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PRACTICAL HOME BREWING WITH MALT EXTRACTS

The following information is intended to identify and stress only the most important points of good home brewing practice. It is geared to small batch techniques with emphasis on quality, reliability, control and wholesomeness. It will provide an excellent basis upon which to build additional information, but will also work well as a "stand alone" instruction if we limit the activity to malt extract or partial mash brewing.

Numerous technical considerations and many years experience lie behind the information we present here. In our approach to the process, we will use a blend of art and carefully applied science. Except where there is clear benefit to quality or reliability, sensory evaluation will be favored versus more accurate scientific measurement. We will gear our handling of the batch to actual observed behavior (at known temperature) instead of attempting to infer behavior from a secondary variable like density (read with a hydrometer). Then, no matter what recipe combination we wish to try, we remain in control.

While we purposely do not wish (necessarily) to emulate the parts of commercial practice which have to do with operating efficiency or profit margins, etc., there is one area of brewery procedure that is especially important for small batch reliability and quality: We wish to establish fermentation as very fast as possible by adding a large active yeast starter immediately when the batch is cooled. To do this, the starter will need to be made ahead of time from separate materials as a separate operation. A recipe and procedure for beer yeast starters is given on page 6.

When fermentation begins, all air is expelled from the fermenter liquid and headspace by a very large outflow of CO_2 gas. Since almost all the micro-critters that may contaminate the brew need air to grow, establishing fermentation quickly is the best and easiest way to prevent their growth. By adding a large quantity of active brewing yeast (the starter) we also make sure that any small amount of wild yeast(s) which may be present will be overwhelmed in number and not grow to significant levels.

These special efforts are justified on the basis that the yeast which ferments our beer is responsible for perhaps 20 to 30% of the flavor character of the beer. Just as wild yeast contamination may reduce quality significantly, pure yeast cultures can enhance quality.

Using dried brewing yeast requires preparation time from a few hours to as much as a half day or so. With the dried yeasts we can decide to brew on fairly short notice. Liquid yeast cultures are generally regarded as having better purity and yielding better flavor but require about two days for preparation.

We recommend the liquid yeasts wherever possible as soon as basic recipes and procedures are set.

TWO-STAGE HOME BREWERY EQUIPMENT

Specialty Items

7-1/2 Gal. Food Grade Plastic Bucket or 6-1/2 Gal. Glass Carboy (Primary Fermenter)
Plastic Sheet, About 1 Sq. Yd. - To cover bucket type primary fermenter
5 Gal. Glass Carboy (Secondary Fermenter)
Fermentation Lock and # 6-1/2/# 7 Drilled Rubber Stopper - To fit carboy(s)
Racking Tube, Siphon Hose and Pinch Clamp - For liquid transfer
Grain Bag - To contain specialty grains during processing
Metal Brewing Thermometer, 32 to 212 ^oF (0 to 100 ^oC) - For partial or full mash brewing
Automatic Springless Bottle Filler
Bottle Capper - Hand or bench type
Crown Caps - For beer bottles
50 (Minimum) 12 Oz. Beer Bottles - Non-twist off types
Bottle Brush - For beer bottles
Carboy Brush - For glass carboys
Cleaner/Sanitizer - For all equipment

Household Items

4 To 7 Gal. Non-aluminum Brew Pot, 16 to 28 Qt.
Thermometer - For air temperature
Stainless Steel or Chrome Plated Spoon, 12 to 16 inches length
Measuring Cup(s) and Spoons
Glass Jar or Bottle, One to Two Qt. - For yeast starters
Coffee Cup or Mug
Aluminum Foil or Saucer
Funnel - To fit beer bottles
Gravy Baster
3 to 5 Gal. Wash Bucket
Elastic Band Loop (made from rubber bands) - To hold plastic sheet over bucket type primary fermenter in drum head fashion

Optional Items

Jet Spray Bottle Washer/Rinser - Speeds bottle and carboy rinsing
Vinator Pump Bottle Washer - Speeds sterilizing bottles - Use with Jet Spray for best handling
Wort Chiller, Immersion Type - Greatly speeds cooling the cooked wort
Brewcraft Pressure Barrel, Very Heavy Plastic 5 Gal. Self Contained Draft System
5 Gal. Stainless Steel Soda Kegs (Used) - Require CO_2 cylinder & regulator
Party Pig^{TM}, 2.25 Gal. Portable Self Contained Draft System
Party Keg, 1.32 (5 Liter) Steel Canister Draft System
Carboy Handle - Fits on neck of carboy for easier handling
Beer Bottle Labels
External Temperature Controller For Refrigerator - For fermentation or lagering in hot conditions

BASIC PRINCIPLES OF HOME BREWING

Many different recipes and schemes for making home-brewed beers (using various equipment setups) are found in books and pamphlets, etc. While the details of procedure will depend in part on the type of equipment in use, the general points of this discussion will be helpful in using any equipment more effectively to achieve the best possible results.

