Brewing! Has It Changed That Much?

By Jack McCabe, Technical Director M.B.A.A.

I always tell the students at the Brewing and Malting Science and the Packaging Courses that there is no such thing as a “dumb question.” You will never know unless you ask! I thought you might be interested in a panel Discussion conducted by District Chicago back in January of 1952 and the questions that were on the minds of Brewers at the time. This type of program might be of interest to the Districts today for a productive change in their Technical Programs!

**District Chicago Features the Forum**

**Presiding – Chairman Gerald W. Seng**

Chairman Gerald W. Seng: May I have your attention, Gentlemen? Tonight our technical session will consist of a round-table discussion of practical brewing problems. The members of our Technical Committee have kindly consented to be the panel of experts, and with their assistance I think we can reach a prising our Technical Committee. As you well know, these men are well known to you but for the record, I have two requests to make. The first is that if any member of the panel has a different opinion than that expressed by his colleagues, I wish he would state it. No one should be offended; we are here tonight to evolve the best, most complete answers to the problems, and it’s only by a lively and open discussion that we will achieve that end. The second request is that if personal experience has given us just a little different slant on the problem, don’t hesitate to ask it.

Mr. Wahl: The edible lactic acid is the one we have had the most experience with, and consequently we prefer it. As lactic acid is natural to the human body, it is very agreeable and compatible accompanied with yeast, and there is no objection to it from any food authority.

Mr. Wahl: Dr. Wahl, I have heard of the use of phosphoric acid. Do you have any comments on this agent?

Mr. Wahl: Well, from the standpoint of the activation of proteolytic power, in which I have had considerable experience, and the use of various acids in the mashing for that reason, you will find that any of the mineral acids or their derivatives have not been necessary. They just do a certain amount of neutralizing, and, of course, you must consider the large protein content in mash which alters its basic structure from a basic protein to acid protein from the standpoint of whatever acid we use. Therefore, by the use of phosphoric acid, you get more phosphoproteins which are later troublesome. Research showed us that the phenomenal action, stimulation of proteolytic power exercised by lactic acid over any other type of acid was due to certain salts of lactic acid. We have published some of our work along that line. We made laboratory mashes with sulphuric acid, hydrochloric acid, phosphoric acid, and did not receive any stimulation of proteolytic power during mashing, while with lactic acid we received quite an action. From the result of that work we have come definitely to the conclusion that for brewing the preferred acid in the mash is lactic acid.
**QUESTION NO. 2**

**How many parts per million of sodium chloride should be present in:**

A. The brewing water? B. The finished beer?

**Mr. Robert Tenney:** In general there seems to be an idea that there is a certain amount of saltiness that is desirable in beer, and that amount of saltiness almost always amounts to about five pounds per hundred barrels of beer, without particular regard to the amount of salt or sodium chloride specifically in the brewing water. That is a rather old rule of thumb that is still practiced in many breweries, and a favorite place of adding that has been either in the kettle, which is more common, or in the mash tub, where it becomes a part of the brewing water. In my own opinion, I rather prefer to have something between two hundred and three hundred parts remain in the brewing water and do not add any in the kettle, and would accept whatever that equals in the final beer. Now, I present that as an opinion and would like to hear others. Let me say, in support of this, that in some methods the salt is not necessarily all sodium chloride, but, in general, the salts enhance the extraction of the enzymes. Going on the thought that if the extraction of those enzymes is the end, then our mashing will proceed a little easier. However, whether the small percentage of sodium chloride is enough to cause that activation is a little questionable. After all, three hundred parts per million is a very low percentage, and laboratory-wise, when we want to activate those enzymes, we would go up to two or three percent, which is too salty a taste as far as beer is concerned. Because of the possibility of the salt exercising some beneficial action, I would prefer to use it in the brewing water rather than add it in the kettle.

