
UNIVERSITI SAINS MALAYSIA

Supplementary Semester Examination
Academic Session 2008/2009

June 2009

IMK 209 – Physical Properties of Food
[Sifat-sifat Fizikal Makanan]

Duration: 2 hours
[Masa: 2 jam]

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

Answer **FOUR** questions. All questions can be answered in Bahasa Malaysia OR English.

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

*Jawab **EMPAT** soalan. Semua soalan boleh dijawab dalam Bahasa Malaysia ATAU Bahasa Inggeris.]*

1. Answer all parts of this question.

(a) “The presence of a significant yield stress will impart various qualities to a fluid that may or may not be desirable”. Discuss this statement in the context of food applications by giving appropriate examples.

(10 marks)

(b) Explain the significance of shear thinning and thixotropic behavior in food applications (processing, formulation, sensory properties).

(10 marks)

(c) **Figure 1** shows the flow curves for three samples of margarine spread with different fat contents. Power Law model was fitted to calculate the consistency index (K) and Power Law index (n). Explain the important characteristics of the flow curves of the three samples.

(5 marks)

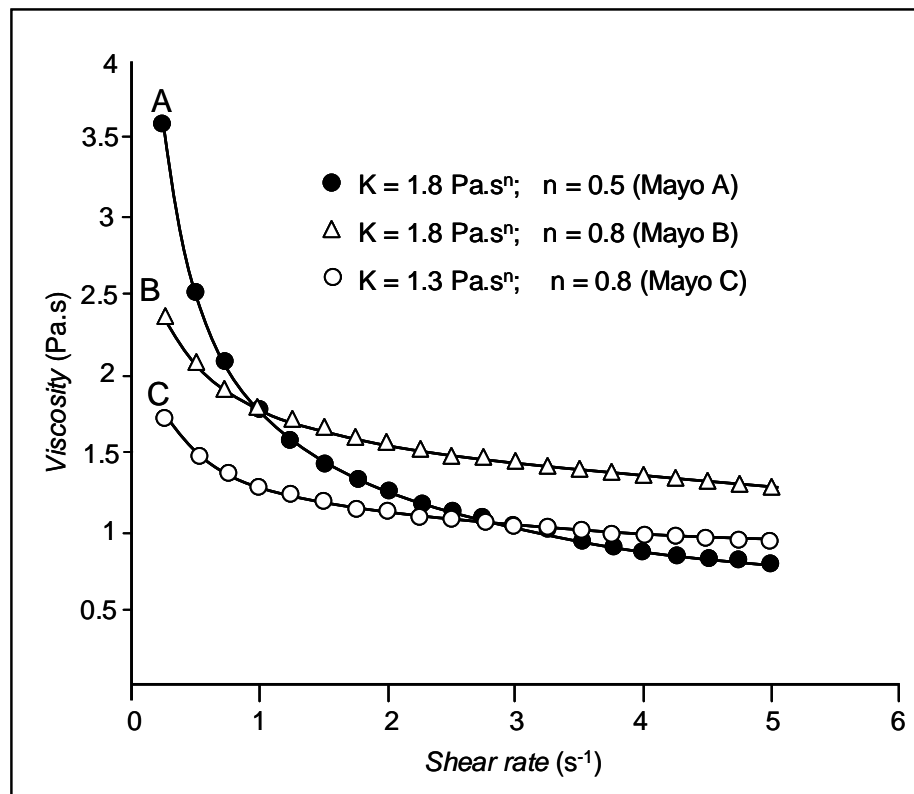


Figure 1

2. Answer all parts of this question.

(a) What is secondary nucleation? Give examples of food processing whereby secondary nucleation need to be limited/controlled. Explain the reasons for controlling secondary nucleation in such systems.

(10 marks)

(b) List the processes and products whereby (i) large number of fine crystals is desirable and (ii) small number but coarse crystals is desirable.

(10 marks)

(c) Briefly, explain how the case in (b)(i) can be achieved.

(5 marks)

3. Answer all parts of this question.

(a) Explain the DLVO theory. Based on this theory, explain the stabilization of an emulsion system through electrostatic stabilization.

(10 marks)

(b) Explain the phenomenon of creaming and methods of preventing destabilization of emulsion through this phenomenon.

(5 marks)

(c) Explain the role of an emulsifying agent and stabilizer in the stabilization of an emulsion.

(10 marks)

4. Answer all parts of this question.

(a) What is meant by “glassy state” in a food system? By using a diagram, explain the physical changes when a glassy amorphous material transform into a crystalline state?

(10 marks)

(b) By using glass transition concept and a state diagram, discuss the following phenomena that can affect the quality of food products:

(i) keropok (a type of crispy snack food) become soggy when exposed to air at ambient temperature;

(ii) caking of food powder

(15 marks)

5. Write a short note on the following topics:

(a) Foam stability

(10 marks)

(b) Method to prevent crystallization (for product that does not require crystal formation)

(10 marks)

(c) Flow curve and its significance

(5 marks)

1. Jawab semua bahagian soalan berikut.

(a) “Nilai tegasan yil (yield stress) yang signifikan akan memberikan pelbagai kualiti yang tertentu terhadap suatu bendalir yang mana ini mungkin dikehendaki atau tidak dikehendaki”. Bincangkan kenyataan ini dalam konteks aplikasi makanan dengan memberi contoh-contoh yang sesuai.