It is during the preparation of the *wort* (the batch liquid before it is fermented) and handling of the brewing yeast before fermentation begins that greatest care is necessary. Once the batch is set into fermentation, it is largely self protective. For this reason, the yeast starter and preparation procedures (pg. 6) are geared to very fast onset of fermentation. During fermentation and bottling, the equipment and techniques we use will easily protect the brew from harm. Overall, there are four areas of concern:

1. AIR Before fermentation begins, air (particularly oxygen) is necessary to help the yeast grow. For this reason, aeration of liquids involved will be instructed during the preparation of both the yeast starter and the batch wort. To avoid oxidizing some delicate components in the wort, especially in light colored beers, we need to have both cool temperature and slightly acidic conditions. Usually the ingredients themselves provide enough acidity, but if measuring pH (using pH paper or meter) for all grain or partial mash brewing, adjust to 5.2 to 5.4 by the addition of 1/4 to ½ teaspoon of citric acid.

Pouring the wort into a bucket type primary fermenter or through a funnel if using a carboy for primary fermentation will provide enough aeration if the wort is cooled to at least 70 ^{o}F. If siphoning the wort, simply position the hose outlet so that the liquid falls freely for a foot or more.

After fermentation begins, air contact needs to be minimized. The large volume of CO_2 gas generated by the fermentation clears air from both the liquid itself and the headspace above it and automatically provides the airless condition necessary for the conversion of sugar to alcohol. This blanket of heavy gas will provide continued protection from air for a time so long as the temperature is fairly constant and the headspace is not too large. We recommend primary or single stage fermenters no larger than 7.5 gal. (for 5 gal. batches) so that the fermenter is at least 2/3 full.

Using a 5 gal. glass carboy as a secondary fermenter will safely provide adequate time for good settling and allow an accurate evaluation of the fermentation activity before bottling. By filling the carboy to the base of the neck or up into the neck a little, we will be able to observe the bubbling activity and the accumulation of bubbles on the liquid surface. Since the headspace volume is minimal, even a very slow fermentation will assure that the headspace is free of air. The observation of actual behavior (at known temperature) is a better measure of the readiness for bottling than density changes read on a hydrometer and avoids any extra exposure to air.

Handling Techniques. Each time you start the siphon and before bottling, run off a small amount of liquid to a side container. This will purge the line of rinse water and provide a sample to taste. To minimize splashing and aeration, place the siphon outlet at the bottom of the receiving container before restarting the flow. Before each step involving liquid handling, it is a good idea to be organized and have all needed materials ready for use. When setting up to bottle the batch, several measures are described (pg. 8) to sterilize the bottles and caps before opening the fermenter so that exposure to air and light are minimized. At bottling time, the beer is still saturated with dissolved CO_2 gas and the handling during siphoning and bottle filling causes the release of some of this heavy gas, creating a layer which gives automatic protection against undo air contact.

2. BACTERIA, MOLD AND WILD YEASTS Beer wort (the mixture before it is fermented) is rich in various vitamins and nutrients and can be an excellent growth medium for stray micro-critters. To minimize the chance of significant contamination, we offer several suggestions:

Sanitizing The Equipment. For most types of cleaner/sanitizer a brief soak or wash in the liquid is all that is required. Rinse thoroughly with water as hot as practical (do not use extremely hot water on cold glass carboys) and use the item immediately. It is normal for hop resins to stain a plastic primary fermenter after a few uses. The stains will not harm the beer. Wash plastic fermenters with a light detergent using a soft cloth or sponge after each use and rinse thoroughly with plain warm water. When cleaning plastic fermenters, do not use abrasive materials. A scratched surface can harbor spoilage bacteria.

After being sanitized chemically or after cooking, all containers should be kept covered as much as possible. The kitchen is usually the cleanest and easiest area in which to prepare the yeast starter and to cook the batch.

