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THE ANATOMY OF A RESPONSUM: THE *KASHRUTH* OF VINEGAR PRODUCED FROM WINE ALCOHOL

INTRODUCTION

“As vinegar to the teeth and as smoke to the eyes, so is the laggard to them that sent him” [Proverbs 10:26]. In this imagery, King Solomon suggests that failure to fulfill responsibilities with vigor and intelligence leads to confusion and frustration. The torch that was to dispel the darkness often produces a smoky flame that smarts the eyes and blurs the vision. The vinegar intended as an appetite stimulant sometimes suppresses appetite when it dulls the teeth. The recent finding that vinegar produced from alcohol distilled from wine had mistakenly been used to produce kosher food products, caused much consternation within the Torah community. Much of this dismay resulted from the failure to properly apply the halakhic process to elucidate the problem. The purpose of this presentation is to demonstrate the methodology that must be applied when scientific and technological data are evaluated for halakhic import.

I. THE SCIENTIFIC AND TECHNOLOGICAL BASIS FOR THE HALAKHIC DECISION

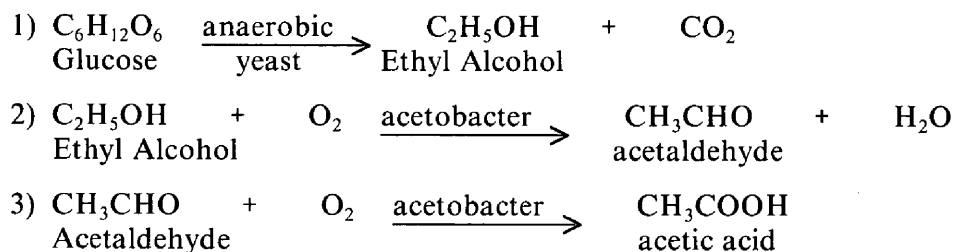
A. Definitions

In the U.S.A., vinegar is defined as a condiment made from a carbohydrate material that had been fermented with yeast to produce alcohol, which is subject to a subsequent acetous (acetic acid) fermentation with acetic acid bacteria. It must contain a minimum of

4 grams of acetic acid per 100 ml. (4%) to be sold as vinegar. Alcohol produced by chemical synthesis may also be used as a source for the acetous fermentation. The vinegar derives its descriptive name from the material used to produce the first alcoholic fermentation: cider vinegar from apple juice, wine vinegar from wine, alegal from ale, spirit vinegar from distilled alcohol, and vinegar from rice, whey, malt, wheat, corn, and other substances.

B. Microbiology

Yeast and acetic acid bacteria (*acetobacter* sp.) occur naturally on most fruits and vegetables. Yeast (*saccharomyces cerevisiae* var. *ellipsoideus*) under anaerobic conditions produces alcohol from the fruit sugars. Subsequently, when adequate air (oxygen) is introduced, the *acetobacter* ferment the alcohol to acetic acid. The simplified chemical reactions are:



In commercial manufacture a culture of high alcohol-producing strains of yeast are added with the first fermentation and a quantity of “old” vinegar is added to the second phase to guarantee the presence of good quality *acetobacter* which will yield high concentrations of acetic acid. Generally this “slow method” is reserved for *natural* vinegars containing the whole juice that has been fermented to approximately 12% alcohol content. There is no need to add additional nutrients to support the growth of the *acetobacter* except for apple cider which is low in nitrogenous materials.

White distilled (spirit) vinegar is made by the acetous fermentation of dilute ethyl alcohol. The alcohol can be obtained by distillation from fermented natural juices such as wine, apple cider, and corn syrup, or from synthetically produced alcohol (petroleum-based synthesis from ethylene). The final product must meet FDA standards, of which the following are significant for the halakhic analysis: it must contain a minimum of 4% acid and a maximum of .5% residual alcohol; it must be colorless and may not have any residual odor from the alcohol raw material. In general the “natural” process is not economically competitive with the production of spirit vinegar from synthetic alcohol or with the derivation of acetic acid from ethylene gas.

C. *Manufacturing method*

The following description applies to the fermentation method used to produce that vinegar recently declared “non-kosher” by some individuals and organizations.

1. *Raw materials*: Two kinds of wine alcohol were used to produce the vinegar in question.

a. Wine alcohol—90 to 94% alcohol (ethanol) distilled from grape wine having a 12% alcohol content.

b. Marc alcohol—alcohol distilled from marc or pomace. Marc consists of the residue from the grape after the juice has been removed from the wine press. It consists of 60–70% grape skins and pulp; 25% grape seeds and 8–10% debris or grape ‘raffles’.

