THE UNCERTAIN HALAL STATUS OF EDIBLE PRODUCTS WITH NATURAL OR ADDED ALCOHOL

Alina Abdul Rahim[1]
Siti Mashitoh Abdul[2]

ABSTRACT

This article will discuss the problems related with alcohol usages in food and beverage products and fatwa released by the National Fatwa Council. The challenges of Muslim consumers in choosing the Halal products among the almost limitless varieties of products, which food technology have created may result in confusion to the general public. The importance of understanding the ingredients and additives, and the negative effects of alcohol consumption will also be highlighted.
Keywords :

ABSTRAK

Artikel ini membincangkan permasalahan berkaitan dengan penggunaan alkohol dalam produk makanan dan minuman serta mengupas keputusan fatwa-fatwa yang telah dikeluarkan oleh Jawatankuasa Fatwa Kebangsaan. Turut diketengahkan, cabaran

[1] Pensyarah Kanan / Pengarah Institut Pengurusan dan Penyelidikan Halal (IHRAM), Universiti Sains Islam Malaysia (USIM).
[2] Pembantu Penyelidik, Institut Pengurusan dan Penyelidikan Halal (IHRAM), Universiti Sains Islam Malaysia (USIM).

pengguna Muslim dalam memilih produk Halal yang wujud dalam pelbagai variasi hasil pengeluaran dari teknologi, mungkin mencipta kekeliruan kepada orang awam. Kepentingan dalam memahami dan mengenal bahan dan aditif dan kesan buruk pengambilan alkohol juga turut dibincangkan.
Kata kunci :

DEFINITION OF ALCOHOL

The word alcohol refers to ethanol, or ethyl alcohol, which is the main ingredient in what the Quran refers to as '*khamr*', or alcoholic drinks. Alcohol is a chemical common in nature and has many uses and applications. To the chemist, alcohol refers to a class of organic compounds containing hydroxyl (OH) groups. To most people, though, alcohol refers to the intoxicating ingredient in beer, wine and distilled liquor (hard liquor). The chemist's name for this particular alcohol is ethyl alcohol or ethanol.

ALCOHOL USAGE: THE PAST AND PRESENT

Alcoholic beverages date back to the very early part of man's history. Many archaeologists believe that wines made from grapes have existed for more than 10,000 years and that drinks such as mead and beer have existed for even longer. In ancient times, it was mainly consumed as alcoholic drinks. Alcohol was made by fermentation from fruits such as grapes and dates, and is now also made from grains such as rye, wheat, barley and corn. Potatoes and whey are also used to make alcohol (Riaz, M. N. & Chaudry, M. M, 2004).

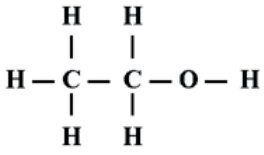
Alcohol is produced by yeast cells reacting on carbohydrate in fruits and grains. Throughout its history, alcohol has been used socially for many diverse purposes, such as calming feuds, giving courage in battle, sealing pacts, celebrating festivals, and seducing lovers. Historians speculate that prehistoric nomads may have made beer from grain and water before learning to make bread. The Celts, Ancient Greeks, the Norse, Egyptians, and Babylonians all have records of production and consumption of alcoholic drinks. Alcohol was included in the Egyptian burial provisions for the journey to the afterlife (n. a. n. d. http://www.drug-rehabs.org/alcoholhistory.php).

Today, alcohol is widely used as solvents and raw material ingredients in the cosmetic and pharmaceutical industries. Other major uses in edible products are as alcoholic beverages, food ingredients, flavour and solvents in foods. Alcoholic beverages legally can contain between 0.5 and 80% ethyl alcohol by volume. Pure industrial alcohol can be 95% alcohol (Lide, R.D, 1992).

Alcohol in Beverages

In the market, there are three major classes of alcoholic beverages, which are fermented beverages, distilled or spirit beverages and compound or fortified beverages. Fermented beverages are made from agricultural products, including grains and fruits, and may contain from 3 to 16% alcohol. Distilled or spirit beverages are made by distillation of fermented beverages. Distillation increase alcohol content of these products may be as much as 80%, while compound or fortified beverages are made by combining fermented or spirit beverages with flavouring substances. Riaz, M. N. and Chaudry reported The alcohol content of these products can also be as high as 80%.