**Mr. Al Stiermann:** Bob, I have brewed beer both with salt and without. I couldn’t tell the difference, and nobody else could. Way back in 1923, ’24, and ’25, we made a lot of near-beer. In every barrel we made, we put in about six ounces of salt water. We were supposed to sell a lot more beer that way. I think we did; I think it went off all right. But as far as adding the salt in the beer, if it’s sparge water or kettle, I don’t think it makes a bit of difference. I doubt if I can tell the difference.

**Dr. Olshausen:** An amount of as much as two hundred to three hundred parts per million is very desirable to the brewing water more than the beer, because as far as the beer is concerned I know that the threshold of taste, the saline sensation, starts in the very neighborhood of three hundred parts in a million, depending on the individual. We have made blindfold tests where four hundred parts to the million definitely was recognized as a distinctly saline test, and I would imagine that the incorporation of three hundred parts, whenever its incorporation, in the brewing water entails a possible risk, although I can fully appreciate the underlying reasons for doing this, the way Mr. Tenney has expounded. I believe that fifty to one hundred and fifty parts per million of sodium chloride is a good level in any brewing water, in any wort, and in any beer.

**Mr. Wahl:** I say that just from the practical standpoint, we recommend from experience with a number of brewers that they use six pounds per hundred barrels of beer added any way that they like; in the mash or in the kettle or divided up, to improve the flavor. That is, most things we eat taste better with a little salt. I think that beer does, too, because people sit at the table and often take the salt shaker and shake it into their glass of beer. Besides making it foamy, it seems to flavor it for the particular person who likes salty dishes. Six pounds of salt per hundred barrels figures about two hundred and fifty parts per million.

**Robert Tenney:** I don’t think one particularly notices the salt that is put in their vanilla ice cream or their mashed potatoes or the green beans which you get at restaurants, but if it is entirely absent, it tastes rather flat. I do think that the salt extracted from the malt, the salt that is normally present in many brewing waters, is sufficient to take care of at least a background saltiness, but there is a certain level in foods and beverages that pleases all of us, and it will be little different for each individual. But rather than brewing blank beer and providing a salt cellar hanging on the neck of each bottle to salt your own, the industry seems to settle around, I say 5, Dr. Olshausen said one to three, and Dr. Wahl said six pounds per hundred barrels.

**QUESTION NO. 3**

**How long should new crop hops be stored before using?**

**Dr. Olshausen:** We presume that this question meant the new crop hops as they come from the supplier in bales and ready for use. I discussed this at length with my colleague, Kurt Becker, for whom I am really pinch-hitting, and we both agreed that they do not need to be stored at all. Use them at once; the reason being that any storing of hops will not benefit them. Depending on atmospheric moisture conditions, storing will only cause the valuable soft resins to deteriorate and make them gradually grow stale. I do not think storage will improve a material represented by what we call hopes, the hop plant, for use in the brewery.

**QUESTION NO. 4**

**In the blending of hops, is it advisable to use them from different years? To what extent should this blend of crop years be carried out?**

**Mr. Donald Ruff:** Yes, I think they should be taken from different years; in most cases this is in order to carry over hops from one year to the other. I don’t believe that the hops in use should be from more than three years back, although preferably two years, and that the transition from the older crop to the new crop should be gradual. By that I mean, when you’re changing from one crop to another, first of all you should use 75% of the old hops and 25% of the new crop, and that runs for about a month; change it very slowly to a 50-50 basis, and then in another month use 75% of new hops and 25% of the old hops, and the fourth month you will be using all the new crop. Of course, that depends upon the source of old hops and which hops are available, and also upon the vintage or age of the old hops.

Sometimes sales do not correspond to expectations, and for that reason you may have a lower production for that particular year and you’ll have an excess of the older crop hops. On the other hand, if your sales were greater than you expected, you may have to make the transition faster, in even as little as three months. But the important thing to remember is that the transition should be gradual; if it has to be made at a very rapid rate, it may be necessary even to cut the amount of hops slightly. Assuming that the hops are of similar quality, even then your new crop hops are going to be a little stronger, a little more aromatic than the old, so it will be necessary to cut down the flavor.