3. TEMPERATURE Cooling the cooked portion of the batch rapidly to 65 to 70 ^{o}F avoids a prolonged period at temperatures that encourage contaminant growth. Using an immersion wort chiller makes rapid cooling very easy, even for large hot volumes. Any batch water which is not part of the cooked volume should also be cool so that when the batch is mixed, the yeast starter can be added (pitched) immediately.

In order that the fermentation behavior we observe is a reliable measure of the condition of the batch, we will need to know the temperature in the fermentation area. Place an air measurement thermometer close to the fermenter(s). Although stout and other full flavored dark beers will tolerate fermentation and aging temperatures in the 70 to 75 ^{o}F range, we will generally achieve higher quality by fermenting these and most other beers (except lagers) at 65 to 70 ^{o}F. At cooler temperatures, some ale yeasts may not ferment thoroughly enough to avoid over-carbonation after bottling. It is a good idea to raise the temperature to 65 ^{o}F or so for a few days to observe the behavior before bottling.

To make lager beers using cold tolerant lager yeasts, a temperature controlled environment is necessary. After establishing fermentation at 55 to 65 ^{o}F, the temperature can then be lowered in 5 to 10 ^{o}F increments over several days time to reach 35 to 45 ^{o}F for lagering. An extra refrigerator with an external control is ideal. This equipment can also be used for fermentation in hot climates.

4. LIGHT Beers lighter in color will tend to be the most sensitive to light. Although regular room lighting will not be a problem for a short time during bottling, do avoid direct sunlight and high ultraviolet output fluorescent light. If necessary, an opaque enclosure such as a large cardboard box may be placed over primary and secondary fermenters to provide dark conditions while the beer ferments and settles. The enclosure will also assure a more constant temperature where variation is otherwise unavoidable. Dark bottles and a dark location for bottle aging will maintain best quality until the beer is consumed.

<u>WATER FOR MALT EXTRACT BREWING</u>

Malt extracts in dried or concentrated syrup form are dehydrated products made from an original water solution which itself contained soluble minerals. During spray drying or vacuum evaporation, volatile components (mostly water) are removed. Thus a good part of the original mineral content remains part of these products. Although the minerals (hardness) contained in various extracts surely differs, the extracts themselves may contain as much of certain types of minerals as the beer can tolerate well. For this reason, the amount and type of minerals in the brewing water we use for malt extract brewing is very important. In some cases the brewing water may be a limiting factor in the quality we achieve.

In general, dark beers are least sensitive to water which is less than ideal and light colored beers (lager or ale) are most sensitive. Although amber beers logically fall between the two, they are significantly less touchy than light ones. Our normal suggestion is to make either dark or amber beer as a first batch.

In most cases (except possibly porter and stout), we find that <u>lime hardness</u> (calcium bicarbonate/carbonate) reduces the quality of extract-made brews in several ways. Flavor, color, carbonation and hop bitterness can be adversely affected. However, because of the high number of variables involved, your own taste evaluation of the beers you make with various waters will be the best bottom line.

To test for the presence of lime, boil a few cups of water for ten minutes or so and let stand to cool. If sediment and/or surface solids appear, the water probably contains lime in harmful amounts. Those with municipal water supply may simply phone the local water department to determine calcium carbonate levels. If the lime content is much above 40 parts per million (PPM) or about 3 grains per gallon, boiling (and cooling) before use in the batch will reduce the lime content of the water. It will also kill bacteria, reduce harmful iron levels, and drive off chlorine and sulfur or other odors which may be present. If tap water quality is otherwise good, its hardness can also be reduced by diluting with a portion of distilled water. The result can be better beer.

<u>To reduce lime hardness</u>, boil as much of your brewing water as you can for about 15 minutes, <u>cover</u> and allow at least several hours to cool and settle thoroughly. Colder temperatures will cause more lime to settle out. Use the racking tube/syphon hose assembly to siphon water away from sediment and surface solids into a sterilized container which has been marked to measure gallons. The remaining batch water can be purchased distilled or drinking water. Remember to discard the first few ounces of outflow when starting the siphon.

NOTE: Standard water softeners do not remove carbonate from water, but exchange sodium for calcium. The resulting sodium carbonate is highly soluble and therefore cannot be removed by boiling. Use <u>unsoftened</u> water when boiling to reduce lime content of brewing water.