Alcohol as Contributor of Flavours



Ethyl alcohol
C_2H_5OH

Source: Bruker, R. 2002

Various alcohols, which are utilized widely as flavour are produced by fungal conversion. The formation of sclareol, a labdoanediterpene used in foods, has been studied in *Cryptococcus albidus* (Farbood MI, Willis BJ, and Christenson PA: 1986). Bioconversion of citronellol, leading to the formation of 2, 6-dimethyl-1, 8-octanediol and (*E*)-2, 6-dimethyl-2-octene-1, 8-diol was studied with four strains of *Botrytis cinerea* in grape dregs (Brunerie *et al*, 1987).

Lomasco *et al*. worked out the possibility of producing 2-phenylethanol (rose flavour) from *Aspergillusniger*, using as precursor phenyl alanine, which was synthesized as the sole aromatic product (Table 1) (2001). These few examples of flavours are natural products of alcohol, from fungal and microbial activities.

Table 1: Nonterpene Fungal Flavoring Constituents

Compound	Fungi	Product
Alcohol	Botrytis cinerea	Octanediol
	Aspergillusniger	2-Phenylethanol

Foods are cooked in alcohol to enhance the flavor or to impart a distinctive flavor. Wine is the most common form of alcohol used in cooking. Although it may seem that all of the added alcohol evaporates or burns off during cooking, itdoes not. Rena Cultrufelli of the USDA prepared a table listing the amount ofretained alcohol in foods cooked in alcohol. The retained alcohol varies dependingon the cooking method.The following are some of the retained alcohol contentsof foods prepared by different cooking methods (Larsen, J, 1995):

i. Added to boiling liquid and removed from the heat: 85%
ii. Cooked over a flame: 75%
iii. Added without heat and stored overnight: 70%
iv. Baked for 25 min without stirring: 45%
v. Stirred into a mixture and baked or simmered for 15 min: 40%
vi. Stirred into a mixture and baked or simmered for 30 min: 35%
vii. Stirred into a mixture and baked or simmered for 1 h: 25%
viii. Stirred into a mixture and baked or simmered for 2 h: 10%
ix. Stirred into a mixture and baked or simmered for 21/2 h: 5%

Alcohol as Solvent

Two of the major uses of pure alcohol are as a solvent and raw material. As a solvent, it is used to extract flavouring chemicals from plant materials such as vanilla beans. Dilute ethyl alcohol is almost universally used for the extraction of vanilla beans. After the extraction, vanilla flavour called natural vanilla flavouring is standardized with

alcohol. By the FDA's standard of identity, natural vanilla flavouring must contain at least 35% alcohol by volume, otherwise it cannot be called natural vanilla flavouring (FDA, 2000).

Alcohol in Pharmaceuticals

Alcohol is also used in pharmaceuticals, cosmetics, and topical products. Alcohol is frequently present in cough syrups and mouthwash, though these days one can find some alcohol-free products. In perfumes, the use of SD alcohol is common. SD alcohol is ethanol that has been denatured. Denaturing involves adding substancesto alcohol to make it undesirable for consumption. The denaturing substancesare very difficult to remove from the mixture, so denatured alcohol cannotbe used in food or drink, but the product remains prohibited for Muslims (Riaz, M. N. and Chaudry, M. M, 2004).

EFFECT OF ALCOHOL ON SHELF-LIFE OF FOOD

Adding ethanol to water lowers the water activity value, Table 2 presents the water activity of ethanol solutions as calculated from Raoult's Law (Lide, 1992). This may be due to the hydrogen bonding of ethanol molecules with water molecules.When water molecules are bound with ethanol through weak hydrogen bonds, this leave less free water available, and microbes have less water to survive on. This resulted in a preservative effect towards certain food products, when alcohol added as an ingredient in the food formulation, before cooking. As ethanol reduce the water activity in food, this characteristic help preserve high-moisture food by delaying microbial spoilage (Table 3) (Jay, J. M.: 1992), as free water which is available for the microorganisms are reduced, through reduction of water activity (a_w) (Ferro Fontans, C. and Chirife, J.: 1981). An example of such product is the Christmas pudding, cherry in wine alcohol or mixed fruit cake. Brandy or whiskey is examples of alcoholic beverages added to provide flavor, at the same time providing a prolonged shelf life.

