

## ***- Making Good Garlic Last as Long as Possible -***

### ***The Ever Changing Taste and Flavor of Garlic.***

***Not all garlic has the same taste or flavor or other eating characteristics. There are wide variations from variety to variety and also the taste and flavor of any given garlic bulb will vary greatly from when it is harvested in summer through the fall and winter or until it is eaten, planted, rots or dries out beyond use. There are several differences in the eating characteristics of garlic, mainly flavor, the garlickiness of a given raw garlic and taste, the pungency or hotness of any raw garlic. There may be better ways to explain it but this is what I have chosen to do. There are also significant differences in the aftertaste that garlicks leave behind in the mouth and throat after eating raw. Garlic can be mild or strong in either or both taste and flavor. The flavor ranges from bland to heavy earthy musky garlickiness, but some also have a distinct green onioniness or mustardiness to their flavor. The pungency ranges from bland to extremely hot with some raw garlicks being instantly hot while others start off mild and 10 to 45 seconds later become hot to very hot. Each one is different and each year the taste and flavor of any garlic variety will vary with growing conditions and some years they are milder or stronger than usual. There is no such thing as a stable taste in live garlic.***

***Any given bulb of garlic is as mild as it will ever be at the time it is harvested and cured (dried down enough to trim roots and leaves without getting a garlicky smell) and from the moment of harvest garlic slowly loses moisture and dehydrates, a process that takes 4 to 10 months at room temperature. As it dries down it loses size and weight and increases in pungency as its mass decreases and things inside condense. Neither mild onions nor garlic stay mild, they all lose mildness with age. When you dehydrate garlic it stops changing and remains at whatever pungency and flavor level it was when it was sliced and dried. The best way to stabilize the cooking qualities of garlic is to slice and dry it when it is at it's best flavor, according to your own tastes. Needless to say, drying garlic ruins it for raw eating as the satisfying crunch can only come when it is still living and reasonably vigorous. That's where long storing garlicks like Porcelains and Silverskins pay dividends since they're still good long after most others have deteriorated. Garlic sliced and dried at warm, not oven hot, temperatures will retain the beneficial compounds that result in health benefits to the consumer; the idea is to dehydrate it not cook it. Crushed, chopped or powdered garlic that is cooked results in odorous fat-soluble polysulfides that circulate in the lymphatic system and have anti-tumor properties and other health benefits, according to research at Penn State.***

***Pickled garlic, on the other hand, has entirely different beneficial compounds than dried, cooked garlic and they work differently in the human body. Eating pickled garlic does NOT give the consumer either immediate garlic breath or secondary garlic odor (sweat, lungs, etc.) hours later whereas cooking fresh or dried garlic gives both kinds of odor. The acid in vinegar neutralizes the Alliinase and slowly breaks down the rest of the cloves into odor-LESS water-soluble compounds that circulate via the bloodstream, mostly S-allyl cysteine (SAC), the active ingredient in Kyolic brand of aged garlic extract. Kyolic has shown in many studies that SAC lowers cholesterol, blood pressure and sugar levels and inhibits platelet aggregation as well. While SAC has some anti-tumor properties, the odorous sulfides that circulate in the lymphatic***

*system have greater anti-cancer properties. The wonderful thing is that the longer you leave the garlic in the vinegar, the more SAC is formed - for over 4 years - it just gets better with age - up to about 5 years! There's just as much SAC in the vinegar as there is in the garlic. Growing and pickling your own garlic is a great and inexpensive way to enjoy excellent flavor and get a few health benefits, too.*