The marc is extracted with water to give a solution containing the residual sugar from the grape solids. This solution is fermented with yeast to give an alcoholic “beer” that is unfit for drinking because of its high concentration of methyl or wood alcohol (10,000 ppm as compared to 1,000 ppm in wine). This alcohol is also concentrated to approximately 94%.

2. *Equipment*: The process utilizes large wooden tanks with capacities of 20 to 40 cubic meters of wood shavings; pumps; and cooling equipment. These simple, durable apparatuses, known as Frings generators, have been in use for over 30 years.

3. *“Charging” the generator*: The process is a continuous one. Its success depends upon maintaining a “healthy” culture of acetic acid bacteria on the massive surface area of the wood shavings. It is this surface area that facilitates the satisfaction of the oxygen requirements of the *acetobacter*, but it also allows for the growth of competing undesirable organisms. The maintenance of an environment conducive to the continued growth of the *acetobacter* is essential for population dynamics to inhibit unwanted micro-organisms from the environment. Thus there must always be a concentration of alcohol and vinegar in the generator to maintain this favorable environment.

4. *Flow sheet or “sample-run” of the vinegar process*:

a. The 90–94% alcohol is first diluted in a ratio of one to seven, yielding an alcohol concentration of approximately 13% (as found in natural wines).

b. This alcohol is denatured by the addition of ethyl acetate (in Europe concentrated acetic acid is used) to make the alcohol unfit for drinking and thus avoid the alcohol tax liability. The ethyl acetate is “split” by the *acetobacter* to give ethanol and acetic acid. The denaturant is thus consumed during the acetous fermentation.

c. “Vinegar food” must be present. Fruit juices or natural grains have adequate amounts of nutrients to support the growth of

the *acetobacter*. The denatured, diluted, distilled ethanol does not. Like all living organisms the *acetobacter* needs, in addition to the ethanol which is its energy source (analogous to sugar in our diet), a protein or nitrogen supply, minerals, vitamins, and growth stimulants. In general, a mixture containing ammonium phosphate, urea, asparagine, protein digests, yeast extract, glucose, malt starches, and salts is added to each batch of diluted alcohol-starting material. The mixture varies with each vinegar manufacturer.

d. The Frings generator holds approximately 11,000 gallons of liquid at all times. Approximately 4,000 gallons are pumped out when the acidity reaches 10–12% and an equal volume of denatured, diluted alcohol is pumped in at the rate of 90 gallons per minute. Pumps circulate and mix the new material with the generator contents for 72 hours. The vinegar thus produced has an acetic acid concentration of approximately 12% which is then diluted to 4 or 5%. It is usually decolorized with activated charcoal to remove the yellowish tint produced during the fermentation. It is then pasteurized and bottled for sale.

II. SUMMARY OF RELEVANT FACTS TO BE EVALUATED FOR HALAKHIC IMPORT

1. Marc alcohol, unsuitable for human consumption, is used as a component of the raw material.

2. The alcohol is denatured prior to acetous fermentation.

3. The alcohol is diluted prior to its introduction to the Frings generator, is further diluted by the prior contents of the generator, and is diluted again as the vinegar produced in the generator is diluted to a 5% concentration for consumer use.

4. Unlike the process of natural vinegar formation, a component (alcohol) is removed to a new environment (the generator) where it is “fed” to a “herd” of microscopic “animals” (*acetobacter*) which digest the ethanol and excrete a “waste” product, acetic acid.

5. This digestion can occur only in a carefully engineered generator, which provides proper oxygen tension and temperature control, and *cannot* occur without the addition of a carefully balanced nutrient mix to support the growth of the microorganisms.

6. The following factors and considerations are relevant in determining the dilution of the alcohol for halakhic purposes:

a. In the absence of accurate information, it is halakhically proper to assume that the raw alcohol consisted of equal parts of forbidden wine alcohol and the halakhically acceptable marc alcohol.

b. Since 4,000 gallons of diluted (1:7) alcohol were added to 7,000 gallons of other material in the generator, the actual

quantity of forbidden wine alcohol used in each production run was 285 gallons (1/7 of half of 4,000). This alcohol is contained in a total final volume of 11,000 gallons for a dilution factor of 1:38.

c. Vinegar is produced from the generator at a concentration of 10-12% and is diluted to yield food vinegar for the consumer at a 5% concentration. This results in a final dilution factor of the alcohol of approximately 1:75.

d. Condiments and “pickled” products further dilute the vinegar by a factor of at least two and possibly as much as ten. This yields a dilution of the original wine alcohol by a factor of at least 1:150.

III. HALAKHIC DEFINITIONS, DESCRIPTIONS, SOURCES

The main discussion relevant to our responsum occurs in the Talmudic tractate *Avoda Zara*. A mishna (29b) forbids the use of the vinegar produced from wine manufactured by non-Jews. Vinegar from kosher wine may be handled by non-Jews and not become *stam yeinam*.