Table 2: Water activity of ethanol solutions calculated from Raoult's Law

Ethanol concentration (%,w/w)	Water activity (aw) value
	Calculated by Raoult's Law
0.5	0.998
0.5	0.998
10	0.958
14	0.94
20	0.911
24	0.89
30	0.856

* FPD – freezing point depression

The types of microbes micro flora will also change, when water content is reduced in food. Bacteria cannot survive below water activity 0.86 and mold will start to grow at water activity 0.82 and below mold (Table 3).

Table 3: Minimum water activity limit of growth for representative microorganisms

Microorganism	Minimum Water Activity (aw)
Pseudomonas flourescens	0.97
Pseudomonas spp.	0.95
Escherichia coli	0.95
Salmonella spp.	0.92
Bacillus spp.	0.90 to 0.95
Micrococcus spp.	0.86 to 0.93
Staphylococcus aureus	0.86
Aspergillusfumigatus	0.82
Saccharomyces cerevisiae	0.8
Penicilliumchrysogenum	0.79
Aspergillusniger	0.77
Osmophilic Yeast	0.62
Xerophilic	0.61

ALCOHOL AND HEALTH: HOW MUCH IS TOO MUCH?

Islam prohibits any food and beverage that get people intoxicated, both in small and large quantities, whether it is alcohol, drugs or food. However, the issue of neglible amount of alcohol permitted in processed food is still debatable. Prominent Muslim scholar, Sheikh Yusuf Al-Qaradawi, the president of the International Union for Muslim Scholars issued a fatwa that consuming drinks containing tiny quantities of alcohol that is "constituted naturally through fermentation" did not violate Islamic teachings (http://afp.google.com/article/ALeqM5j4rYTsf0M3YTGTJNLwY-JLzZGwUw).

The fatwa was issued in response to a question from the Qatari Standard and Specifications Authority (QSSA) on allowing 0.05 percent of alcohol constituted naturally through fermentation. However, the fatwa had sparked controversy and criticism from some newspapers in Qatar, where Abdullatif al-Mahmud, editor of the *Ash-Sharq* daily wrote that "the fatwa will open the door to those who want to consume drinks containing small proportions of alcohol under the pretext that neither the Qur'an nor the Sunnah (Prophet Muhammad's deeds) defined the proportion".

In order to answer public's questions and defended the fatwa, QSSA Director, Mohamed Saif al-Kuwari stressed that the percentage was not set by Sheikh Qaradawi but rather by the QSSA which consider it the maximum percentage of alcohol naturally constituted through fermentation. This percentage of ethyl alcohol which results from naturally fermentation is something common in many types of fruits. Table 4 shows the alcohol blood level and brain responses (Whitney, E. and Rolfes, S. R., 2008).

Table 4: Alcohol blood levels and brain responses

Blood Alcohol Concentration	Effect on Brain
0.05	Impaired judgment, relaxed inhibitions, altered mood, increased heart rate
0.1	Impaired coordination, delayed reaction time, exaggerated emotions, impaired peripheral vision, impaired ability to operate a vehicle
0.15	Slurred speech, blurred vision, staggered walk, seriously impaired coordination and judgment
0.2	Double vision, inability to walk
0.3	Uninhibited behaviour, stupor, confusion, inability to comprehend
0.40 to 0.60	Unconsciousness, shock, coma, death (cardiac or respiratory failure)

NOTE: Blood alcohol concentration depends on a number of factors, including alcohol in the beverage, the rate of consumption, the person's gender and body weight. For example, a 100 pound female can become legally drunk (≥0.10 concentration) by drinking three beers in an hour, whereas a 220-pound male consuming that amount at the same rate would have a 0.05 blood alcohol concentration.

ALCOHOL AND NUTRITION

Alcohol alters both the amino acid and protein metabolism. It can disturb synthesis of proteins which is important in the immune system, slows down, weakening the body's defenses against infection. Protein deficiency can develop, both from a diminished synthesis of protein and from a poor diet. Whitney also reported, normally, the cells would at least use the amino acids from the protein foods a person eats, but the drinker's liver deaminates the amino acids and uses the carbon fragments primarily to make fat or ketones. Eating well does not protect the drinker from protein depletion; a person has to stop drinking alcohol.