While bicarbonate/carbonate hardness can be harmful, sulfate hardness can be beneficial, especially for ales. It offsets small amounts of residual lime and buffers the pH lower (more acidic). The net result can be better beer. Most <u>processed</u> bottled drinking water contains reduced mineral levels and some contain little or no lime. These will make excellent extract brewed lager beers without any hardness additions. For ales, a small addition of sulfate in the form of burton salts or gypsum will generally improve results. Again, your own taste evaluation is the best bottom line.

DETAILED PROCEDURE FOR TWO-STAGE EXTRACT BREWING

Yeast starters for beer are separate small batches of malt extract solution prepared ahead of time to grow the yeast several fold and acclimate it to malt fermentation. Their main function is to provide a large and vigorous colony of yeast to add to the wort so that fermentation will be established very quickly. Starters are most conveniently made using dried malt extract which is easily measured in the small amounts needed. Then, only as good activity in the starter is proven, the syrup(s) can be opened to assemble the recipe. This is particularly important for dried yeasts whose activity and vigor may be questionable. We recommend always having extra dried yeast available before you begin brewing. If necessary, more can be added to the starter to achieve good activity.

For Wyeast Brewer's Choice™ liquid yeasts, allow the package to warm to room temperature and break the inner seal about two days before you intend to brew. The package will puff fully in about one day. After it has fully expanded, make the starter according to the recipe and procedure below and allow about one more day for good activity to develop.

For dried yeasts, make the starter two to eight hours before you intend to start. Dried yeasts should be hydrated before use as follows: Sterilize and rinse a coffee cup or mug and a cover for it. If using chlorinated tap water, fill the cup/mug about 3/4 full with hot water, cover and allow to cool until only slightly warm to touch (about 100 °F). Bottled water may be warmed gently to the same temperature. Then sprinkle in one or two packages of dried yeast and cover again. Do not stir the yeast into the water yet - let it settle on its own for about 15 or 20 minutes.

To make the starter, heat three cups of brewing water to steaming hot condition in a small saucepan. Turn off the heat and stir in four tablespoons (1/4 cup) dried malt extract (or two tablespoons malt syrup extract), one tablespoon of corn sugar and 1/4 teaspoon yeast nutrient. When dissolved, heat to a low simmer for about 10 minutes. The stirring spoon may be sterilized by leaving in the saucepan during the simmer. As the starter is cooking, sterilize and rinse a one quart mason jar or larger similar glass container and a cover for it. Cover the jar. When the cooking is complete, force cool the solution by placing the saucepan in a few inches of cold water in the sink and stirring for about two minutes. Dry the sink water from the pan and feel to confirm it is cool to touch. Pour the starter liquid into the glass jar so that it falls and splashes to aerate. Stir the hydrated dried yeast (in the coffee cup) to disperse it until smooth and lump free and pour into the starter liquid. If using a liquid yeast culture, sterilize and rinse the outside of the package before opening and pour into the starter liquid. Cover and place in a 75 to 85 °F location until active.

When the starter shows obvious active fermentation, then place it in a cooler spot and begin the procedure below (step 1). If the starter shows signs of life but is not vigorous, more time may be necessary or it may have passed its most active stage already. To check the extent of fermentation in the starter, pour off a small amount and taste it. If there is noticeable sweetness, the starter will need more time. For dried yeasts, another package may be hydrated and added. Warmer temperature (up to 85 °F) will also speed the growth process. Although lager yeasts are normally not as foamy as ale types, both should show a foam-up in the starter jar when the liquid is swirled. If a yeast starter cannot be used when it is first ready or if it has passed its most active stage, it will generally still work well several hours later. However, if 12 to 24 hours additional time is needed, pour off about half the liquid and cook up an additional half recipe, cool and add to the starter. Using a cooler location (65 to 70 ^{o}F) will also extend the starter additional time as more yeast is grown.

1. If crystal malt and/or other specialty grains are part of the recipe, these may be gently crushed before placing in the grain bag. Hold the dry bag over the sink when adding the grain and jiggle the bag to sift out most of the fine or dusty material. Close the bag at the top and place in as much room temperature brewing water as possible in the brew pot while still allowing about one gal. of headspace. Heat to steaming hot condition but <u>not above 170 ^{o}F</u>, stirring occasionally, turn off the heat and cover. Allowing the grain to soak in the hot water for a while will make better use of it. Remove and drain the bag before adding other ingredients.

