Paper ID # 29 **Effect of Drying Temperature on the Dehydration Kinetic and Rehydration Characteristic of Dried Potato**

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Drying of food material is aimed to reduce the moisture content to a certain level where the decay due to microbial activity can be prevented. While, most of dehydrated product are usually rehydrated during their use. The purpose of this study was to determine the effect of air temperature on the dehydration kinetics and the rehydration characteristic of dried potato. The moisture diffusivity during the dehydration and the rehydration characteristic of the dried potato, which was represented by the rehydration ratio, were used as the main observed parameters. The dehydration process was performed in laboratory scale electrically heated hot air convective dryer. Thin layer of potato slice was dried using hot air at temperature of 50, 60, 70, 80 and 90 °C. While the rehydration process of potato slices and powder was conducted in a 50 ml beaker glass at room temperature. The research result showed that the moisture diffusivity during dehydration process increased with increasing the hot air temperature. Its ranging from 2.03 x 10-8 m^2/s for air temperature of 50 °C up to 5.07 x 10-8 m^2/s for air temperature of 90 °C. The rehydration of potato was characterized by a diffusion controlled process and the existence of a rapid water absorption rate in early/primary phase followed by a secondary phase of much slower transfer rate.

Keywords: dehydration; drying; effective diffusivity; potato; rehydration

1 Introduction

Upto nowdays, food and agriculture sector remains the key priority sector to accelerate economic development in many developing countries including Indonesia. It ensures food security, alleviates poverty, and conserves the natural resources toward sustainable development. Potato (*Solanum tuberosum* L) is one of the world's major food after rice, wheat and maize. Besides constituting an expressive carbohydrate source, it is still rich in vitamins, minerals, and essential bioactive compounds that are important for the human body. In Indonesia, as consequence of the population and country economic growth, the market demand of potato is continuously growing, then it gets priority to be developed. In 2011, the national production of potato was about 1 million tons [1].

Unfortunately, after harvesting the quality of potato will deteriorates during long time storage. Then, preservation the fresh potato to the product which stands for long time storage is one of the attractive choices to increase the added value of potato product. Dehydration of potato as slices to produce dried potato chips or flour, which was produced from freshly harvested potato by drying, becomes one of the promising alternatives. Moisture removal from food materials, which was known as drying or dehydration, is an important step in food processing industries, especially in post harvest treatment of agricultural products. Basically, dehydration process is the removal of water from the material to a certain level at which microbial spoilage is avoided [2].

Dehydrated products are usually rehydrated during their use. Rehydration, which is a complex process aimed at the restoration of raw material properties when dried material comes in contact with water, can be considered as a measure of the injury to the material caused by drying and treatment preceding dehydration. Generally, the objective of rehydration study is to obtain products with as much as original textural characteristics and as fast as possible. Rehydration cannot be simply treated as the reverse process of dehydration [3]. Rehydration characteristics are used as a parameter to determine quality of dehydrated products. Rehydration typically composes of three simultaneous processes: the imbibitions of water into dried material, the swelling of the rehydrated products and the leaching of soluble. The wide variety of dehydrated foods, which are available today to the consumers and the concern for meeting quality specifications and conserving energy, emphasize the need for a thorough understanding of the rehydration processes in an objective of optimizing the processes [4]. The study of the rehydration kinetics would be very useful to optimize the process variables. Moreover, from a processing and engineering point of view, it is interesting not only to know how fast the absorption of water can be accomplished, but also how the soaking time under given conditions can be predicted [5]. The wide variety of dehydrated potato products available today (potato slices, granules, flakes and flour) and then a more intensive research is needed to improve the product quality, to develop an efficient production process and to minimize the cost of production. [6]. The purpose of this study was to determine the effect of air temperature on the dehydration kinetics and the rehydration characteristic of dried potato.

2 Materials and Methods

2.1 Raw Material

Freshly harvested potato were purchase at local market and used in all experiments. After peeling, the potato were cut into slices 2 mm thick, 40 x 40 mm^2 rectangular flat surface and then undergo drying process.

2.2 Dehydration Methode

The potato slices were subjected to a stream of hot air at desired temperature in a convective hot air dryer (Memmert UFE 600, Schwabach, Germany). To quantitatively measure the dehydration rate, the sample weight was detected every 10 minutes. The dehydration was stopped when the equilibrium moisture content was reached which was indicated by constant weight of sample. The sample was then put in an oven at 105 ^oC overnight to measure the bone dry weight. The dehydration was performed at hot air temperature variation of 50, 60, 70, 80, and 90 ^oC.