**Mr. Robert Siebel:** That’s true. In fact, if you buy the same type of hops from the same growing locality, the crop from one
year to another might vary considerably, and those things of course have to be taken into consideration. With a soft hop— that is, it has a higher soft resin content—it may be necessary to cut the hop rate, when you use soft hops especially, by you might say about 10%. But if at the end of the four months, however, some of the soft resins have changed, they’ve lost some of their freshness. So in a period not to exceed six months, I would say the freshness of the new hops would have toned down to where they could be used on an identical or a similar basis with the old crop hops.

Mr. John Joerg: Do you think it would be wise, Don, to make a brew of entirely new hops to evaluate their character?

Mr. Don Ruff: It might be wise, to give you some idea of what sort of a hop character you had, and to get the comparative flavor of that with a similar brew made with all old hops. But I believe in most cases the transition is gradual for six months, gradually decreasing the amount of old hops and increasing the amount of the new crop. And that figure of 25% is getting to be accepted.

Mr. John Joerg: I think that’s perfectly safe. In fact it may be true that you maybe could make the transition faster than that. But in our typical organizations we make the transition on about a 25% basis, so that in four months’ time we switch from old-crop hops to new-crop hops.

Mr. Robert Tenney: I’d like to comment a little on that. Your discussion with Don seems to be pointed directly to the objective of the question, but we don’t want to have a drastic flavor change, or at least a flavor change that is significantly different. I think all of us in the Chicago District probably draw upon some of those experiences in Chicago breweries where blending has not been followed and some brewery inventories have been caught with almost no hops on hand at the end of the season; then get new hops in, and so right away you’re on new hops without any chance of blending. To avoid that seems to be the objective of this question. I’ m reminded of one brewer in the Northwest who happens to grow hops himself, who uses a blend over a five-year period; and he never uses more than 30% of new hops in the blend that he’s using. He does mix in some hops that he doesn’t grow, but about 80% of the hops that he uses are from his own ranch, where he has control over the growth factors. He feels that by blending over such a long period of time, and incidentally keeping those hops very well in cold storage, that he is going to avoid any changes in hop flavor. He does not, in doing that— of course this is rather an empirical blend— he does not follow any chemical analysis or resin content. He feels that those hops coming from the same area under essentially the same growth conditions will be of the same flavor character, and that if he does not use over 30% of new crop, that he will always maintain a very mild character. Now, he is after an exceedingly mild hop character, and there is not warmth and aroma in his beer. So in a period not to exceed six months, I would say the freshness of the new hops would have toned down to where they could be used on an identical or a similar basis with the old crop hops.

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Don, I’d like to address this specifically to you. Your figures were rather of an empirical blend. Are you familiar with the procedure proposed by Brenner, where the hop brewing value or some figure on resin content, either alpha plus beta over three, or beta over nine, or alpha alone, would be multiplied, say, by hop intensity— Multiply that value by the time in contact with hot wort, and attempt hopping procedure from year to year on that. Are you familiar with that?

Mr. Don Ruff: Yes, in fact we used that procedure in the past in making recommendations, and it does work out. However, it’s not a hard and fast rule, and for that reason we are inclined today not to make our recommendations in that manner any longer.

Mr. Tenney: Do you find that it holds the bitter but not the other taste qualities?

Mr. Don Ruff: That’s true. The aromatic qualities of the hops dissipate, while it holds true for bitterness. As I said, it’s not the reliable yardstick that can be used implicitly.

Commenting on your example, to me it seems a little bit foolish to buy hops and buy them in such quantity that you must keep them for five years and blend them in a manner so that you use the hops up in a five-year period, because you’re paying for a premium quality, or you’re paying for freshness and aroma and high in soft resin content; and it seems uneconomical to let those hops lie around four or five years and then gradually there will be a change in chemical constitution and eventually you lose that. I believe today the majority of the brewers, however, are buying from one season to another, and they carry over just enough to make the transition period, so that the change is gradual. They maintain, or they try to maintain, through buying various types of hops, California types, and through blends of lot numbers and different types of hops, that is growth localities, to arrive at a uniform hop flavor, whether it is hop bitter or hop aroma.