Alternatively, to do a partial mash, the water may be heated to about 160 ^{o}F <u>before</u> adding the crushed malt in the grain bag (including crystal malt or other specialty grains if used). Turn off the heat. When the crushed malt is added the temperature should be reduced to about 150 ^{o}F. Additional hot or cold water may be added to adjust the temperature. Stir well, cover and let stand about 45 minutes, stirring several times. Then, remove and drain the grain, rinse with a little hot water and add the rinse water to the brew pot.

2. After removing the grain and with the <u>heat off</u>, add all ingredients except hops (or hop pellets) and yeast to the pot in top to bottom order as shown in the recipe formats (pgs. 11 & 12). Stirring the hot liquid into rapid circular motion before adding dried malt extract or malto-dextrin will minimize lumping. Both syrup and dried extract will require a few minutes of stirring to dissolve and mix well. Reheat over high heat, stirring frequently.

3. When boiling begins, <u>watch for a foam-up</u> and stir to prevent a boil-over. After establishing the boil, add the bittering hop pellets and continue the boil for about 45 minutes. Adding hops later in the boil reduces the bitterness extracted from them. Stir during the addition to prevent a boil-over. When bittering with whole hop flowers, boil at least one hour, adding half at the beginning of the boil, 1/4 for the last half hour and 1/4 for the last 15 minutes. Stir frequently during the boil. Whether bittering with pellets or whole flower, a half to one ounce of the flower added for the last two or three minutes of the boil for *finishing* contributes more aroma. Record the boil time and the hop addition times.

4A. (Using Bucket Primary) During the last part of the boil, sterilize and rinse the bucket type primary fermenter and its cover and measure into it the volume of brewing water needed to reach 5.25 gal. total, including the portion in the brew pot. Pour this water, allowing it to fall a foot or more to aerate it. Cover the fermenter and place in a dark and cool (65 to 70 ^{o}F) location suitable for fermentation.

4B. (Using 6.5 Gal. Carboy Primary) During the last part of the boil, sterilize and rinse the 6.5 Gal. carboy and a fermentation lock assembly to fit the carboy. Measure into the carboy additional brewing water as needed to reach 5.25 gal. total, including the portion in the brew pot. Pouring through a funnel will provide adequate aeration. Attach the fermentation lock and place the carboy in a dark and cool (65 to 70 ^{o}F) location suitable for fermentation.

5. When boiling is complete, leave the brewing spoon in the hot wort, cover and place the pot in a

sink of cold water. Stir frequently and move the pot back and forth through the sink water for rapid cooling. Repeat the alternate stirring and pot movement and replace the sink water several times with cold water until the outside of the pot feels cool (about 10 to 15 minutes). When the wort is no longer hot, ice may be added to the sink water to help cool the wort faster. If using an immersion wort chiller, after attaching to a cold water source, simply stir the wort constantly past the coils until cool (about 5 minutes).

6. Remove the pot from the sink and dry off the outside before pouring or siphoning the cool wort into the primary fermenter so as to aerate it. Stir well to assure a uniform mixture. Swirl the yeast starter and pour it into the fermenter - do not stir. Attach cover and/or fermentation lock. Within a few hours, the liquid surface should be covered with foam, indicating active fermentation has begun.

7. Inspect the primary fermenter several times a day and when the foam head has collapsed to a thin foam layer or a few spots of foam (usually only one or two days), then siphon to a five gallon glass carboy. Place the racking tube inlet (with sediment guard in place) at the far side of the primary fermenter to minimize disturbance of sediments. Collect the first few ounces of outflow in a small side container to purge the line of rinse water. Taste this side portion and if there is no evident sweetness, we should not see any further vigorous fermentation. When most of the beer has been siphoned, the primary fermenter may be tilted a bit so that the racking tube inlet is in the lowest area for maximum liquid carry over. If the 5 gal. carboy is not filled to at least the base of the neck when the siphon breaks, boil and cool a little water to add to bring the liquid to this level. There should be about two inches of head space to the bottom of the fermentation lock stopper. When attaching the fermentation lock, remember to dry the stopper and the inside neck of the jug. Fill the lock about half full with water. Place the carboy in the fermentation area until the beer is bottled.