2.3 Rehydration Characteristic

Dried potato slices of known weight were submerged in 50 ml beaker glass containing distilate water. The slices were then removed, drained for 30 s, and weighed. Samples were removed after 20, 60, 80, 100, 120, 140, and 160 minutes. Triplicate measurements were performed and the means were calculated for each sample. Similar rehydration processes were performed for dried potato powder. Potato powder were obtained by crushing the dried potato slices using a laboratory scale grinder. Powder which passes 70 mesh sieve were collected for rehydration experiment.

One of the rehydration characteristics, which is usually evaluated for dehydrated foods, is rehydration ratio (RR) [7]. The rehydration ratio was calculated by (1) and was expressed as g absorbed water/g d.m.

$$RR = X_{rh} - X_{dr} \qquad (1)$$

Where:

X_{rh} moisture content of the sample after the rehydration process (g water/g d.m.)

X_{dr} moisture content of the sample after the hydration process (g water/g d.m.)

2.4 Measurenment Bulk Density of Powder

The potato powder, which were passed 70 mesh screen, were poured into a known weight 10 ml graduated glass and then weighed. The potato powder is poured in such a way that its volume can be determined directly from the reading of existing scale of the glass cylinder. Bulk density of the potato powder was then calculated by dividing the mass by its volume. The measurement was performed triplicate and displays the average value.

3 Theory

3.1 Kinetic of Dehydration

There are four transfer mechanisms which usually intervene during the dehydration process; they are: 1) Heat transfer from outside towards the product surface; the energy can be generally brought by contact, convection, or radiation, 2) Heat transfer within the product; the energy is transmitted by conduction, 3) Water transfer within the product; it is carried out either in liquid (by various process including capillarity and molecular diffusivity; the driving force is the gradient of water content) and / or vapour phase (the driving force is the gradient of the partial pressure of vapour), 4) Vapour transport from the surface towards outside. Energy exchange to the product surface result in constant rate drying period and proceed in very short time [2]. Then, especially for biomaterials, during almost overall drying process, the water transfer takes place within the product that results in falling rate of drying.

By assuming that external heat and mass transfers do not limit the overall rate operation and that there are adequate air flow temperature and velocity, only internal transfers are considered as controlling the processes. Considering the resistance of involved transport phenomenon, simplification was made by assumed that, when mass transfer is much slower than conductive heat transfer within the product, the drying kinetics is controlled by mass transport of water within the granule; this is the case of numerous biopolymers [8]. The process is then described by a first stage of superficial interaction followed by a diffusion Fick-type's law within the material; Allaf's formulation is generally used: [9]

$$\frac{\rho_w}{\rho_m}(\vec{v}_w - \vec{v}_m) = -D_{eff}\ \vec{grad}\frac{\rho_w}{\rho_m} \qquad (2)$$

where:

ρ_w apparent density of water in the material (kg.m-3)

ρ_m apparent density of dry material (kg.m-3)

v_w absolute velocity of water flow within the porous medium (m.s-1)

v_m absolute velocity of solid medium (m.s-1)

D_{eff} effective diffusivity of water within the solid medium (m^2.s-1)

Neglecting effects of possible shrinkage, and with the hypothesis of constant effective diffusivity during drying, Fick's second law becomes for 1-D:[2]

$$\frac{\partial \rho_w}{\partial t} = \left[D_{eff} \frac{\partial^2 \rho_w}{\partial r^2} \right] \quad (3)$$

The effective diffusivity D_{eff} is considered as constant because of the constant temperature during drying. This constant D_{eff} assumption was made at the studied range of moisture content. In this research, the change in the potato structure was also regarded as having insignificant impact on the value of effective diffusivity. Different mathematical solutions have been proposed for this equation, depending on the initial and boundary conditions [10]; in our study, we can adopt the solution given by Crank, according to the geometry of the solid matrix [11]; by expressing the amount of water in the solid as moisture ratio (MR),

$$MR = \frac{X - X_e}{X_0 - X_e} \quad (4)$$

Where X is the water content dry basis at any time, X_e is the amount of X at equilibrium (time➔◎) and X_0 is the value of X at time = 0. For a slab geometry form, (3) becomes:

$$MR = \frac{8}{\pi^2} \sum_{n=0}^{\infty} \frac{1}{(2n+1)^2} \exp\left(-\frac{(2n+1)^2 \pi^2 D_{eff} t}{4L_0^2} \right) \quad (5)$$

Where D_{eff} is the effective diffusivity (m2/s); L_o is the thickness of slab (m), and t is time (s). For long drying period, Eq. (4) can be further simplified to only the first term of series [10,12]. Thus (5) is written in logarithmic form as follows:

$$\ln MR = \ln \frac{8}{\pi^2} - \frac{\pi^2 D_{eff} t}{4L_0^2} \quad (6)$$

Diffusivities are typically determined by plotting experimental drying data in term of ln MR versus drying time t in (6), the plot gives a straight line with a slope as follows:

$$Slope = \frac{\pi^2 D_{eff}}{4L_0^2} \quad (7)$$

3.2 Activation Energy

The temperature dependency of the effective diffusivity was generally expressed by the following Arrhenius-type equation (8), and temperature has more significant effect over the drying process rather than the initial moisture content of the product [13].