Mr. Robert Tenney: Well, Don, I agree with you on the poor economics of my example. I posed it as an extreme in order to over amplify, and certainly if a brewer had to go out and buy hops for a five-year stock in order to blend over that long a period, he’d be wasting money. But this brewer happens to raise his own hops, so he has a little bit of an edge there. But even so, he could sell the hops that he’s bringing into his own brewery to somebody else with profit, so I don’t know that it’s so economical.

Chairman Seng: Before we leave this question, it has been said that you can underboil hops. In other words, we’ve been recommended not to put hops in the last five minutes of boiling, at the time of knocking out. I wonder if Colleague Weber would like to elaborate on that a little bit.

Mr. Peter Weber: Yes. I’d like to comment on that and another thing that John asks, and that is whether crops, a new crop of hops, should be used entirely in a brew—that is, when you first get those hops in. A suggestion is that you try the hops for one addition. Usually three additions are made, and by trying out the hops for each addition, you’ll learn much more of the value of that hop than you can by using it for an entire brew.

Regarding the second point, boiling most of the wort without hops is intended to get a gentle break, and that break is due to a combination of your proteins of the worts with the tannin that comes from the malts. Once that has been accomplished, you have a certain balance or ratio of your protein and your tannin. Now with each hop addition, however, you’re introducing first, a different amount of tannin substances; and secondly, usually you have some of the wort running in the kettles just since the last running, so that your ratio of tannin to your proteins changes. Now, when you come to your last hop addition, either the kettle is full, or it is about full, and you may or may not be running in some of the last wort. Now, if you do not get that combination of the tannin substances with the protein of the
wors too long; but his story is so identical with a lot of practical tests, and that is that as long as you don't boil any hops any longer than, let's say, 30 minutes, you're not going to lose too much of the resin value of that hop. A suggestion has been made that the last hop addition be for at least 15 minutes boiling time, and that does not include the striking out time, because that means that's a variable that I don't think we can consider. So the two different things I have to offer are, first, when you get a new crop of hops, yes, find out what it will do at each hop addition; and second try to add the hops, any hops in the last addition, so that they boil a sufficient length of time to get the real benefits of your resins; to accept just the tannin only gives you harshness, and you can't get rid of harshness by boiling the kettle. You must extract the resins to get the real benefit from your hops.

Mr. John Joerg: Pete, do I understand you correctly — you say that you only add a third of the new crop hops to the kettle in order to evaluate their effect upon the final product?

Mr. Peter Weber: Yes. Now I don't know how many hop additions you are making, but let's say you're making three hop additions. So for the first hop addition, use all the new hops as soon as you can; find out what influence they have on the flavor. For the second brew, use all new hops for your second hop addition, to find out what effect that has when used at that point. And then for a third test, use all for the last hopping. Now there you've got three different brews, it is true, but they can blended off nicely, and you have found out one thing you want to know, what is that hop going to do to my beer? Then you can regulate your future use of it accordingly.

Mr. William Kayer: Pete, that's assuming that you know your hops. Right? The reason I say that is, after all some hops are more flavorful than others. Your percentage then is based on the way that you are hopping. In other words, if you're using six hoppings, compared to three hoppings, it would be based on that. But what I'm getting at is, if you're using a hopping for flavor, you would naturally use your flavor hopping for the last hoppings, and in the proportion to the other hops.

Mr. Peter Weber: Well, perhaps you and I are talking the same language; the suggestion is that the hop be tried out in each hop addition that you make, of course substituting for whatever hop has been used previously. The purpose is to determine the effect that that hop will have upon the beer you're brewing, so that you will neither underhop nor overhop.