Allow <u>at least one week</u> before bottling for good settling. The slow fermentation which goes on during this settling time should produce a small amount of foam in the neck of the jug, often only a ring or collar at the glass edge 1/8 or 1/4 inch wide. Bottling may be delayed for an additional week or two but should be carried out before fermentation stops altogether. If fermenting with ale yeast (liquid or dried), and the temperature is 60 ^{o}F or lower, raise the temperature to 65 to 70 ^{o}F for a few days to be sure of slow fermentation before bottling.

BOTTLING PROCEDURE

1. Handling gently to avoid disturbing the sediments, set the glass carboy on a counter or tabletop in position for siphoning. Heat one cup or so of brewing water in a small stainless steel or enamel saucepan. When hot, turn off the heat and dissolve ½ to 1 cup (according to the recipe) of corn sugar for priming. The <u>bottle fermentation</u> of this sugar carbonates the beer. The quantity of sugar added gives some control of the level of this carbonation. The suggested amounts given in the recipe formats (pgs. 11 & 12) are purposely set to be conservative to avoid over-carbonation. Boil the priming sugar solution for a few minutes, cover and set aside.

2. Sterilize 50 <u>already clean</u> 12 oz. beer bottles by pouring sanitizer solution from bottle to bottle with a funnel, or by using a vinator washer to pump the hot solution into the bottle. Rinse thoroughly with hot water and drain on several layers of paper toweling in cardboard box (or similar container) or on a drain tree. The bottles should remain upside down until they are filled.

3. Sterilize the priming bucket and siphoning equipment and gently siphon the beer from the 5 gal.

glass carboy into the priming container, being careful to leave the sediments behind. Remember to set aside the first few ounces of outflow. Place the siphon outlet at the bottom of the priming vessel before starting the flow to minimize aeration.

4. While stirring the beer gently with bottom to top motion, add the priming sugar solution (prepared in step 1.) and continue stirring until well mixed. Set the priming vessel on the counter top and proceed with bottling.

5. Remove the sediment guard from the racking tube inlet and establish the siphon with the hose outlet held higher than the liquid surface in the priming vessel. Connect the sterilized bottle filler to the hose outlet and set the tip down briefly in an extra container to release a few ounces of liquid. This purges the filler of air and rinse water and provides a sample to taste. The sweetness which is present from the priming sugar confirms how easily noticeable this small amount (about 0.6% by weight) of sugar is in the beer.

6. One at a time, turn the bottles upright and fill by setting the filler tip on the bottle bottom. Fill to the very brim. When the filler is removed, minimum head space is created. Additional liquid may be delivered by touching the filler tip at an angle to the inside neck of the bottle. To stop the flow, return the filler to vertical position. One inch of head space is adequate for bottle fermentation. Place a sterilized cap on each bottle immediately after filling. If a second person is not available to help, the caps can be crimped down later.

7. Set the bottles upright in a dark location at about 65 to 70 ^{o}F for at least two weeks for bottle conditioning. After this time, the beer should be clear and a slight yeast sediment should be visible in the bottle bottoms.

8. Although after only two weeks the beer is still very young, you may wish to chill and open a bottle to check carbonation and flavor development. If carbonation is adequate, a cooler location may be used for further bottle aging. Although most beers will be at least drinkable after three or four weeks in bottle, heavier beers and/or those with more hop content may take several months to reach peak quality. Tasting the beer periodically as it ages will help you evaluate the recipe and perhaps develop better appreciation for fine beers.

DESIGNING RECIPES FOR MALT EXTRACT BREWING

The many choices of ingredients available today for home brewing make possible literally millions of combinations. Experimenting with various recipe options can increase the enjoyment of the hobby and lead to some unique and excellent beers. The information we provide here is intended to guide the brewer in a general way. The initial recipes can be fine-tuned in later batches to achieve beers custom brewed to personal taste. A brief discussion of the ingredients follows.

<u>MALT AND MALT EXTRACT</u> Malting is the process in which a cereal grain is sprouted to a particular stage of development and dried. Although a number of cereal grains can be malted, the term “malt” alone generally refers to barley malt. After sprouting, the grain contains enzymes which can convert the starch of the grain to fermentable sugars and other water soluble components. Mashing is the process of cooking ground malt in water at controlled temperature and pH so that the enzymes carry out this conversion rapidly. The resulting water solution is <u>malt extract</u>. About 70 to 80% of the

extract solids are fermentable sugars. Malt extract is available in vacuum evaporated syrup form or as a spray-dried powder. If more highly roasted malt is included when the extract is made, darker color and flavor result, ranging all the way from amber to very black. The syrup extracts are available plain (unhopped) or as hopped syrup in kits.