$$D_{eff} = D_o \exp\left(-\frac{E_a}{RT}\right) \qquad (8)$$

Where E_a is the activation energy of the moisture diffusion (kJ/mol); D_0 is the Arrhenius factor equivalent to the diffusivity at infinitely high temperature (m^2/s); *Deff* is the moisture effective diffusivity (m^2/s); *R* represents the universal gas constant (=8.314 J/mol/K) and *T* is the absolute temperature (K).

4 Results and Discussion

4.1 Dehydration Profile

The global dehydration profile of potato slices at various hot air temperature, from the lowest air temperature of 50 °C up to 90 °C, was shown on Fig. 1. Since, the initial moisture contents of the potato slices used in dehydration experiments were relatively constant (average value: 5.2 g water/ g d.m.), then the dehydration time obtained at this present study inversely proportional to the average dehydration rate.

It could be seen from Fig. 1 that the higher hot air temperature resulted in the shorter dehydration time. It mean that in the falling rate of convective drying process the temperature of the air take a significant role in the case of increasing the rate of dehydration process. Since during the falling rate periode of drying the dehydration kinetics is controlled by mass transport of water within the granule, it indicated there is a correlation between dehydration temperature and the diffusion resistance of water within solid granule.

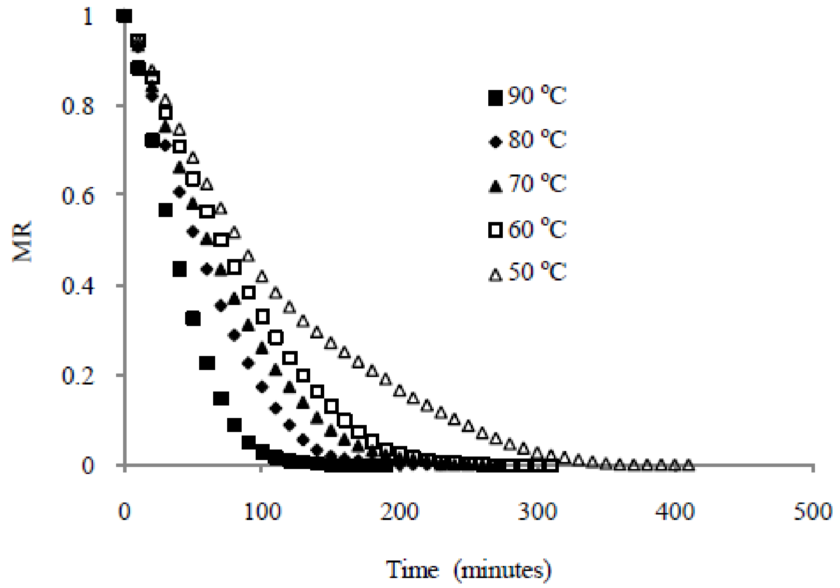

Figure 1 Dehydration profile expressed as moisture ratio as function of dehydration time

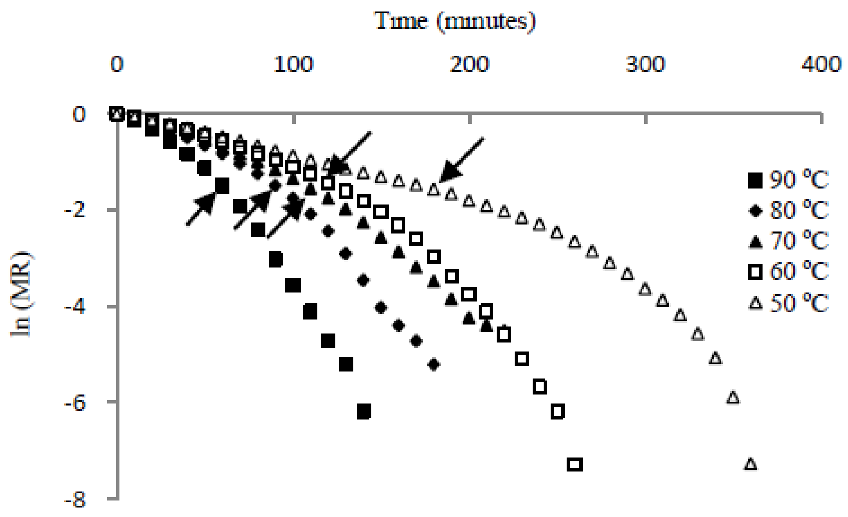

Figure 2 Dehydration profile expressed as logarithmic of the moisture ratio as function of dehydration time