*There is an important variation in refrigerator pickled garlic that you do yourself that is worth discussing. Since heat is not used, the garlic cloves break down slowly into the SAC and for the first couple of years, there is residual alliinase in the pickled garlic so you get both the odorous fat-soluble polysulfide compounds as well as the water-soluble SAC and gradually, the pungency decreases as the remaining alliinase is neutralized and eventually the fat-solubles completely disappear, leaving only the water-solubles, which increase each month as the vinegar converts the main bodies of the cloves into SAC and other water-solubles. Fat-solubles are important because they circulate in the lymphatic system and have antitumor properties whereas water-solubles circulate in the bloodstream and have more circulatory system benefits but little or no antitumor properties. This does not happen when garlic is heat treated in the canning process as the heat deactivates the alliinase immediately and from that point onward, that garlic has only the water-soluble compounds and is odor-free when eaten.*

*Whether frozen garlic has any appreciable health benefits or not is a function of whether it is frozen whole or chopped or crushed first. Garlic that is frozen whole has few, if any, health benefits as the alliinase is neutralized by the cold and while flavorful, the polysulfides do not form. On the other hand, if you crush or finely chop garlic and wait 15 minutes before putting into freezer bags or ice trays, it will have formed the alliinase already and the sulfides will form upon thawing and result in the health benefits that studies have shown for garlic. One lady told me she freezes crushed garlic in small cocktail-size ice cube trays and pops out a few of the 1/2 square cubes whenever she wants garlic to cook with.*

*Irradiated garlic keeps for a long time and retains its flavor but loses its pungency - no heat when raw. The reason for this is that the irradiation literally kills the garlic and it is dead. When you slice irradiated garlic cloves vertically, instead of a healthy, living, light green central spike, it is brown and wilted since it is dead. I have not seen any studies using irradiated garlic but I will predict that they will have no sulfide compounds since the alliinase is neutralized by the irradiation and the sulfides cannot form since there is no alliinase to trigger the process and any health benefits from crushing and cooking would be minimal. I would expect, however, that the SAC would still be there if you pickle irradiated garlic since the pickling process that forms the SAC doesn't require alliinase.*

*The best garlic for preserving however you want to do it is homegrown garlic or farmers market garlic, preferably locally grown because it will store at room temp long enough for you to enjoy it in its natural state for a while, maybe months, before you preserve it. Store-bought garlic usually sprouts within a week or so after you bring it home. There's a reason for that - it was stored in the back room cooler at 32 F and it stores quite well at that temp for about a year but when you bring it up to room temp, or refrigerator temp, it will sprout within days. Garlic that has been stored at or near room temp from harvest will store well for 4 to 10 months at room temp, depending on how healthy and clean the garlic is.*

## *The How-to's of Drying, Pickling, Freezing, Etc.*

*No matter how you try to store garlic, sooner or later it will dry out or rot away if not used. Some will store only a few months, some will store for nearly a year, but in time all will decay unless some means is employed to preserve them. We have had a lot of people ask about preserving garlic for future use so we decided to discuss it.*

*First of all, I'm not sure that there is any way to really preserve the total character of fresh garlic, you're always going to lose some of its essence because once you preserve it, it is no longer a living thing and that part of it is lost.*

*The taste of fresh garlic is caused by allicin that is formed when the garlic is newly crushed. But the allicin will not last long as it dissipates within hours or days and becomes something else with a different taste. That taste is the result of an active chemical process that stops with pickling. The enzyme, alliinase, that drives the process is destroyed by pickling, so pickled garlic contains no allicin. So anytime you preserve garlic, the taste will change - it will be a good taste, just different than fresh garlic.*

*I really think the best solution is to grow several varieties yourself, including some very early maturing and some very long storing varieties so that you will always have good fresh garlic, year-round. Silverskin garlics are usually still good all through the winter and into the spring when the earliest harvesting turban / Asiatic garlics are ready to pull. Just a thought.*

*But if you're going to want to try to preserve it, anyway, then you have three pretty safe choices for longer term storage (drying, freezing and pickling - recommended) and one fairly dangerous choice for shorter term storage (in oil - NOT recommended).*

