

## Halal status of ethanol

The word Khamr (alcoholic beverage), fermented fruits, was described in Quran 4 times; Alkhamr refers to the solution, which is produced from fruits or any natural sugar source by anaerobic fermentation and potentially could be used or lead to intoxication. The main ingredient of Alkhamer is ethanol, which is the chemical substance responsible for intoxication, the physiological state induced by the ingestion of ethanol where a person usually becomes pleasantly relaxed, with an easing of tension and anxieties. The control centre in the brain becomes less active, and inhibitory centre is less efficient and may lead to mild euphoria, talkativeness, decreased attention, and impaired judgment.

Complete intoxication is achieved when blood alcohol content (BAC) is ranging between 0.08-0.10% depending on gender, weight and age. Utilizing Widmark's formula ([Widmark 1981](#)), a female with 55 kg weight, if consumed 10% (w/v) ethanol (e.g. Wine), intoxication is achieved within 1 hour after ingestion 500 ml volume, equivalent to 50 g of absolute ethanol, this ratio may slightly decreased or increased depending on the individual sensitivity. If ethanol content is increased by physical and or chemical means to 27% (w/v), and 500 ml volume is ingested by a 55kg weight female, this is the fatal dose (BAC= 0.30%) and consumption of this large amount of alcohol, 135 g, within a short span of time may affect different systems of the body, namely respiration, heart rate that ultimately may lead to death of the person, this ratio may slightly decreased or increased depending on the individual sensitivity. Similar fatal dose (BAC= 0.30%). can be achieved after ingesting 900 ml of 15 % (w/v) ethanol. From this analysis, we may conclude that when ethanol content is 15% (maximum concentration obtained by fermentation) or less, it is treated as fermented alcohol, its status is forbidden (non-Halal) and need to be avoided; preparing, carrying and drinking it is forbidden as mentioned in the Holy Quran. If ethanol content is higher than 15%, usually it is inaccessible via fermentation, alternative method is needed to achieve the desired high concentration, it is obtained either by distillation or addition of absolute ethanol. The Halal status of alcohol higher than 15% (w/v) is toxic, therefore it is strongly prohibited to drink, attempts to drink toxic substance is considered suicide attempt in Islam, which is hardened sanctity than drinking fermented alcohol. On the other hand, toxic ethanol solution is allowed to prepare, hold, transfer and use for disinfection and other industrial use.

With regard to ethanol less than 1% (w/v), obtained by natural fermentation process under oxygen (air) atmosphere. The process goes through two steps: first the oxidation of sugar into ethanol, followed by the oxidation of ethanol via acetaldehyde into acetic acid, air flow is not prevented during the process. The transformation of ethanol into acetic acid, carbon dioxide and ethyl acetate, is controlled by ethanol concentration (Fig 2). If ethanol is < 0.2%, acetic acid undergoes over oxidation and generate carbon dioxide (Lea 1989), whereas higher than 1%, ethyl acetate formation is observed (Joshi and Sharma 2009). In both transformations, acetic acid concentration is reduced, thus pH value is increased (> 4). Acidity is the most important factor affecting microbial spoilage of fruits and vinegar (Aguilar et al. 2005). To reduce microbial growth rate, optimum value of pH <4 is maintained by keeping ethanol concentration between 1.0-0.2%. Therefore, ethanol Halal status at concentration less than 1% is allowed, and called Mubah (neither forbidden nor recommended) in Islam, and essential to maintain acidic condition and prevent growth of harmful microbes. Prophet Mohammad (PBUH) said that whatever intoxicates in large quantities, a little of it is also forbidden (Tirmidhi). If a 55 kg weight female, consumed 1% ethanol within 1 hour, intoxication limit will be reached (BAC= 0.09%) after ingesting 4000 ml volume. Medically, drinking 4 litres of water within one hour will lead to rapid and severe hyponatremia (Sahay and Sahay 2014), a condition that occurs when the level of sodium ion in blood is abnormally low. Blood dilution causes kidneys not able to flush water out of the body fast enough thus blood becomes waterlogged, causes entry of water into brain cells and lead to brain swelling, which manifests as coma and death. As drinking 4 litres of 1% of alcohol to reach intoxication is practically impossible, therefore one may conclude that alcohol less than 1% should be treated as a preserving agents rather than forbidden for reasons described above.

In Islam, human deeds are judged on the bases of intentions (Niyyah), Prophet Mohammad PBUH said “Verily, deeds are only with intentions” (Sahih Bukhari 54). Therefore, any ethanolic beverage made with intention to achieve partial or complete intoxication, it is prohibited, no matter if ethanol content is <1% or >15%, table 1 describe most types of non-Halal beverage drinks. In case of ethanol <1%, it is lower than the limited value for reaching intoxication, but placebo effect will dominate and intoxication may easily be reached with minute amount of alcohol. With regards to spirit drinks, alcohol content is higher than 15%, usually prepared by fermentation followed by distillation, Halal status is forbidden and toxic, prohibited to drink and not to be used in industries. Ethanol prepared by fermentation and distillation to

achieve concentration above than 95%, chemically it is identical to synthetic ethanol, thus 95%, absolute and denatured ethanol are considered as toxic substance and could be used for perfumes and other industrial applications as long as the initial intention was not made as beverage drink.

With regard to vinegar's halal status, in general it is halal and recommended by the prophet, In a hadith narrated by Ayesha, Muslim and Ibn Maja, Prophet Muhammad (PBUH) said "Allah has put blessing in vinegar, for truly it was used by the prophets before me". When vinegar's ethanol content reach 1%, which is rare with exception of wine vinegar, it is halal as long as there is no deliberate treatment to induce the conversion of ethanol into acetic acid ([Heikefelt 2011](#)).