Toxicity of Alcohol

Stated in a book titled *Perubatan Islam dan Bukti Sains Moden Edisi Ke-2,* liquor is alcohol in the form of ethyl alcohol form and may act as a drug which react in human brain and can cause addiction. Like liver cells, brain cells die with excessive exposure to alcohol. Liver cells may be replaced, but not all brain cells can regenerate. Thus some heavy drinkers suffer permanent brain damage. Whether alcohol impairs cognition in moderate drinkers is unclear (Krahn, D. *et al*, 2003).

Alcohol and Its Adverse Effects on Pregnancy

Records on births of babies with fetal alcohol syndrome (FAS) affect up to 1300 to 8000 babies annually, according to Centers for Disease Control and Prevention. These undesirable physical and mental deformities are due to the habits of mothers consuming alcohol during pregnancy (Danial bin Zainal Abidin, 2007).

Fetal Alcohol Syndrome

How does drinking alcohol during pregnancy endangers the fetus? Alcohol crosses the placenta freely and deprives the developing fetus of both nutrients and oxygen. The damaging effects of alcohol on the developing fetus cover a range of abnormalities referred to as fetal alcohol spectrum disorder (Hoyme, H. E *et al*, 2005). Those at the most severe ends of the spectrum are described as having fetal alcohol syndrome (FAS), a cluster of physical, mental and neurobehavioral symptoms that includes:

i. Prenatal and postnatal growth retardation
ii. Impairment of the brain and central nervous system, with consequent mental retardation, poor motor skills and coordination and hyperactivity
iii. Abnormalities of the face and skull
iv. Increased frequency of major birth defects: cleft palate, heart defects and defects in ears, eyes, genitals and urinary system

Alcohol interferes with the orderly development of tissue during their critical periods, reducing the number of cells and damaging those that are produced. The damaged of alcohol toxicity during brain

development is apparent in its reduced size and impaired function (Olney, J. W. *et al*, 2002). When alcohol crosses the placenta, fetal blood alcohol rises until it reaches equilibrium with maternal blood alcohol. The mother may not even appear drunk, but the fetus may be poisoned. The fetus's body is small, its detoxification system is immature and alcohol remains in fetal blood long after it has disappeared from maternal blood (Whitney, E. & Rolfes, S. R., 2008).

DALIL OF PROHIBITION IN ALCOHOL CONSUMPTION

Al-Qur'an:

يَا أَيُّهَا الَّذِينَ آمَنُوا إِنَّمَا الْخَمْرُ وَالْمَيْسِرُ وَالأَنْصَابُ وَالأَزْلامُ رِجْسٌ مِنْ عَمَلِ الشَّيْطَانِ فَاجْتَنِبُوهُ لَعَلَّكُمْ تُفْلِحُونَ

O ye who believe! Intoxicants and gambling,(Dedication of) stones, And (divination by) arrows, Are an abomination of Satan's handiwork; Eschew such (abomination), That ye may prosper.

(Al-Maidah, 5: 90)

Hadith of the Prophet (pbuh):

« كل مسكرخمر، وكل مسكرحرام »

Each thing that caused intoxicant is liquor and each thing that caused intoxicant is haram.

(Hadith Muslim)

These generally ascribed principles assert that these substances such as intoxicants (*al-khamr*), swine and impure things could not be consumed at all costs, yet there are certain situations that heed the need of using these substances such as in the case of emergency or out of the necessity for survival (*al-darurat*) and so on.

CHALLENGES AMONG MUSLIM DECISION MAKING: *'HUKUM AND FATWA'*

Istihalah

Istihalah is a process of change, where a substance is transformed into an entirely different form and core position (Mausu'ah Jamal Abdul Nasir i390H.), which differs in terms of name, characteristics and description. In other words, it can be define as change or more precisely, a chemical change which places the item under a list which is different from its original grouping (http://webcache.googleusercontent.com). Changes occurred may be caused by chemical reaction, heating or cooking. Examples of chemical reaction include the process of making soap from oil and tallow or the breakdown of triglyceride into glycerol and fatty acids.

Alcohol as Food Ingredient

As a raw material, one of the uses of alcohol is to convert it to acetic acid to make vinegar. Vinegar is then used in salad dressings, mayonnaise and other applications. Whereas the use of alcohol in alcoholic drinks is *haram*, converting it to acetic acid (vinegar) makes it *halal* (Riaz, M. N. and Chaudry, M. M, 2004).