Mr. Bob Tenney: To go back to Gerry's question what is the minimum time for boiling, I think that we would reveal that a lot of our own experience, looking around the room here, and knowing how some of you men hop and knowing how some of you have hopped — I think we can get some rather interesting comments on the suggestions which so far have come from this panel. I know that some of your practices differ from the recommendations. Now I kind of think that that's the purpose of this thing, to say, "Well, I don't do it that way, and my beer's all right" – or do you think your beer's all right? There are two gentlemen in the room who have had experience in adding lupulin in the cooler pan experimentally. I don't know how many of you have had experience with dry hopping in the cellars. I think at least three or four of you have. And both of those would seem to preclude any boiling whatsoever. Does anybody want to talk about that? I don't want to point my finger at anybody, but it seems to me we could have a basis of a good discussion based on that, from your own experience.

Chairman Seng: Would the undesirable tannins be removed from the hops in, say, a five-minute boiling period?

Mr. Peter Weber: You mean, would they be extracted and put into the wort? Yes, I think they would.

Chairman Seng: Would the heat of the wort standing in the hot wort tank be enough to join them with any of the proteins?

Mr. Peter Weber: You aren't going to combine any more of the tannin, whether it's coming from malt or hops, with the proteins, unless you have protein to take that tannin up. I hoped I hadn't made that too unclear. If you have X pounds of proteins in the wort, that pretty certain, a pretty definite quantity, and only a fraction of them will combine with tannin, and when all of that is combined with tannin, all the rest of the tannic acid you add is just going into the wort as tannin; it's not going to come out until you add something to take it out. After you've once reached the end of that reaction, which is probably in the kettle, you are just adding tannin to add to the bitter flavor of your beer. You might say that I don't think hops are a very efficient way of accomplishing what we want to do when we use hops, but let's not get into that.

**QUESTION NO. 5**

**How is ale yeast washed?**

Mr. Donald Ruff: Really, I can see no reason why ale yeast couldn't be washed the same as ordinary yeast. In my travels, I've come in contact with some Canadian ale brewers who washed every generation. The reason that they washed so often is to keep the bacteria count down, and they keep it down to a practically negative amount, such as a count of one bacterium per thousand. That is their policy. If it goes up as high as three, they begin to worry about it. Washing every generation with a very selective washing procedure, they get it perfectly clean. I think the products of these particular breweries certainly warrants the procedure, because they have an excellent ale. I think that just about covers the subject.

**QUESTION NO. 6**

**What is the greatest percentage of adjuncts that can be used which will not affect the health of the yeast?**

Mr. John Joerg: I asked that question, and it's purely an academic question. It is of theoretical interest to me to see the materials that are used in various breweries, and how their use differs. I was wondering just how the yeast is affected, and whether it was necessary to supplement the wort or the material by some other sources of protein, or whether they could actually brew beer using a 50-50 basis. I know that during the war we had experience at the plant with a brew with 60% malt, and our dead cell count went up quite a bit until we added soya flakes. It then became very vigorous.

Chairman Seng: At one time we used as high as 45% adjuncts and the yeast maintained a healthy condition without using any additives.

Mr. Peter Weber: There is one answer to that question, I think, that might be pertinent. And that is that while there is no real standard of identity for beer, nevertheless it has been considered as being a fermented beverage produced with malt and...
other materials. But as long as there is any standard of that kind, I would assume that a product to be called beer would necessarily have to be made from at least 50% malt. That's just a thought.

Well, point number 2. I think that your pitching rate with a 50% malt would mean as much as anything else, because the number of cells which have to be grown to ferment your beer; there's a big relationship to the health of your yeast. Now, in conducting fermentation tests while we were having school, we would have the students count the number of yeast cells that there were in a brew at certain periods during the fermentation, and there was a direct relationship between the number of yeast cells and the percentage of alcohol in the beer up to a certain stage. The number of times that the yeast will multiply also depends upon this, so I would say that roughly your problem there is to ascertain how much yeast is to be added for the work to be done. Naturally the original gravity of the wort would be an important factor — that, and also the quality, you may say, of the proteins which are introduced by the malt.