SPECIALTY MALTS AND GRAINS These are used to impart special properties of flavor, color, texture and aroma to the wort. Several are of special interest for extract brewing because they do not require mashing (starch to sugar conversion).

Crystal malt (also called caramel malt) is made by heating moist barley malt at temperatures which allow the enzymes present to convert starch to sugar inside the grain. After this conversion, the malt is further roasted at various higher temperatures depending on how much darkening or caramelization of the sugars and other components is desired. The darkness of the grain is expressed in its lovibond (L) rating where higher numbers denote darker color. It is available in colors from 10L to 120L. In addition to color and malty sweetness, head retention and smooth mouth feel are significantly enhanced in extract-brewed beers. Generally, the lighter roast 10L will provide more texture and less color, while the darker roast 80L will contribute more sweetness and darker color. Intermediate lovibond ratings provide a combination of these properties. Recipes will generally call for ½ to one lb. in 5 gal.

Chocolate malt is roasted to dark chocolate brown color and can be used in amounts from ½ to 1 cup in 5 gal. (along with crystal malt if desired) to impart darker color and roasted flavor. Larger amounts are sometimes used in porter and stout recipes. It can be used uncrushed or crushed as desired.

Roasted barley is roasted in similar fashion to chocolate malt to a dark brown color, but is made from unmalted barley. In small amounts (1/4 cup) in 5 gal. it imparts reddish color to red ales. In larger 1 to 3 cup amounts it enhances dark color and flavor in dark ales, porter and stout and improves head retention. Again it can be used with crystal malt if desired, uncrushed or crushed.

Black patent malt is highly roasted to black color. In small amounts it imparts darker color to dark beers and in larger amounts contributes black color and burnt flavor to stout and porter. Use up to 2 cups in 5 gal., crushed or uncrushed.

Wheat Malt is used in combination with barley malt to make weizen or weisse beers. It is available as a grain for mashing, or in syrup or dried extract form. The extracts are about 60% wheat and 40% barley.

HOPS are a climbing vine whose flowers are cooked into the beer to add balancing bitterness to the rich flavors of the malt. The many varieties available also provide various herbal flavors and aromas to the beer as well as improved resistence to spoilage. Hops are available in three forms. The whole flower in loose form, the compressed whole flower as a hop plug and the hop pellet which is the flower ground and extruded to pellet form. The bitterness of the hop is designated in its alpha acid analysis. Higher numbers denote more bitterness. Generally longer boil times increase the bitterness extracted, and shorter times favor more herbal flavor. Hops added for the last 2 to 5 minutes for finishing contribute mainly aroma.

CORN SUGAR (DEXTROSE) should be used in minor amounts only in the recipe and for priming at bottling. Although it will increase alcohol, more than a few cups will make a cidery/sour flavor in the beer. Generally, using dried malt extract instead of corn sugar makes much better beer.

BREWING YEAST is the heart of the process in converting sugar(s) to alcohol. Various types are available in either dried or liquid form in several sizes. The liquid form provides a much larger selection of specific strains in all the types discussed below. Since it is important for its flavor contribution, the choice of brewing yeast is part of the recipe. Although the liquid yeasts cost a little more, the improvement in flavor is generally worth the extra cost.

Ale yeast generally ferments well at temperatures in the 60 to 72 ^{o}F range and for that reason is much easier for home brewers to use. A cool room or basement area provides a good environment for fermentation with these yeasts. Flavors produced tend to be somewhat fruity in nature. These yeasts can be used on any color, but are more commonly used in amber, dark or black beers.

Lager yeast in all but a few cases is used to ferment beers at cooler temperature. During final fermentation and for a period of bulk aging (lagering), cold temperatures (as low as 30 to 40 ^{o}F), are necessary. Lager beers are made in all color ranges, from very light to very dark.

Wheat yeast is used exclusively for weizen beers. It is generally fermented at the same temperatures as ale yeast and can be used in light amber or dark beers.