Mazhab Hanafi and Maliki

The *mazhab* of *Hanafi* and *Maliki* accepts *Istihalah* as the process of transforming *najis* or alcoholic material into a pure acceptable form, regardless of whether the process is governed by nature or man-made. This is bared on the judgement that alcohol is only *haram* when it an intoxicant. When alcohol undergoes *Istihalah* and loses its toxicity, this new substance is no longer *haram* (n.a, 2008).

The *Ulama Malikiyah* define *"inqilabul'ainnajasahila 'ainukhra"* as changes from one substance into a new product, like alcohol, is *haram*, but when this alcohol turns into vinegar, it is *halal* and when the vinegar changed into an alcoholic end product, the *hukum* is *haram*. The *Ulama Hanafiah* explained that salt is different from meat and bones. When a pig drowned in a salt lake and decompose into salt, the characteristics of a pig were lost, the salt is now *halal*.

The *mazhab* of *Hanafi* and *Maliki* agree that alcohol mixed or naturally present with food, beverage and medication, when these mixtures fulfill the requirements of *Istihalah*, therefore it is *halal* (n.a, 2009).

Mazhab Syafie and Hanbali

The concept of *Istihalah* is partially accepted by the *Mazhabs* of *Syafie* and *Hanbali* with three basic conditions (Journal Syariah, Jil. 17, Bil 1 (2009):

i. Natural process of change, when alcohol is transformed into vinegar.
ii. Tanning of animal hides, beside pigs and dogs.
iii. Decomposition of carrion or dead animals.

Alcohol As Soft Drinks' Stabilizer

Cordial that contains any flavour added with alcohol as a stabilizing agent is permissible if:

i. The alcohol produced is not from the liquor making process.
ii. The quantity of alcohol in that flavour is small, which do not cause intoxicant.

Food Containing Vinegar

The opinion of the prominent Muslim scholar, Sheikh Yusuf Al-Qaradawi is referred on this issue. Muslim scholars unanimously agree that if wine turns into vinegar by itself, it is lawful. However, if it turns into vinegar with the aid of a chemical substance or by adding something, such as salt, bread or onion, to it, scholars hold contradicting views regarding it. Although some scholars say that it is pure and lawful because it has been changed from its original state, others say that it is still impure and, thus, it is must be avoided.

In his book, Imam an-Nawawi states that if wine changes into vinegar by itself, it becomes pure according to the majority of scholars. However, if the change is a result of putting something in it, it is considered impure. Imam Ahmad and most scholars also hold on this

view. *Imam Abu Hanifah*, Al-Awza'i and Al-Layth consider it pure. *Imam Malik* has reported three hadiths on this, the most authentic one is that treating wine is prohibited. In the book of the Maliki jurists, it is stated that it is permissible to treat wine so that it becomes vinegar (Al-Nawawi, 2001).

If wine changes into vinegar, it becomes pure and lawful as it has changed from its original state and this requires a new ruling as is the case with all other converted impurities regardless of whether this occurs naturally or by human interference. Wine itself originated from a pure substance as it was made from grapes. After becoming an intoxicant, wine becomes prohibited. When the wine loses it intoxicating characteristic and change into something which regains its original ruling, which is *halal*. The view of the Hanafi scholars and those who follow them in this respect seems to be strong. They say that treating wine is similar to its natural change into vinegar as both involve the removal of the reason of prohibition, which is intoxication, as well as the attainment of its benefit of nourishment and medicinal purposes.

In addition, the reason for declaring it impure (intoxication) no longer stands. It is well known that a ruling is attached to its reason in terms of existence or otherwise. Imam At-Tahawi states that since treatment is a process of reformation, it is permitted as is the case for tanning impure leather (Kitab Sharh Mushkil Al-Athar). It is stated in an authentic hadith: 'When animal leather is tanned, it becomes pure.' This applies to the case in hand, such as vinegar, and it includes all its types.

By and large, it's clear from the above-mentioned statements and quotations that so long as vinegar originates from wine directly, without the aid of any additives, it is lawful according to the unanimous view of scholars. As for the vinegar that originates from wine through human interference, it is somehow controversial among scholars (http://www.islamonline.net).

