A Mini-Review Of Salting Techniques To Improve Food Quality

Rossi Indiarto, Georgina Jeanette, Hilman Mulkya Zdikri, Namira Azkia Yusra, Edy Subroto

Abstract: Food has a high level of moisture so that it is damaged easily. Preservation is an effort to improve a food's shelf life. Salting has been one of the oldest known food preservation. The simple process usually leads to this preservation by the community naturally. It can be done conventionally and naturally. Salting preservation is by reducing the level of water so that bacteria cannot grow up and develop. The osmotic properties of high salt can break down the microbial cell membrane, and its hygroscopic properties can interfere with proteolytic enzyme activity and dissociated Cl ions. Salting is not a single curing process, so other treatments such as dessication or boiling are usually followed. Salt also plays a vital role in developing specific tastes, textures, and aromas. The salting process is divided into a wet-dry and wet-dry combination, and a curing process is also carried out. The NaCl salt is in the form of a crystal or solution. In the curing process, nitrate and nitrite salts are used. This paper is intended to review the salt mechanism for the application of food preservation. It is widely used in food products such as salted cod, kimchi, sauerkraut, beef, milk, and cheese. In certain foods, the lactic acid bacteria fermentation phase begins with salt added. The effects on food are flavor, water-holding capacity, protein characteristics, and lipid oxidation.

Index Terms: Flavor, microbe, moisture content, osmosis, salting, shelf life

1. INTRODUCTION

Fresh food generally has high water content. It can make the foodstuffs perishable [1]. Food that is damaged cannot be reused and only becomes waste [2]. A preservation process can prevent food damage. Traditionally, people have carried out preservation, starting from smoking, cooling, and one of the oldest methods is salting. This method has been used long before smoking and drying [3]. Salting is a method of preservation using salt (NaCl). In general, the definition of salting is a series of activities aimed at preserving products using salt [4]. This process is divided into dry-salting, wet-salting, and combining them [3]. Salt can be a preservation method because of its bacteriostatic nature to inhibit certain polluting microorganisms [5] selectively. Salting can affect the taste, texture, aroma, and ingredients characteristics. This process can be carried out on various commodities, from vegetables, dairy products, and meat to fish. This paper aims to review the method and use of salt as conventional food preservation, mechanism and effect on the quality food product.

2. DEFINITION, FUNCTION, SALTING MECHANISM

2.1 Definition

Salting is a method of preservation using salt (NaCl). In the salting process, preservation is done by reducing food's moisture content and removing bacteria not to live and develop again [5]. Salting is usually called brining. Salting is not a single pickling technique but is followed by other processes such as drying or boiling. This salting method is widely used to preserve fish for several reasons, namely [6]: 1) The salting technique is straightforward and can be done by everyone; 2) Technology with cheap preservation; 3) Processed products combined with drying have long durability to be stored or distributed to remote areas without requiring special treatment; 4) Salted fish products are cheap so that all levels of society can reach them.

2.2 Salting function

In general, the definition of salting is a series of activities that aim to preserve fishery products using salt [4]. The salt used is a type of table salt (NaCl), either in crystals or solutions. The salting process aims not only for preservation but also to get the desired sensory changes such as texture, color, and distinctive aroma and taste. Salt is bacteriostatic, so it can selectively inhibit certain polluting microorganisms [7]. The microbes most affected by salt levels are the rot (proteolytic) microbes or spore-forming microbes. Salt can bind and reduce Aw, which is a growth factor for these microbes. Salt also determines the formation of certain flavors and aromas [8]. In salting, there is a process of penetrating salt into the fish's body [9]. The fluid in the fish's body will come out because of the concentration difference [10]. The salt concentration in the body and environment of the fish will be similar so that the remaining body fluids will thicken, protein coagulation will occur, and the shrinking of fish body cells will change the nature of the meat.