4.2 Effect of Temperature on D_{eff}

The logarithmic of moisture ratio as a function of time was shown on Fig. 2. Referring to the correlation as was expressed in (6), which was derived for dehydration by one side only, straight line should be displayed. In this work, during the dehydration, the potato slices were placed on a tray in an convective oven so that evaporation occurs only on the upper surface of the potato slices. Observations during the experiment, however, found the transformation of the potato slices into curvature shapes, which was started at the point indicated by the arrows as was shown on Fig. 2. Starting from that point potato pieces constantly changing its form towards the greater curvature of the surface. In these conditions the evaporation does not only happen on one side of the upper surface of the potato pieces, but also occurs from the bottom surface of the slices. As a result, a straight line as formulated in (6) cannot be met and deviations were shown by the increasing gradient curves due to increased surface of evaporation.

The dehydration profile before shape transformation was shown on Fig. 3 which satisfied the correlation (6).

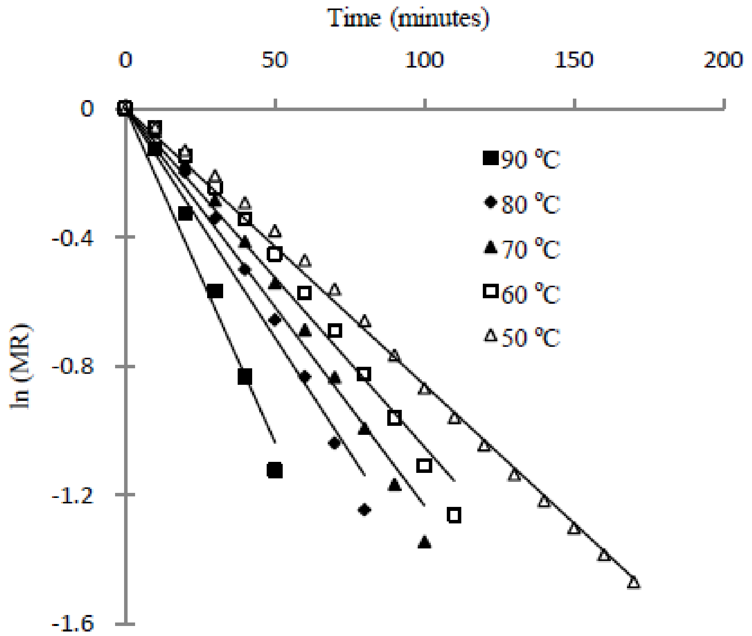

Figure 3 Dehydration profile expressed as logarithmic of the moisture ratio as function of dehydration time before shape transformation

Table 1 Moisture Effective Diffusivity

Hot air temperature (°C)	Moisture effective diffusivity, D_{eff} (m^2/s)
50	2.03 x 10^{-08}
60	2.54 x 10^{-08}
70	3.04 x 10^{-08}
80	3.55 x 10^{-08}
90	5.07 x 10^{-08}

The moisture effective diffusivity, calculated from (7) using the slope of straight lines shown on Fig. 3, was tabulated on Table 1. The result showed that the moisture effective diffusivity increased with increasing hot air temperature, ranging from 2.03 x 10^{-08} m^2/s up to 5.07 x 10^{-08} m^2/s for increasing the air temperature from 50 °C up to 90 °C. Since the overall dehydration rate was controlled by moisture diffusivity within solid granules, these results also explained the shortening of the dehydration time when the air temperature was raised, as shown in the dehydration profile Fig. 1. The obtained moisture diffusivity was comparable with the value reported by different authors which were obtained at hot air temperature 60 °C: 3.840 x 10^{-08} m^2/s [14], 8.310 x 10^{-08} m^2/s [15], and 2.553 x 10^{-08} m^2/s [16].

4.3 The Activation Energy

Activation energy is the energy needed to initiate mass diffusion in food [17]. The plot logarithmic of moisture diffusivity versus the reciprocal of absolut temperature was shown on Fig. 4. The parameters of D_o and E_a in (8) were determined by a least squares method using the obtained effective moisture diffusivity. The calculated constants were D0 = 5.05 x 10^{-5} m_2/s and Ea = 21.06 kJ/mol. By obtaining the linear regression coefficient r_2=0.97, it was confirmed that an Arrhenius-equation was applicable for the relationship between the effective moisture diffusivity Deff and the absolute temperature T for potato.