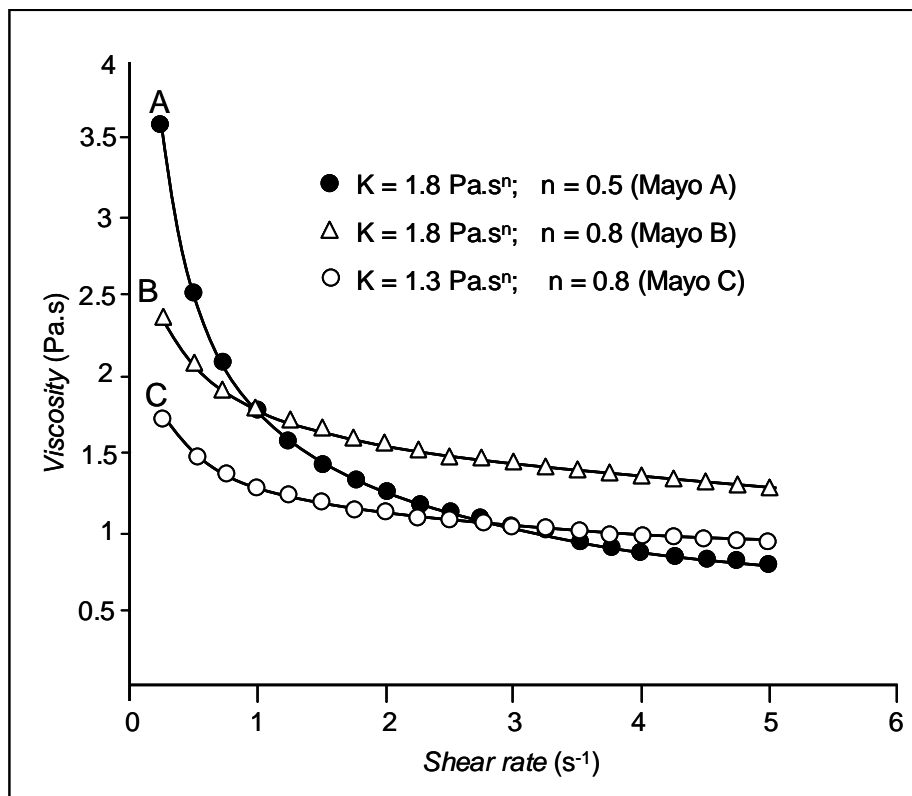
(10 markah)

(b) Terangkan kepentingan sifat-sifat penipisan ricih (shear thinning) dan tiksotropi (thixotropic) dalam aplikasi makanan (pemprosesan, formulasi, sifat-sifat sensori).

(10 markah)

(c) **Rajah 1** menunjukkan kurva aliran bagi tiga jenis sampel margarine spread yang mempunyai kandungan lemak yang berbeza. Model Hukum Kuasa (Power Law Model) telah digunakan bagi menghitung indeks kekonsistenan (K) dan indeks Model Kuasa (n). Beri ulasan tentang ciri-ciri utama kurva aliran bagi ketiga-tiga sampel tersebut.

(5 markah)



Rajah 1

2. *Jawab semua bahagian soalan berikut.*

(a) *Apakah maksud nukleasi sekunder (secondary nucleation)? Beri contoh-contoh pemprosesan makanan yang mana proses nukleasi sekunder ini cuba dihadkan/dikawal. Mengapa perlu dihadkan?*

(10 markah)

(b) *Senaraikan proses-proses atau produk-produk makanan di mana (i) bilangan hablur halus yang banyak dikehendaki dan (ii) bilangan hablur yang sedikit tetapi kasar dikehendaki.*

(10 markah)

(c) *Secara ringkas, terangkan bagaimana kes (b)(i) di atas dapat dicapai.*

(5 markah)

3. *Jawab semua bahagian soalan berikut.*

(a) *Terangkan mengenai teori DLVO dan aplikasi teori ini dalam menerangkan penstabilan sistem emulsi melalui penstabilan elektrostatik.*

(10 markah)

(b) *Terangkan mengenai fenomena penkriman (creaming) dan cara-cara bagi menghalang penyahstabilan emulsi melalui fenomena ini.*

(5 markah)

(c) *Terangkan peranan bahan pengemulsi dan penstabil dalam penstabilan emulsi.*

(10 markah)

4. *Jawab semua bahagian soalan berikut.*

(a) *Apakah yang dimaksudkan dengan “keadaan berkaca” bagi suatu sistem makanan? Dengan bantuan gambarajah, terangkan perubahan keadaan fizikal suatu bahan amorfus berkaca kepada keadaan berhablur?*

(10 markah)

(b) Dengan menggunakan konsep suhu peralihan kaca dan bantuan gambarajah keadaan (state diagram), bincangkan fenomena berikut yang boleh menjejaskan kualiti produk makanan:

(i) keropok menjadi lemau apabila didedahkan kepada udara pada suhu ambien

(ii) pengkekan (caking) makanan berbentuk serbuk

(15 markah)

5. Tulis catatan ringkas mengenai perkara-perkara berikut:

(a) Kestabilan busa

(10 markah)

(b) Kaedah untuk menghalang penghabluran (bagi produk yang tidak memerlukan pembentukan hablur)

(10 markah)

(c) Kurva aliran dan kepentingannya

(5 markah)