SPECIALTY INGREDIENTS Certain ale recipes will call for ingredients such as brown sugar or molasses to impart darker color and sweetness. Ales of certain types are also made with fruit or spices for unique effects. Dark ales and stouts may contain brewers licorice for smoothness and flavor. Some ale and lager styles can be brewed using honey in the recipe with excellent results. However, specialty ingredients are best used with the guidance of a specific recipe, and in fairly small amounts. Some brewers will enjoy experimenting with other odd ingredients or trying any of the many recipes available for novelty beers.

RECIPE FORMATS

The following recipe formats provide general guidance in the quantities of various ingredients to make 5 gal. of beer using malt extracts and certain specialty grains. Each format represents a large number of individual beers according to your choice of specific ingredients, and will accommodate any brand or color of extract. Available malt extracts include light, amber, dark or stout, and many varieties are available hopped or plain (unhopped). The hopped extracts are generally style specific, i.e. red ale or stout, etc., while the plain extracts offer a more flexibility in choice of hops. Dried (powdered) malt extracts are convenient to use in whatever odd amounts desired to adjust the total extract solids content of the wort. The formats provide a starting place from which the brewer can develop his own favorite beers.

The number in parentheses by each format shows the approximate malt extract solids content of the wort expressed in lbs. per gal., and is a measure of the heaviness of the beer. As more extract is used we should expect increased calorie and alcohol content. The syrups are assumed to be 81% solids and the dried extract 100%.

1. LIGHT BODY (0.73 to 0.85)

½ Lb. Crystal Malt or 8 Oz. Malto Dextrin
l Lb. (3 Cups) Light Dried Extract
3.3 to 4 Lb. Malt Syrup Extract
1 Cup Corn Sugar
1/4 Oz. Pkt. Burton Water Salts or 1-1/2 Tsp. Gypsum (For Ales)
1 to 2 Oz. Hops or Hop Pellets, Alpha Acid 3 to 7% For Light Colors, 8 to 12% for Dark
Omit Hops For Hopped Syrup extracts

Prime: 3/4 Cup Corn Sugar

2. MEDIUM BODY (0.93 to 1.00)

½ to 1 Lb. Crystal Malt or 8 Oz. Malto Dextrin
2 Lb. (6 Cups) Light Dried Extract
3.3 to 4 Lb. Malt Syrup Extract
1/4 Oz. Pkt. Burton Water Salts or 1-1/2 Tsp. Gypsum (For Ales)
1 to 2 Oz. Hops or Hop Pellets, Alpha Acid 3 to 7% For Light Colors, 8 to 12% For Dark
Omit or Reduce Hops For Hopped Syrup Extracts

Prime: 3/4 Cup Corn Sugar

3. MEDIUM FULL BODY (1.07 to 1.20)

½ to 1 Lb. Crystal Malt and/or 8 Oz. Malto Dextrin
6.6 Lb. Malt Syrup Extract(s), Plain And Hopped Syrups May Be Used Together
1/4 Oz. Burton Water Salts or 1-1/2 Tsp. Gypsum (For Ales)
1 to 3 Oz. Hops or Hop Pellets, Alpha Acid 3 to 7% For Light Colors, 8 to 12% For Dark
Omit or Reduce Hops For Hopped Syrup Extracts

Prime: 3/4 Cup Corn Sugar

4. HEAVY BODY (1.37 to 1.48)

1 Lb. Crystal Malt and/or 8 Oz. Malto Dextrin
1-1/2 Lb. (4-1/2 Cups) Light Dried Malt Extract
6.6 to 7.3 Lb. Malt Syrup Extract(s), Plain And Hopped Syrups May Be Used Together
1/4 Oz. Burton Water Salts or 1-1/2 Tsp. Gypsum (For Ales)
1 to 3 Oz. Hops or Hop Pellets, Alpha Acid 5 to 8% For Light Colors, 9 to 15% For Dark
Omit or Reduce Hops For Hopped Syrup Extracts

Prime: 3/4 Cup Corn Sugar

5. VERY HEAVY BODY (1.60 to 1.72)

1 Lb. Crystal Malt and/or 8 Oz. Malto Dextrin
9.9 to 10.6 Lb. Malt Syrup Extracts, Plain And Hopped Syrups May Be Used Together
1/4 Oz. Burton Water Salts or 1-1/2 Tsp. Gypsum (For Ales)
1 to 4 Oz. Hops or Hop Pellets, Alpha Acid 5 to 8% For Light Colors, 9 to 15% For Dark
Omit or Reduce Hops For Hopped Syrup Extracts

Prime 3/4 Cup Corn Sugar