---

## **Drying Garlic.**

**Drying garlic is the least expensive and safest way to preserve garlic and retain as much as possible of its fresh character. It's also easy to do. Simply cut the garlic into 1/8" to 1/4" thin slices, and dry them in your dehydrator at 130 F or so and dry them until they are hard and crisp, even on the inside but still light in color. Do not overcook them until they are brown as it will make them bitter. Or if you do not have a dehydrator, you can place them on a screen or rack so that the bottom side gets ventilation also and dry at warm room temperature (100 to 110 F - we have a SW back room that gets warm like that) out of direct sunlight (cover loosely with cheesecloth to keep airborne dust particles and things off the slices if you are worried about that sort of thing).**

**Drying garlic is the only way to retain the potential to make allicin - neither freezing nor pickling can do that, and allicin is the beginning of everything that garlic means to us as food, flavoring or pharmaceutical. Allicin is formed when the amino acid, Alliin, mixes with the enzyme, Alliinase, which is stored in separate cells in the garlic clove and mix to form sulfenic acid which breaks down into Allicin when these cellular walls are ruptured. For more details**

on this please see [the Chemistry of Garlic](#) Page of our website for a more complete discussion of this.

The idea is to dehydrate it not cook it.

It takes a few days for it to become completely dry, but once it does it will keep for years if you can keep it dry. I store my dried garlic in a Mason jar with one of those silica gel - Not To Be Eaten - packets that come with vitamin pills and camera equipment and lots of other things as they absorb excess moisture and keep the garlic dry. They will store safely several years this way.

The dried slices should to be kept whole until used in order to better preserve the allicin potential. You can grind the dried slices into powder or nuggets at the time you use them and upon re-moisturizing, allicin happens. The whole dried slices will retain almost all of their potency.

---

## Freezing Garlic.

*Actually, my own experience is limited. A customer told me she would freeze the bulbs whole (especially the smaller ones) and take one out and use it as needed and that they were great for cooking. I tried it and she was right, although you had to use the whole bulb immediately as it would rapidly deteriorate. I thought about putting some separated cloves in freezer bags to see how well they worked and, sure enough, I got an e-mail from someone else telling me how they kept bags of peeled whole, strips and diced garlic cloves in the freezer for instant use and how happy they were with it.*

*I would like to hear from more people who use frozen garlic. What kinds of recipes do they work best in and what kind do they not do so well in? How do they do in salsa or pesto or other recipes that normally call for crushed fresh garlic? Do you have any special recommendations for prepping them for freezing or for thawing? I'm looking for ideas from people more experienced than I am at this that I can pass on to others in the website.*

*My own personal preference is for fresh raw garlic, (There, I've said it and I'm glad. - I'm prejudiced and I admit it, but I'm free at last!) for one thing because of its crispness and texture (similar to water chestnut) as well as the unique taste sensation that is a part of each garlic. To me, these characteristics are lost in preserved garlic, though pickled garlic has a nice crunch and excellent flavor, something is lost in the transistion. Thawed frozen garlic was mushy and discolored but had a surprisingly robust flavor - perhaps that had something to do with the fact that I used a very strong garlic. It retained the flavor well, but there wasn't any hotness because the cloves were frozen whole and the cole denatured the alliinase.*

*I admit it, I'm spoiled rotten when it comes to garlic. We live a very plain and simple old style country life and love it, but when it comes to garlic, we reside in regal splendor. I like the idea of having lots of fresh bulbs and cloves in the kitchen so you can just grab a handful or two of cloves and peel, crush or slice and throw in the soup or stir fry. Sounds like an exercise in*

*opulence to me. I remember one year at the Garlic is Life Festival in Tulsa watching Tony Lia, Head Chef at The Stinking Rose Restaurant in Hollywood, grab handfuls of sliced and slivered garlic from big mixing bowls full of it and throw scads of garlic into the cubes of filet mignon he was stir-frying in olive oil. It felt great just smelling it and watching but when I ate it I thought it was the best steak I have ever eaten and I live on a cattle ranch and have had some pretty good steaks in my life.*