The obtained activation energy is similar to those given in the literature for dehydration of different foods: between 13.2 – 15.1 kJ/mol for mango and between 12.1 – 15.4 kJ/mol for cassava [18] ; 18.0 kJ/mol for olive cake [19]; 26.4 kJ/mol for onion [20]; 28.4 kJ/mol for carrots [21]; 26.2 kJ/ mol for broccoli [22]; 46. kJ/mol for rose hip fruits [23]; 12.3–39.5 kJ/mol for potatos and beans, respectively [24]; 41.95 kJ/mol for Red chilli [25]; 30.79 kJ/mol for pistachio nuts [26]; 35.4 kJ/mol for green bean [27]; 57.0 KJ/ mol for prunes [28]; 20.0 kJ/mol for potatos [29]; 27.6 kJ/mol for corn [30]; 49.0 – 54.0 for grape [31]; and 28.8 kJ/mol for soybean [32].

At any dehydration process, the activation energy barrier must be overcome to activate moisture diffusion. It is the reason why dehydration at higher temperature would be beneficial to increase the dehydration rates by increasing moisture diffusion [26].

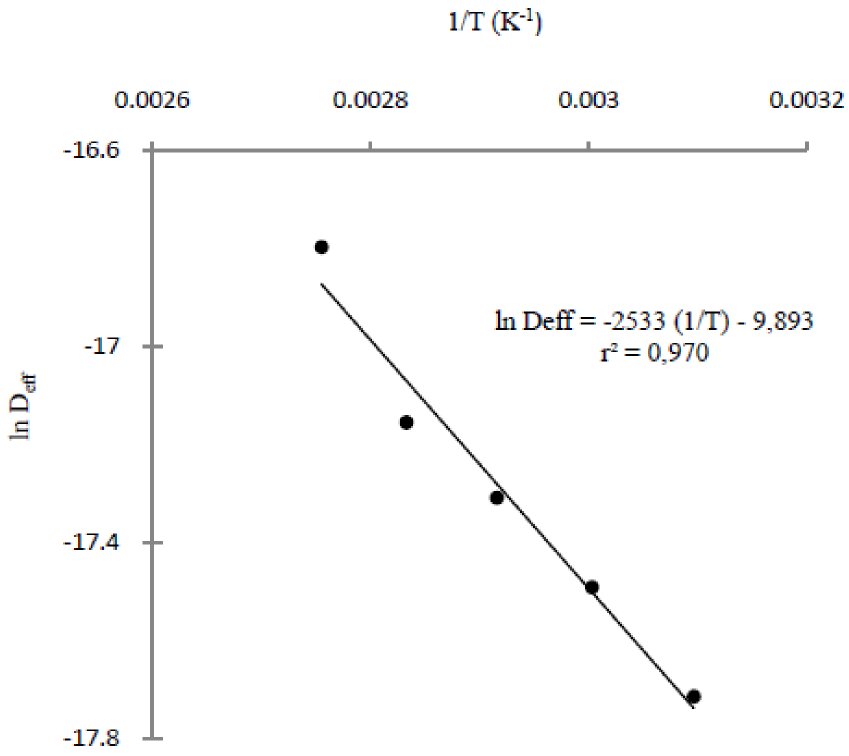

Figure 4 Plot of the logarithmic of moisture diffusivity versus the reciprocal of absolut temperature

4.4 The Rehydration Characteristic

Evolution of water absorption during rehydration of potato dehydrated at various temperatures were shown in Fig. 5 and Fig. 6 for potato slices and potato powder, respectively. Hyperbolic curves were obtained. Such curves are characteristic of a diffusion controlled process. Then, these results allow us to affirm that diffusion is the controlling mechanism during rehydration.

The rehydration profiles show that in the in the early/primary phase, dehydrated potato samples absorbed water at a rapid transfer followed by a secondary phase of much slower transfer rate. This primary period of high water uptake can be attributed to the rapid filling of capillaries and cavities near the surface of the sample [33].

