi ini.

(6 markah)

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- (c) *Rajah 3 menunjukkan profil kandungan lemak pepejal bagi beberapa jenis produk lemak. Terangkan mengapa profil sedemikian diperhatikan. Apakah kaitannya dengan sifat keplastikan?*  
(8 markah)
- (d) *Mengapakah minyak sawit dan minyak kernel sawit merupakan bahan mentah yang sesuai digunakan untuk menghasilkan mentega koko setara?*  
(5 markah)
4. *Jawab semua bahagian soalan berikut:*
- (a) *Beri dua (2) sebab utama untuk proses fraksinasi minyak/lemak. Terangkan prinsip fraksinasi minyak/lemak.*  
(7 markah)
- (b) *Terangkan perbezaan antara penghidrogenan dan interesterifikasi bagi modifikasi minyak/lemak. Terangkan maksud "selectivity" dalam proses penghidrogenan.*  
(10 markah)
- (c) *Terangkan perubahan fizikal dan kimia yang berlaku semasa proses penggorengan.*  
(8 markah)
5. *Tulis catatan ringkas mengenai perkara-perkara berikut:*
- (a) *Kanji terubahsuai berkelikatan rendah dan aplikasinya*  
(10 markah)
- (b) *Lemak " $\beta$ '- and  $\beta$ -tending"*  
(5 markah)
- (c) *Lemak koko setara (CBE) dan lemak koko pengganti (CBS)*  
(10 markah)