*I have copius amounts of fresh garlic of a wide range of tastes and flavors around me year round but I still pickle and occasionally dry some to keep the emergency supply "fresh" - come to think of it, my sister-in-law swiped my dried garlic for her bread recipe and I now need to dry some more - just in case we lose our crop to droughtt or grasshoppers or something. I also keep a jar of vinegar with garlic, slices of cukes, squash and onions in it. Yeah, I know, I'm rotten. I have jars of pickled garlic of various different kinds pickled in different kinds of vinegar and they all have their own special taste that is clearly different than the others.*

*When it comes to garlic, I live like a king wishes he could.*

*More information will be posted when I get either more info, and /or the time and inclination to enter it.*

---

## *Pickling Garlic.*

*Pickled garlic may not be exactly like fresh garlic but it has a wonderfully refreshing and invigorating flavor of its own. I like any kind but basically use refrigerator pickles more than anything else because they're quick and easy and taste great. I usually add some onion, cucumber, squash slices and a little dill seed in some apple cider vinegar, or any other kind I happen to have on hand. They're fabulous with sandwiches, salads or just as crunchy snacks by themselves. They lose a lot of the heat in pickling and so you can eat more garlic this way. I'm not any kind of expert on canning or preserving but I picked a few recipes to pass on for several different ways of pickling garlic. Pickle the garlic anyway you want to, but pickle it and eat it because it is too delicious of a snack to pass up.*

*Here's a recipe from Canoe, the Canadian Internet Network:*

### *Pickled Garlic:*

*12 large heads garlic, about 838 g (1 3/4 lb)*

*625 mL (2 1/2 cups) white vinegar*

*250 mL (1 cup) dry white wine*

*15 mL (1 tbsp) pickling salt*

*15 mL (1 tbsp) granulated sugar*

*15 mL (1 tbsp) dried oregano*

*5 dried whole chili peppers*

*Separate garlic bulbs into cloves. To soften and loosen skins, blanch garlic cloves in rapidly boiling water 30 seconds; immediately immerse in cold water, drain and peel cloves.*

*Place 5 clean 250 or 236 mL Mason jars in a boiling water canner; fill with water, bring to a boil. Boil SNAP lids 5 minutes to soften sealing compound.*

*In a large stainless steel saucepan, combine vinegar, wine, pickling salt, sugar and oregano. Bring to a boil; boil gently 1 minute; remove from heat. Add peeled garlic cloves to hot vinegar mixture. Stir constantly 1 minute.*

*Pack garlic and 1 dried whole chili pepper into a hot jar to within 2 cm ( 3/4-inch) of top rim. Add hot liquid to cover garlic to within 1 cm (1/2-inch) of top rim (head space). Using rubber spatula, remove air bubbles. Wipe jar rim removing any stickiness. Centre SNAP lid on jar; apply screw band just until fingertip tight. Place jar in canner. Repeat for remaining garlic and liquid.*

*Cover canner; return water to a boil. Process -- boil filled jars -- 10 minutes. Remove jars. Cool undisturbed 24 hours. Check jar seals. Sealed lids curve downward. Remove screw bands; wipe and dry bands and jars. Store screw bands separately or replace loosely on jars, as desired. Label and store in a cool, dark place.*

*Makes 5 250 or 236 mL jars.*

*Note: At elevations higher than 305 m (1,000 ft) increase processing time. Add 5 minutes at 306 to 915 m (1,000-3,000 ft); add 10 minutes at 916 to 1830 m (3,001-6,000 ft); add 15 minutes at elevations higher than 1831 m (6,000 ft).*

*Warning: This recipe was specially formulated to allow home canners to preserve a low acid food -- garlic -- in a commonly available boiling water canner. Please do not deviate from the recipe ingredients; quantities, jar size and processing method and time. Any change could affect the safety of the end product.*