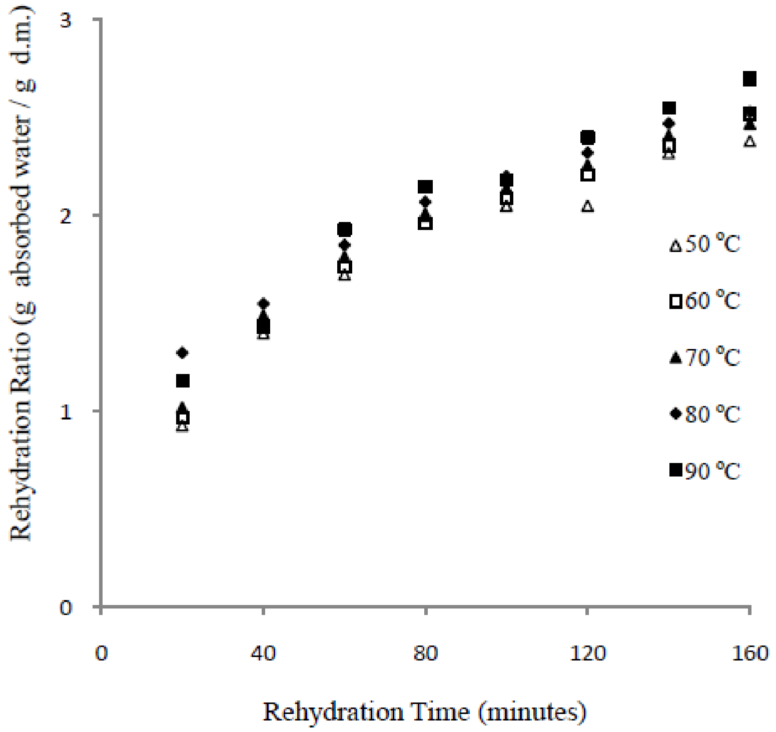

Figure 5 Plot of the rehydration ratio as a function of rehydration time for potato slices

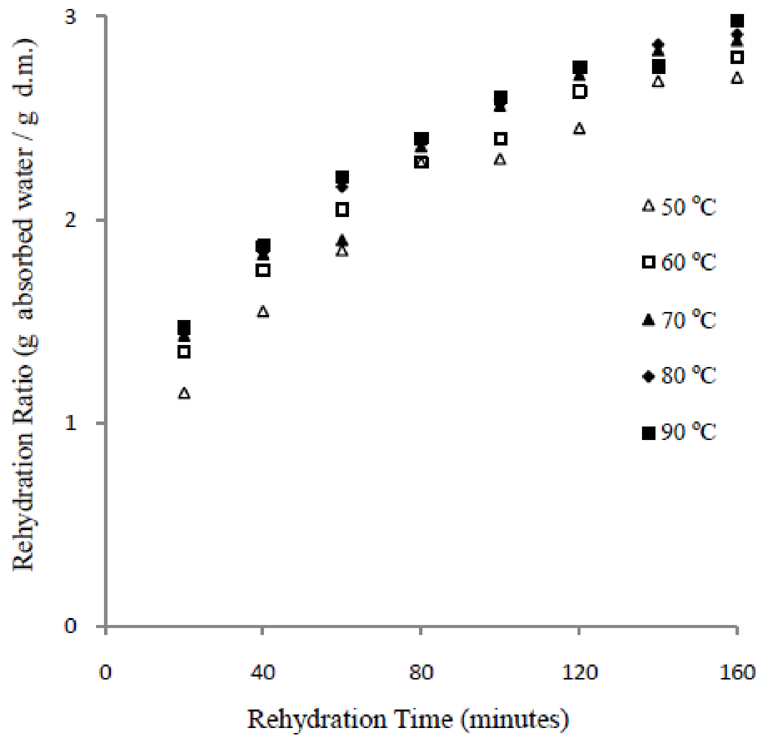

Figure 6 Plot of the rehydration ratio as a function of rehydration time for potato powder

Transition between the primary and secondary phases occurred after approximately the first 10 min of soaking and was reported that the rate of water absorption in the secondary phase was 10 times slower than in the primary phase [34]. As water absorption proceeds, the rehydration rate starts to decline due to the filling of free capillaries and intercellular spaces with water [7]. Two main mechanisms were responsible for the absorption of water by the dehydrated sample during rehydration. First, the hydration of all dry matters (starch, small carbohydrates, proteins), especially starch molecules in their native state, are known to be able to absorb water up to ten times their own weight. Second, there was the saturation by water of all pores in the porous sample structure, which was undoubtedly responsible for the rapid primary entrance of water into the sample [34].

Observing the evolution of rehydration ratio both for potato slices and potato powder sample, it found that at same rehydration time, the potato sample dehydrated at higher air temperature result in higher rehydration ratio. Moreover, the rehydration ratio which was achieved by the powder form was higher than the slice one.

4.5 The Bulk Density of Potato Powder

Result of the bulk density potato powder measurement was presented on Table 2. It could be seen from the table that the bulk density of potato powder seem do not be affected by the air temperature during the dehydration.

Table 2 The Bulk Density of Potato Powder

Hot air temperature (°C)	Bulk density (g/cm^3)
50	0.68
60	0.69
70	0.66
80	0.66
90	0.70

5 Conclusions

Diffusion mechanism control the hydration process, then the experimental data fit Fick's second law. During the dehydration process, the effective moisture diffusivity increased with increasing the hot air temperature. Its ranging from 2.03 x 10^{-8} m^2/s for air temperature of 50 °C up to 5.07 x 10^{-8} m^2/s for air temperature of 90 °C. Moreover, it was confirmed that an Arrhenius-equation was applicable for the relationship between the effective moisture diffusivity Deff and the absolute temperature T for potato. The rehydration of potato was characterized by a diffusion controlled process and the existence of a rapid water absorption rate in early/primary phase followed by a secondary phase of much slower transfer rate.