Mr. John Joerg: Pete, may I ask a question? As the adjunct rate increases, would you believe more or less yeast should be pitched per barrel?

Mr. Peter Weber: I would say relatively more.

QUESTION NO. 7

What is the optimum temperature and time of peptonization for the benefit of: (A) Stability of the beer; (B) Flavor of the Beer; and (C) A compromise to produce a well-balanced beer from both standpoints?

Mr. Bob Tenney: Well, you've got that marked down for me to lead off on, and, frankly, fellows, that's all I intend to do. There's a lot of opinion on it: a lot of experimental work has been done; and a lot of conclusions have been drawn that differ in different plants or different end objectives. When you say, which is best for the flavor of the beer, each brewer — theoretically at least — is after his own flavor, so he may have his own preferences there. I don't bring that up in an effort to dodge the question, but to try to define the limits that the answer shall adhere to. Stability, I think we can hold pretty well to definitions of stability. On the compromise question, Part (C) — that, of course, brings in flavor again.

Well, let's look at the variables in beer production that are going to influence stability insofar as peptonizing is concerned. First of all, we've got a variation in our balance — a variation due to climatic conditions, a variation due to varietal conditions, and soil conditions as well. On top of those three major variations, let's put the other variables of different malting techniques; and when you multiply maybe three or four malting techniques by three basic variances, you have at least nine or more permutations that are possible to give you a different protein balance existing in the malt, which you're getting to start with. Let's assume that we only have nine possible variations of that protein in the malt; that the malster by blending and by trying to anticipate the desires of the individual brewer will still have had about nine degrees of variance in that. I think that's a fairly liberal estimate of the amount of variation. Then you have the desires of the brewer himself. Frankly, I have seen a very odd influence in that respect, where some brewers would swear — I'm talking not about the brewmaster, but about the brewer at the kettle, who'll swear that with a certain malt he gets better results at 30° than he does at 36° Reaumur for a peptonizing temperature. Another man in the same plant just can't get that lateur to run off if he is told to make it 36° or 30° when he has his own private preferences. That is another variation that is very difficult to measure, but certainly the variation in individual approaches to that problem have to be considered, and there are quite a few plants where you do have to consider that.

I would generalize in this way: Certainly, the temperatures around 50° Reaumur are to be avoided. There have been several indications that those temperatures are rather optimum for some of the proteolytic enzymes, and are apt to produce fractions which are undesirable from a stability standpoint. Ordinarily, brewers don't peptonize in the neighborhood of 50°, but sometimes those temperatures are met. Except on a flake mash, they are usually dangerous.

The question of whether to go down as low as 30° or as high as 38°, or somewhere in between, is pretty much a matter of test.

My next statement, I'd like some comments from some of the malsters that are here — not that I'm shifting blame to them; I'm shifting credit. I think that 80% or more of the proteolysis that we have eventually getting into the beer — that's grammatically incorrect, but I think you know what I mean — 80% of the proteolysis that occurs in that entire process from barley to wort occurs in the malthouse, so that the brewer actually doesn't have a great deal of control over it, and certainly not a great deal in the selection of his mashing temperatures between 30° and 38°. Let's recall that the English system very frequently goes in at a high temperature, holds that temperature right straight through the clarification, and doesn't bother to peptonize at all. Certainly they also have beers that have good foam and good stability. There is a brewery in this country that I know of currently that is doing that on lager beer, and in their particular market their beer is more stable than any of the competing brands — and I say that knowing the actual measurements of that beer and its competitors — and its flavor must be all right, for it happens to lead the sales in that area. Now, maybe their flavor isn't right; I know their stability is. That's not a plea for no peptonization; it's just a state that that is being done.