### *Easy to Make Refrigerator Garlic Pickles*

*Ingredients: Whole, peeled garlic cloves Red wine vinegar  
Salt (about 1 Tbs. per cup of vinegar)*

*Place the cloves of garlic in a jar with an air-tight lid. Add enough vinegar to cover, and add salt. Place lid on jar and shake to dissolve salt. Store in the refrigerator for two weeks before using to "cure". These should keep almost indefinitely, covered and refrigerated.*

*Kim Gunderson's (G&H Garlic Farm in Littleton, NH) Soy Refrigerator Pickled Garlic - Added  
October 14, 2005*

*Ingredients: Whole, peeled garlic cloves  
5% Vinegar of your choice  
Kikkoman's light soy sauce with reduced salt*

*Place the cloves of garlic in a jar with a lid and add enough vinegar to cover. Place lid on jar and store in the refrigerator for two weeks to "cure". Drain vinegar off and use separately as garlic flavored vinegar. Place cloves into jar and add soy sauce to cover. Wait a week or more before eating. These should keep almost indefinitely, covered and refrigerated.*

### *Another Recipe for Refrigerated Pickled Garlic*

*Great midnight snacks for true garlic lovers!*

*2 whole heads garlic, divided into peeled cloves*

*2/3 cup distilled white vinegar or white wine vinegar*

*3 tablespoons sugar*

*1/4 teaspoon salt*

*1/2 teaspoon commercial mixed pickling spice*

*3 sprigs fresh thyme, 3 inches long*

*one 1/2 pint sterilized jar with lid*

*Peel garlic, Cut any pieces that are thicker than 3/4 inch in half length-wise. In a small saucepan, boil vinegar, sugar, salt and pickling spice, stirring until sugar is dissolved. Add garlic cloves and return to a boil; cook stirring for 1 minute. Put thyme sprigs in jar then pour in garlic, liquid, and spices, filling to within 1/4 inch of top, making sure garlic is covered. Cover tightly. Let sit at room temperature for 24 hours to blend flavors, then refrigerate for up to 2 months.*

*Makes one 8 ounce jar.*

*By: Renee Shepherd and Fran Raboff*

*Shepherd's Garden Seeds*

*The North Carolina State University website says: Vinegar is an acid food but could become a low acid food if too much plant material is added to it (herbs and garlic). As long as only a sprig or two are added and they become fully acidified throughout and don't change the pH of the original vinegar then the contents remain an acid food. The problem is that what is a sprig to me may be a branch to someone else. The material must be fully submerged and you should have a way of determining if the pH of the plant material is below 4.6. These conditions and controls have been determined for the commercial manufacture of flavored vinegar but do not exist for the home.*

*Garlic contains sulfur compounds which can react with copper to form copper sulfate, a blue or blue-green compound. The amount of copper needed for this reaction is very small and is frequently found in normal water supplies.*

#### *Garlic Can Turn **Blue***

*Raw garlic contains an enzyme that if not inactivated by heating reacts with sulfur (in the garlic) and copper (from water or utensils) to form blue copper sulfate. The garlic is still safe to eat.*

#### *Garlic can turn **Green***

*If the garlic was not fully mature or dry, pigments in the garlic may turn green when in the presence of acid. Garlic will also turn green (develop chlorophyll) if exposed to an temperature*

*change or is exposed to sunlight. Some people say it can be stored for 32 days at or above 70 - 80° F to prevent greening, but I'm not yet sure that is true. Green garlic is safe to eat.*

---

### ***Storing Garlic in Oil - Warning! - Not Safe.***

*It's important to keep food safety in mind when storing garlic in oil. Low-acid foods like garlic can be a source of Clostridium botulinum bacteria which are found in soil, water, and air. Oil's oxygen-free environment is perfect for growth of this anaerobic bacteria. Garlic in oil, therefore, must be stored correctly to prevent botulism food poisoning.*