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The official conference language is English.

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Registration Hours

Thursday, March 28	6:00 PM – 8:00 PM
Friday, March 29	9:00 AM – 9:30 AM

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No Internet Service is available inside conference rooms.

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Program

The technical program includes invited plenary lectures, oral sessions and poster presentations.

Oral Presentations

Oral presentations are scheduled for 15 minutes of presentation and 5 minutes of Q&A.

All presentations should be in PowerPoint or PDF formats. A laptop and LCD projector will be available in all sessions. Each presenter is requested to bring the presentation in a USB storage device and upload it to the laptop before the session begins. All presentations will be destroyed at the end of the session.

We urge all presenters to use the provided laptop for presentation so as to minimize changeover times.

Since we have a very tight and fully packed program, we request all the delegates to be punctual and respect the allocated timeslots.

In case of absence of some presenter, next presenter will be called for presentation.

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The dimensions of the poster board will be 594 mm (Width) x 841 mm (Height) (or equivalently 23.3 in (W) x 35 in (H)). This corresponds to A1 Size in portrait layout. Posters are to be put up according to the assigned Paper IDs shown in the detailed program. The posters can be put up from Thursday afternoon 6:00 PM, and must be removed after the poster session. Posters left on the boards will be taken down and disposed of.

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Full registration guests may receive a complimentary Kuala Lumpur City Tour. Special tourism bus can be arranged for easy commutation. Presenters are requested to make a mention of their consent to join the city tour at the registration desk.

Road Map of Conference Venue

Detailed Program

Day-1; Mar 29, 2013

Registration (9:00 – 9:30 am)

Opening Ceremony (9:30 – 11:00 AM)

Welcome Address: (Conference Chair, ICCNSE-2013)

Plenary Speech(es): *Prof. Dr. Said S. E. H. Elnashaie*
(Chemical and Environmental Engineering Department, University Putra Malaysia(UPM), Serdang, 43400, Malaysia.)
Plenary Speaker 2

Tea/Coffee Break (11:00 - 11.30 AM)

Paper ID	***Oral Session A1 (11:30 AM - 1:00 PM)*** ***CHEMICAL*** ***Chair:*** ***Secretary:***
11	SYNTHESIS OF HELICAL CARBON NANOTUBES BY THERMO CATALYTIC DECOMPOSITION OF METHANE OVER Co/Al_2O_3 CATALYST *Sushil Kumar Saraswat*
22	SYNTHESIS OF ALUMINUM CHLORIDE BY REACTION WITH RECYCLED IRON CHLORIDE *Dong-Won Lee*
28	ADDITION OF COW URINE AND CHEESE WHEY AS NITROGEN SOURCE ON THE BIOGAS PRODUCTION FROM COW MANURE *Puguh Setyopratomo*
30	MATHEMATICAL MODEL DEVELOPMENT OF MASS TRANSPORT IN DIRECT FORMIC ACID FUEL CELLS *Nur Hidayah Maslan*
39	EXTRACTION OF METAL IONS THROUGH SUPERCRITICAL CO_2 *Pradeep Kumar*

45	2D/3D SIMULATIONS OF MASS TRANSFER IN CIRCULAR MICROCHANNELS FOR LIQUID-LIQUID SLUG FLOW *Abhishek Kumar Chandra*
Lunch Break (1:00 – 2:00 PM)	
Paper ID	***Oral Session A2 (2:00 - 3:00 PM)*** ***CHEMICAL***
	Chair: ***Secretary:***
48	ENERGY AND EXERGY ANALYSIS OF HYBRID SYSTEM (SOLID OXIDE FUEL CELL– GAS TURBINE), AND USED IT IN PERFORMANCE ENHANCEMENT OF MISURATA GAS TURBINE *Yussef Awin*
53	REVIEW OF MASS TRANSPORT PHENOMENA IN DIRECT FORMIC ACID FUEL CELL PERFORMANCE *Siti Zuulaika Rejal*
68	THERMODYNAMICS ANALYSIS OF COMBINED CYCLE (COOLING/POWER), AND USED IT IN PERFORMANCE ENHANCEMENT OF TURBINES IN LIBYA. *Abdalla Agoub*
69	THERMAL CHARACTERISTIC AND PHASE FORMATION OF CERATE-ZIRCONATE CERAMICS POWDER PREPARED WITH DIFFERENT CHELATING AGENTS *Nafisah Osman*
79	CHARACTERIZATION OF MODIFIED MOLECULAR SIEVES FOR POTENTIAL APPLICATION OF CARBON DIOXIDE CAPTURE AT OFFSHORE CONDITIONS *Nadia Isabella*
Tea/Coffee Break (3:00-3:30 PM)	
Paper ID	***Oral Session A3 (3:30 - 5:00 PM)*** ***SUSTAINABILITY & NANO TECHNOLOGY***
	Chair: ***Dr. Moon Ki Kim*** ***Secretary:***