2.3 Salting mechanism

The preservation process with salt is as follows [11]: 1) Salt will absorb water from the fish's body through the osmosis process. The fish body's water content has been decreased. Fish bodies that lack water as a medium for microorganism growth cause microorganisms' metabolic conditions to be disturbed; 2) Salt also absorbs water in the body of bacteria and will undergo plasmolysis (separation of plasma nuclei) the bacteria will die. Salting can be used as a pickling method because, in the process, it uses salt with high concentrations and is bacteriostatic derived from the element Cl in salt [9]. Salting is also used in the curing method. Curing inhibits growth and controls microbial activity by using salt in meat [12]. Nitrate and nitrite salts are commonly used in curing. Nitrite will react with sulfhydryl groups and form compounds that cannot be metabolized by microbes under anaerobic conditions. Nitrite will form nitroxide, and with meat, pigments will form nitrosomyoglobin with a bright red color [13] Nitrite yields can be excessive if only nitrite salt is used. Therefore, it is necessary to mix nitrate salt with nitrite salt [14]. Nitrate bacteria will reduce nitrate salts to produce nitrates. However, nitrate salt as a preservative is still questionable; it is even
thought to accelerate decay [15].

3. SALTING EFFECT ON MICROORGANISM ACTIVITY

Salt serves as a preservative because salt can attract water, and water activity decreases from the material so that microorganisms cannot grow and reproduce [16]. Salt acts as a selective inhibitor on polluting microbes such as proteolytic microorganisms and spores. Antimicrobial properties of salt [17]: 1) Salt will affect when added to fresh plant tissues; 2) Salt is a selective inhibitor of certain polluting microbes; 3) Proteolytic and spore-forming microorganisms are easily affected even with low salinity (i.e., up to 6%); 4) Pathogenic microorganisms including Clostridium botulinum except Streptococcus aureus can be inhibited with a salt concentration of 10-12%; 5) Some organisms such as Leuconostoc and Lactobacillus species can increase in the presence of salt. The osmotic properties of high salt can break the microbial cell membrane, and its hygroscopic properties can inhibit the activity of proteolytic enzymes and dissociated Cl ions. When placed in a concentrated salt solution, which is about 30-40%, the cells' water will come out by osmosis [18]. The cells undergo plasmolysis so that they will be inhibited from reproducing. Table 1. demonstrates the impact of salt on the activities of microorganisms in food products.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Effect of salt on microbial activity in food commodities</th>
<th>Reference</th>
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<tbody>
<tr>
<td>Fish chub (Squalius cephalus)</td>
<td>Chub fish were salted 20% and stored at 4 °C. Total aerobic mesophilic, yeast, and mold increased during storage, but coliform decreased</td>
<td>[9]</td>
</tr>
<tr>
<td>Salted-dried goose</td>
<td>In 60% of the leg samples and 47% of the breast samples, the Enterobacteriaceae count is under the detectable level &lt;2 log CFU/g. The yeast-molds count for both the leg and breast samples 80% has been less than 5 log CFU/g</td>
<td>[19]</td>
</tr>
<tr>
<td>Red pepper (Capsicum annum L.)</td>
<td>In the 10% salt sample, Lactobacillaceae can become the dominant population replacing Enterobacteriaceae</td>
<td>[20]</td>
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<tr>
<td>Sauerkraut</td>
<td>A 2.5% salt concentration provides optimal conditions for lactic acid bacteria's metabolism</td>
<td>[21]</td>
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</table>