A. Halakhic definitions of vinegar: Rabbenu Tam in Tosafot (*ibid.*) objects to allowing wine vinegar to be considered as no longer wine, which therefore may be handled by non-Jews, because we do not fully understand when the transition from wine to vinegar occurs. *Hokhmat Adam* [75:3] accepts this ruling as binding. However, the *Shulhan Arukh* [*Yoreh De'ah* 123:6] defines vinegar as wine that has become so “vinegary” that it “bubbles when poured on the ground.” This bubbling is the neutralization reaction between the acetic acid and the basic calcium salts in the earth. If this vinegar is sufficiently concentrated, such “bubbling” will occur (as when vinegar is used to remove water scale—calcium salts—from a tea kettle). Hence wine that is turning sour, although unpleasant to nose and palate, is still halakhically wine. Only when fully oxidized to vinegar does the wine lose its prior status and become vinegar. (This definition is also relevant for the category of *davar harif*.)

B. Marc wine (described above in I.(c)(1)(b)) was known to talmudists as “*temed*.” The *Shulhan Arukh* [*Yoreh De'ah* 123:9] describes its manufacture: water is poured over the skins and seeds residue from the wine press. If the original grape juice has been removed using a wine press [as in our case], so that all available juice has been extracted prior to the *temed* fermentation, the resulting “wine” is not considered wine with respect to the laws of *stam yeinam*.

C. Vinegar made from alcohol distilled from wine was known to the great *posekim* of the last generation. *Tiferet Yisrael* in his commentary on the mishna, *Avoda Zara* 35b, records: “In our territory, we use vinegar made from diluted alcohol. Since this is good-quality vinegar and is inexpensive, while wine vinegar is expensive, we need not be concerned about the *kashrut* of the vinegar we purchase since surely they will not mix more than one part of wine into six parts of our alcohol vinegar.” Similarly, with reference to Passover laws, *Maharam Shick* [no. 218] discusses “vinegar made from spirits” and concludes that such vinegar is *hamets* if the “spirits” (alcohol) came from grain fermentation.

D. The status of distilled alcohol (from non-Jewish wine) is discussed by Rema [*Yoreh De’ah* 123:24]: “Brandy (literally ‘*yayin saruf*’ or ‘burnt wine’) made from *yayin nesekh*, although only a vapor of the wine, is nevertheless considered forbidden wine.” However, Rema here refers to *yayin nesekh* which is an *issur hana’ah* (i.e., all benefit is prohibited). Our wine is *stam yeinam* which is only forbidden to drink or use in food (*issur akhila*); we may derive benefit therefrom.

Does this opinion equating the alcohol with its *yayin nesekh* wine source apply to our *stam yeinam* distillate as well? Rema makes no such distinction. However, *Ahiezer* (no. 11) indeed asserts that there is a valid basis to differentiate distillates of *yayin nesekh* from those of *stam yeinam*; earlier, *Mishkenot Ya’akov* (*Yoreh De’ah* 36) made the same distinction. (The latter is the authority who must be relied upon by those who permit cognac, on the grounds that it is not wine but only a distillate thereof.) This opinion would unhesitatingly approve of vinegar made from *stam yeinam*, wine alcohol, since a further biochemical transformation is introduced.

IV. BITTUL OR THE DILUTION FACTOR

A. The exact ratio of wine and marc-wine alcohol used in the vinegar manufacture in question is unknown. Applying the halakhic principle enunciated by *Shakh* [*Yoreh De’ah* 114:21], we can assume that the larger amount consisted of kosher marc alcohol. However for the sake of added halakhic certitude we will assume that equal amounts of wine and marc alcohol were used in the vinegar fermentation.

B. *Bittul* of *stam yeinam* in water occurs at a 1:6 dilution as recorded in the *Shulhan Arukh* [*Yoreh De’ah* 134:5]. *Taz* [*Yoreh De’ah* 114–16] states that this dilution is also adequate for *bittul* of

wine vinegar when added to grain vinegar. This is also the opinion of *Tiferet Yisrael* referred to in section IIIC above.

C. Rema [*Yoreh De'ah* 92:2] rules that we do not apply the principle of “*Hatikha na'aset nevela*” to liquid mixtures involving only rabbinic prohibitions [such as *stam yeinam*] if there would be significant economic loss. Thus in our case the usual laws of *bittul* apply.