Some Issues of Istihalah Related to Alcohol

We exercise the principle of *Istihalah* on a daily basis. For example, most breads contain yeast, which produces alcohol during anaerobic respiration. However, the amount of alcohol is so small that no amount of ingested bread could cause intoxication (http://webcache.googleusercontent.com). These traces of alcohol are further decimated by the baking process. Yet another example of the principle of *Istihalah* is the medicinal use of certain chemical compounds extracted by dissolving plant tissue in alcohol. The end product is virtually rid of alcohol, although it might contain some infinitesimal traces.

However, one should be aware of abuses of this principle. For example, cough medicine containing alcohol is clearly prohibited since the effects of the alcohol are very noticeable. More generally, any product that contains a measurable amount of a prohibited substance, or in which the properties of a prohibited substance are noticeable, is in itself prohibited. As a rule of thumb, if alcohol, or anything else prohibited, is listed as an ingredient, the product should be avoided (Othman, R. and Riaz, M. N, 2000).

Confusion Between Alcohol And *'Arak' ['Al-Khamr']*

Alcohol is a flammable liquid which is contained in alcoholic drink and liquor. Liquor is an alcoholic drink that cause intoxicant (Kamus Dewan). In arabic, alcohol is called as *khamr*. From language point of view, it is mean something which caused intoxicant produced by fruit juice such as grape and cause impaired judgement (Ibnu Manzur, 1999). According to definition from *Ulama*, alcohol named as *khamr* has a few definition such as (Abu Jaib, saeed. Al-Qamus al-Fiqhi):

i. Anything that caused intoxicant from grape juice.
ii. IbnSaiyidah said that Khamr is grape and other substance which caused intoxicant.
iii. *Imam Hanafi* states that *khamr* is intoxicant from grape juice only (Al-Nawawi, 2001)

The misunderstanding was due to the incorrect translation of term *khamr* (Arabic) to alcohol (English). The term alcohol from the chemistry perspective is more than just ethanol. The permissibility

from a religious perspective and hence its halal compliance of such product will depend on the intention and utilization ofthe product. Ethanol is not necessarily *khamr* although the intoxicating substance in khamr is ethanol.

However, the differences of approaches by the *Ulama* with many versions of interpretations need to see as rahmah in order to justify the confusion among general Muslim public.

CONCLUSION

When Islam prohibited alcohol or wine to be consumed or used at all costs and do not accept it as remedy even when there are certain good aspects about it, there must be a strong justification on this matter. Allah S.W.T says in the Qur'an:

> *They question thee about strong drink and games of chance. Say: In both is great sin, and some utility for men; but the sin of them is greater than their usefulness. And they ask thee what they ought to spend. Say: That which is superfluous. Thus Allah make the plain to you (His) revelations, that haply ye may reflect*"
>
> (Al-Baqarah, 2: 219)

As a Muslim, the requirements to uphold *Maqasid Syariah*, for the well-being, safety and harmony of the *Ummah*, necessitate the prohibition of alcohol. The advancement of technology and complexity of the food industry and the ubiquitous nature of alcohol challenges modern Muslims to combine scientific information with Islamic knowledge to solve this issues, eliminate doubts and prevent fraud or intentional adulteration of alcohol in food, by irresponsible food manufacturers.

With speedy development momentum from technology aspect, people need to understand science language, for example the evolution

and development of technology enable us to detect desired component until highly diluted of trace level or part per billion (ppb). Scientific methods can be further developed to be a robust method for traceability of the source of alcohol in foods and drinks. Some terminology such as percentages, small amount which we categorised as qualitative description, can not be use or sustain and of course will be challanged by various fact and data that achived from chemical analysis used in modern technology.

As a conclusion, it is proposed that an Islamic with scientific approach is adopted, assisting scholars to obtain a benchmark for permissible alcohol contents in food and drinks. The integration of technology and views from different *mazhab* in developing Halal Standard and guidelines is imperative to resolve the alcohol issue, and this enable the industry to expand further for economical benefits.

REFERENCES

Abu Jaib, Saeed. n.d. *Al-Qamus al-Fiqhi*.

Brunerie P, Benda I, Bock G, and Schreier P. 1987. *Bioconversation Of Citronellol By Botrytis Cinerea*.

Danial bin Zainal Abidin. 2002. Perubatan Islam dan Bukti Sains Moden. Edisi Ke-2. Janda Baik: PTS Publication.