4. SALTING APPLICATIONS IN FOOD

The salting method consists of dry, wet, and two ways combined [9]. Dry salting can be done by rubbing salt and stockpiling salt ingredients such as salt, kimchi, and sauerrkraut [22]. The method involves fermentation. Adding salt aims to remove water from material [6]. Wet salting is done by immersing the ingredients in a salt solution [23]. E.g., when making pickles and cheese [24]. The salting method is used in various vegetable and animal food products. Besides being a preservative, salt is also used in vegetables as a softening agent [25]. Salt use is generally low, so it’s not the main preservative. Added salt can cause lactic acid bacteria to ferment [26]. It was done in kimchi, sauerrkraut, mustard greens, and pickles. Salting in milk products stimulate the growth of lactic acid bacteria and delay the spread of other unwanted microbes. Besides, salt is also used to give taste [27], texture [28], [29], affect the water-binding capacity of casein [30], and maintain viscosity [31]. Meat salting can affect the taste, water holding capacity, hardness, color, and microbial growth [6], [32]. Marine products and fish can also be salted. There are three salting types in fish: soft salting with a salt concentration below 20%, moderate salting with a higher salt concentration than soft salting, and intense salting with a salt concentration above 24% [6]. The salting process of marine products and fish is usually followed by a drying process [33]-[35]. Salting affects the physicochemical, microbiological, and sensory properties of food [36]-[39]. The food characteristics of salting treatment are presented in Table 2.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Findings</th>
<th>Reference</th>
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<tbody>
<tr>
<td>Scomberoides lyan</td>
<td>Salted fish, 25% brine, had the best conditions with acceptable pH and moisture content. The values of pH, salt, TVB-N, and TMA-N were higher in salted fish than regular fish, while the numbers of peroxides, fatty acids, and fat hydrolysis were low</td>
<td>[40]</td>
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<tr>
<td>Atlantic bonito</td>
<td>Dry salting inhibits the production of biogenic amines, notable histamine in salted Atlantic bonito</td>
<td>[41]</td>
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<td>Carrot, green chilli, and brinjal</td>
<td>The color, flavor, and texture of the fermented pickles at room temperature were not modified until four storage months. In contrast, the unfermented pickle changed significantly in taste and texture</td>
<td>[42]</td>
</tr>
<tr>
<td>Milk</td>
<td>Traditional milk salting influences food's nature and rheology. The 0-5% increase in salt content causes pH decreases from 6.65 to 6.40 and luminosity from 78.23 to 75.88. Freezing and hardening times are increased by up to 300 %. When the pH is adjusted to 6.5 after adding salt and rennet, an increase can occur up to 600 %</td>
<td>[43]</td>
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<tr>
<td>Kimchi</td>
<td>The increasing the salt concentration by 1.0%-2.1% had no significant impact on changes in pH, acidity, number of living cells, and the number of coliforms. Kimchi with a salt concentration of 1.3% is acceptable because of its quality and safety. Therefore, in other kimchi processing, salt with a level of 1.3% is recommended. Adding salt affects the sample's binding capacity to water, making the texture softer</td>
<td>[44]</td>
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<tr>
<td>Cheddar</td>
<td>Adding low salt to cheese causes soft texture, pale appearance, and excessive proteolysis. While high salt concentration, cheese texture is too hard due to protelysis and lower casein hydration</td>
<td>[45]</td>
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<td>Tenebrio molitor protein isolates (TPIs)</td>
<td>Salting-assisted extraction increases the TPIs yield; salting-in: there is an increase in β-sheet, disulfide bonds and emulsifying properties; salting-out: there is an increase in solubility, α-helix, thermal stability, and emulsion activity</td>
<td>[46]</td>
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<td>Sardine (Amblygaster sim)</td>
<td>Salting and pressing fish show a safe oxidation indicator as the value is below the maximum permissible limit. Salmonella and Vibrio parahaemolyticus were not detected, while other microbiological quality indicators remained within allowable limits. Salting and pressing cause dehydration, so the fish with color darkens. The sensory evaluation showed that consumers accepted sardines from both storage treatments</td>
<td>[47]</td>
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According to Albarracin et al. [6], salting processes have several effects, including taste, water-holding capacity, protein characteristics, and lipid oxidation. The anion component in salt is responsible for the change in taste. That's because salt can limit taste receptor stimulation. NaCl salts generally do not affect these foods' taste but can influence consumers' taste perspectives due to Cl-anion [48]. Water-holding capacity is a material's ability to withstand water from its matrix [49]. Salt anion binds to a water molecule. It causes isoelectric point changes, resulting in water transfer between protein...
molecules. This displacement can reduce the material’s waterholding capacity so that dehydration occurs in high concentration salted materials. In water, protein solubility is influenced by the spread of polar and non-polar components in the amino acid chain [50] or otherwise ionic solution charge [51]. Salting is achieved by dissolving salt in solution to create a saline solution. At low salt solution concentration, some water molecules will escape the system, leading to a decrease in water activity (Aw) in the food. This principle is applied in the salting process in foods, and it is related to a number of food processing factors, such as product quality, safety, and shelf life [52].

5. CONCLUSION

Salting is a useful food preservation method to reduce water content and kills certain microbes to increase shelf life quality. Salting also plays a role in giving taste, texture, aroma to ingredients. The salting method consists of dry, wet, and a combination of both. In dry salting, salt is applied so that the salt gets into the food. In wet salting, salt is added to the food and it can also be a combination of wet and dry salting methods. In marine fish processing, the salting process helps to extend the shelf life of the fish. This is due to the osmotic pressure generated by salt and the ability of salt to draw moisture away from food through a process called dehydration [53].

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REFERENCES