D. My father-in-law, Rabbi Moshe Feinstein, *zt'l* [*Iggerot Moshe, Yoreh De'ah* II:36], in a responsum concerning vinegar produced from wine alcohol, extends the *heter* of Rema “even if there is no significant economic loss since we are dealing with a liquid mixture involving an *issur de-rabbanan*.” In a subsequent responsum he makes two additional points relevant to our question. In *Yoreh De'ah* II:62 he concludes that:

1. There is no concern for *ein mevattelin issur lekhat'hila* (it is forbidden to intentionally dilute *issur* so that the laws of *bittul* will apply) because most of the vinegar is for non-Jewish use.

2. The pungent taste of vinegar does not classify it as *tavlin* or spices to which the laws of *bittul* do not apply, because “the derivative cannot be treated more severely than the original source.” If wine is *batel* at a 1:6 dilution so is vinegar. This principle, applied to alcohol distilled from non-kosher wine, means that if the alcohol concentration is reduced by dilution to the same concentration as found in wine that was diluted 1:6, then the mixture may be considered kosher. In a 1:6 dilution the 12–14% alcohol content of wine is reduced to 1.7–2% (which is quite close to the traditional 1:60 or 1.67%). In the manufacture of the questionable 5% vinegar, the final dilution of the original wine alcohol is minimally 1:75, and in mayonnaise, mustard or other condiments, the dilution factor is 1:150 to 1:600.

V.

Two additional factors that compel the conclusion that the vinegar in question is not forbidden must be added to our analysis.

A. The law of *zeh ve-zeh gorem*: The vinegar fermentation, while using wine-derived alcohol, also required the addition of “vinegar food” consisting of minerals and other food additives to support the growth of the *acetobacter*. Without this addition no acetification would occur. This food mixture shares with the diluted alcohol the credit for the final vinegar production. The presence of a *gorem le-heter* allows the final products to be declared kosher. The

Frings generator also serves halakhically as a *gorem le-heter*. The “*gorem*” impact of instrumentation is accepted as significant by *Tosafot* [*Pesahim* 26b], who considers a baking oven as a *gorem le-heter*. Without this generator, “natural” vinegar would not be produced until three to six months had passed.

B. The digestion of alcohol by the *acetobacter* and the subsequent synthesizing of vinegar (acetic acid) by these microscopic organisms should have the same halakhic import as digestion by macroscopic animals. The *Shulhan Arukh* [*Yoreh De'ah* 81:6] rules that milk found in the stomach of a calf that suckled from a non-kosher animal may be treated as kosher because it was curdled, thus losing its food classification, and is now considered digested material. The live *acetobacter* metabolize the alcohol as humans do, but instead of oxidizing it completely to carbon dioxide and water as we do, they produce acetic acid as their waste product, under the nutritional and environmental conditions provided by the Frings generator. Of special interest to the evaluation of highly processed food for their halakhic acceptability, is the approach of Rema to the *ikkul* or digestion. He agrees [*Yoreh De'ah* 81:6] that curdled milk found in the calf's stomach may be eaten even if the calf had suckled from a non-kosher animal. Yet in reference to an animal that was fed only non-kosher food (e.g., chicken raised on *treif* meat or fish meal) [*Yoreh De'ah* 60:1], Rema declares the animal as not kosher! Surely the conversion from milk to curds is less significant than the conversion from fish meal to the flesh, blood and bone of a chicken! I would suggest that Rema is proposing a concept of *process*. If a manufacturing process entails an intermediary step of *ikkul*, i.e. the loss of *shem okhel* (status as food) or creation of a state of *nifsal me-akhilat kelev* (not fit for animal food), but nonetheless produces a food item for human consumption, we discount the intermediary step. To take an analogous example: the preparation of beef jerky or meat that is *yavesh ke-ets* (fully dried) as a means of preserving it without refrigeration does not produce a *heter*. The intent is to rehydrate it before eating and thus its inedibility is but an intermediate stage of a process. Rema considers the raising of cattle or chicken as a process, in which non-kosher food is transformed into animal protein, and the intermediate digestive process is but preparatory to the final products and therefore is not a *mattir*. On the other hand, the curdled milk found in a calf's stomach never entered the stream of a manufacturing process, and therefore can be judged as fully digested, no longer a food item, and therefore not subject to dietary laws. Although the opinion of Rema concerning animals raised on non-kosher feed is not held by many *posekim*, the principle he

enunciated adds much to our understanding of *halakha* as applied to modern food technology.

CONCLUSIONS

A. There is no valid halakhic basis to *permit* the described process for the *intentional* production of vinegar from non-kosher alcohol.

B. There is no valid halachic basis to *prohibit* the use of the vinegar so produced *in error*.

C. To declare as non-kosher those food products containing vinegar mistakenly produced from wine/marc alcohol, such as mayonnaise, ketchup, mustard, etc., perverts the halakhic process, and is in violation of the halakhot prohibiting both wastefulness (*bal tash'hit*) and causing economic loss to fellow Jews.