59	CHARACTERISTICS OF CARBON-SUPPORTED CATALYSTS DERIVED FOR LOW TEMPERATURE SELECTIVE CATALYTIC REDUCTION: A SHORT REVIEW *Ibrahim Yakub*
32	SYNTHESIS OF MAGNETITE NANOPARTICLES BY HYDROTHERMAL PROCESS *Merry Puspamega*
37	INVESTIGATION OF DIFFUSION-INDUCED STRESS IN SILICON THIN FILM ELECTRODES *Sangjae Seo*
57	CHARACTERIZATION OF CALCIUM HYDROXIDE (C-H) CRYSTALS IN NANO MODIFIED BINDER (NMB) *Norsuzailina Mohamed Sutan*
62	PARTICLE SIZE DISTRIBUTION OF CERATE-ZIRCONATE POWDER PREPARED VIA THREE DIFFERENT METHODS *Najwa 'Adni Ibarahim*
74	INVESTIGATION ON THERMAL CONDUCTIVITY AND MECHANICAL PROPERTIES OF THERMOPLASTIC NATURAL RUBBER FILLED WITH ALUMINA AND BORON CARBIDE NANOCOMPOSITES *Muhammad Zaidi*
Day-2; Mar 30, 2013	
Paper ID	***Oral Session B1 (9:00 - 11:00 AM)*** ***NANOTECHNOLOGY***
	Chair: ***Secretary:***
21	ELECTRICAL PROPERTIES OF GOLD PARTICLES DECORATED AMORPHOUS CARBON NANOTUBES/EPOXY COMPOSITES *Yu Dian Lim*

18	LOCALIZED SURFACE PLASMON FOR BIOMOLECULAR DETECTION *Donghwan Kim*
65	EFFECTS OF EXPOSURE TO DIFFERENT SIZE OF ENGINEERED SILICON DIOXIDE NANOPARTICLES ON ARTEMIA *Mehmet Ates*
10	ADSORPTION OF CO_2 ON LITHIUM SILICATE *Abdul Rahman Mohamed*
61	INVESTIGATING THE LOAD TRANSFER EFFICIENCY IN CARBON NANOTUBE/POLYMER COMPOSITES USING REPRESENTATIVE VOLUME ELEMENTS *Ehsan Mohammadpour*
78	ELECTROCHEMICAL DEPOSITION AND CHARACTERIZATION OF HIGH QUALITY Cu_2ZnSnS_4 THIN FILMS FOR SOLAR CELL APPLICATIONS *Mohammed Aslam*
Tea/Coffee Break (11:00 – 11.30 AM)	
Paper ID	***Oral Session B2 (11:30 AM - 1:00 PM)*** ***CHEMICAL*** ***Chair:*** ***Secretary:***
29	EFFECT OF DRYING TEMPERATURE ON THE DEHYDRATION KINETIC AND REHYDRATION CHARACTERISTIC OF DRIED POTATO *Puguh Setyopratomo*
42	EFFECTS OF SOIL VARIATION BETWEEN PEAT SOIL AND MINERAL SOIL ON FRUIT SIZE AND NUTRITIONAL CONTENTS OF PINEAPPLE (ANANAS COMOSUS), N36 AND JOSAPINE CULTIVA *Amirul Imran Abu Kasim*

76	SYNTHESIS OF ESTER TRIMETHYLOLPROPANE FROM OLIVE OIL BY TRANSESTERIFICATION PROCESS *Nazrizawati Ahmad Tajuddin*
55	THE PROCESS OF CULTIVATION SPIRULINA PLATENSIS USING POME (PALM OIL MILL EFFLUENT) AS MEDIA IN OPEN POND RACEWAY BIOREACTOR *Agus Riyanto Poerwoprajitno*
56	OPTIMIZATION AND SONOPHOTOCATALYTIC STUDIES: DEGRADATION OF RHODAMINE 6G *Shruti Hinge*
Lunch Break (1:00 – 2:00 PM)	
Paper ID	***Poster Session B2 (2:00 - 3:00 PM)***
49	REDOX-ACTIVE INJECTABLE GEL FOR RHEUMATOID ARTHRITIS TREATMENT *Magdalena Bednarowicz*
50	DOXORUBICIN-LOADED PEGYLATED NANOPARTICLES AS POTENTIAL MAGNETIC DRUG DELIVERY SYSTEM *Magdalena Hałupka - Bryl*
Day-3; Mar 31, 2013	
City Tour: Departure from Hotel Lobby at 9:00 AM	

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Chair
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