*Commercial garlic-in-oil mixtures are acidified to prevent bacterial growth. These products can be stored safely at room temperature. Unfortunately, acidification of garlic in homemade oil mixtures can't be recommended because no research exists to support proper procedures. Different people recommend different methods and time to acidify and it is hard to know who is right. Instead, it's best to store these hazardous oils in the refrigerator, but for a limited time only. This conflicts with the desire for long term storage.*

*When raw garlic is stored in oil, Clostridium botulinum bacteria can grow. These mixtures must be refrigerated to slow bacterial growth. After 3 weeks of refrigeration, the increased number of bacteria will become a food safety hazard. Therefore, these mixtures should not be refrigerated longer than 3 weeks.*

*When garlic is immediately removed after flavoring oil, the bacteria will not have a "food source" for growth. The flavored oil can be stored safely at room temperature.*

*When vegetables or herbs are dried, water will not be available for bacterial growth. Therefore, DRIED vegetables or dried herbs (including garlic) in oil can be stored safely at room temperature. Note. Tomatoes are high in acid. Therefore, plain dried tomatoes in oil can be safely stored at room temperature.*

***Storage Recommendations: (According to Oregon State University Extension Service).***

***Raw or cooked garlic and/or herbs in oil:***

***These mixtures MUST be refrigerated. Do not store them longer than 3 weeks in the refrigerator. (Note. Raw garlic MAY be safely stored in vinegar at room temperature.)***

***Dried garlic and/or herbs in oil: If oil is seasoned with dried garlic and/or dried herbs, the mixture may be safely stored at room temperature. (Refrigeration may delay rancidity, however.)***

---

## ***The FDA MEMO on Garlic in Oil Preparations***

***News***

***04/17/1989***

***Garlic in Oil Mixes***

***P89-20***

*Food and Drug Administration  
FOR IMMEDIATE RELEASE  
Chris W. Lecos (202) 245-1144*

*Because of a risk of botulism, the Food and Drug Administration today told companies to stop making any garlic-in-oil mixes which require refrigeration for safety. The agency also urged consumers to discard these and similar homemade products.*

*To be safe, FDA said, garlic-in-oil products should contain additional ingredients -- specific levels of microbial inhibitors or acidifying agents such as phosphoric or citric acid. Most garlic products do contain these additives, as disclosed on their labels.*

*But some food boutique or specialty mixes do not include the additives and need to be refrigerated from production through use. Manufacturers, repackers, food distributors and retailers who may handle these products are being notified by FDA that these products should be withdrawn.*

*FDA Commissioner Frank E. Young, M.D., Ph.D., said, "FDA's concern is that many consumers and retailers may consider such products to be non-perishable develop botulism too, Dr. Young warned, advising that these home products "should be made fresh for each use and not left around at room temperatures."*

*When two men and a woman from Kingston, N.Y., were hospitalized with botulism food poisoning after eating a commercial mix that had not been kept refrigerated, FDA at first issued a warning to consumers March 6 that improperly formulated products left at room temperature may develop deadly botulism toxin. But the agency reviewed these products' safety further and decided to eliminate the susceptible mixes. FDA said studies showed:*

*-- Unrefrigerated garlic-in-oil mixes lacking antimicrobial agents can permit the growth of Clostridium botulinum bacteria with subsequent toxin production without affecting the taste and smell of the products.*

*-- Toxin production can occur even when a small number of Clostridium botulinum spores are present in the garlic. When the spore-containing garlic is bottled and covered with oil, an oxygen-free environment is created that promotes the germination of spores and the growth of microorganisms at temperatures as low as 50 degrees Fahrenheit.*

*Botulism is a potentially fatal food poisoning characterized by blurred or double vision, speech and breathing difficulty and progressive paralysis. Without prompt and correct treatment, one-third of those diagnosed may die. Clostridium botulinum bacteria are widespread in the environment, but their spores cause no harm when there is oxygen in the environment.*

**SOURCE: <http://www.gourmetgarlicgardens.com/>**