Danial bin Zainal Abidin. 2007. *Quran Saintifik: Meneroka Kecemerlangan Quran Daripada Teropong Sains*. Kuala Lumpur: PTS Millennia Sdn. Bhd.

Farbood MI, Willis BJ, and Christenson PA. 1986. S. African Patent No. ZA 85, 04, 306.

FDA. 2000. 21 CFR 169.3 (c).

Ferro Fontans, C. and Chirife, J. 1981.*The Evaluation Of Water In Aqueous Solutions From Freezing Point Depression*. Journal of Food Technology. 16.

Hoyme, H. E. and coauthors. 2005. *A Practical Clinical Approach To Diagnosis Of Fetal Alcohol Spectrum Disorders: Clarification Of The 1996 Institute Of Medicine Criteria*. Pediatrics. 115.

Ibnu Manzur. 1999. *Lisan al-Arab*. Vol. 4. Beirut: Dar Ihya' Turath al-Arabiy.

Jay, J. M. 1992. *Modern Food Microbiology*. New York: Chapman & Hall, International Thomson Publishing.

Journal Syariah, Jil. 17, Bil. 1. 2009.

Kamus Dewan. Edisi ke-4. Kuala Lumpur: Dewan Bahasa dan Pustaka.

Krahn, D. and co authors. 2003. *Alcohol Used And Cognition At Mid-Life: The Importance Of Adjusting For Baseline Cognitive Ability And Educational Attainment*. Alcoholism: Clinical Experimental Research. 27.

Lide, R.D. (1992). *Handbook of Chemistry and Physics*.72nd edn, CRC Press, Boca Raton, USA.

Lomascolo A, Meessen LL, Haon M, Navarro D, Autona C, Faulds C, and Marcel A (2001). Evaluation of the potential os*Aspergillusniger* species for the bioconversation L- phenyl-alanine into 2-phenylethanol. World J MicrobiolBiotechnol 17:99-102.

Mausu'ah Jamal Abdul Nasir 1390H.

Al-Nawawi, Muhyiddin Bin Syaraf. 2001. *Kitab Al-Majmu' Syarah Al-Muhadhdhab*. Vol. 22. Beirut: Dar 'Ihya' al-Turath al-'Arabiy.

n. a. 2008. Info Ilmiah: Istihalah. Info Halal UPM. Vol. 3.

n. a. 2009. The Istihalah Concept. Halal Journal: Nov-Dec. 2.

Olney, J. W. and coauthors. 2002. *The Enigma Of Fetal Alcohol Neurotoxicity*. Annals of Medicine. 34.

Othman, R. and Riaz, M. N. 2000. *Alcohol: A Drink/ A Chemical*. Halal Consum, Fall Issue. 1.

Riaz, M. N. and Chaudry, M. M. 2004. *Halal Food Production*. CRC Press.

Whitney, E. and Rolfes, S. R. 2008. *Understanding Nutrition*. Eleventh Edt. Belmont: Thomson Higher Education.

http://afp.google.com/article/ALeqM5j4rYTsf0M3YTGTJNLwY-JLzZGwUw. (Online 05.10.11).

Bruker, R. 2002. http://www.firehouse.com/training/hazmat/chemist/2002/9_chemist.html Online 04 August 2008.

Larsen, J. 1995. Ask The Dietitian. Hopkins Technology, LLC Hopkins, MN, http://www.dietitian.com/alcohol.html.

n.a. n. d. http://www.drug-rehabs.org/alcoholhistory.php (Online 26.08.08).

http://webcache.googleusercontent.com/search?q=cache:GfGvIDw83iAJ:www.islam-laws.com/gelatinandIstehlak.htm+istihalah&cd=4&hl=en&ct=clnk&gl=my&source=www.google.com.my (Online 27.04.2011).

http://www.islamonline.net/servlet/Satellite?pagename=IslamOnline-EnglishAsk_Scholar/FatwaE/ FatwaE&cid=1119503544262 Online 14.10.08

http://webcache.googleusercontent.com/search?q=cache:zsO9rydzx4IJ:www.themodernreligion.com/health/diet.html+Istihalah+issue+in+alcohol&cd=3&hl=en&ct=clnk&gl=my&source=www.google.com.my (Online 26.04.2011).