



## Optimization of Flour Smoke Making Through Microencapsulated Technology as Food Natural Preservatives

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### ARTICLE INFORMATION

Jurnal IPTEK – Volume 24  
No.2, December 2020

Page:  
123 – 130  
Published Date :  
31 December 2020

DOI:  
[10.31284/j.ipitek.2020.v24i2.983](https://doi.org/10.31284/j.ipitek.2020.v24i2.983)

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### ABSTRAK

*There should be a safe natural preservatives consumed to increase the shelf life of food products. Liquid smoke is a natural food preservative. Liquid smoke if left longer in storage will reduce the saving power of food products. There is a need to develop technology by changing liquid smoke into flour through microencapsulation technology so that it will improve the save power of food products. This research aims to determine long storage time and the optimal drying temperature in the manufacture of microparticle solutions to the quality of food products. In this research the process of pyrolysis and purification of liquid smoke from coconut shell by using pyrolysis, distillation and filtration processes using active zeolite and activated carbon. Then make solution encapsulation, drying, forming microparticles with destruction and sieve, after that applied to food products. Results of the research on the manufacture of optimum smoked flour in the treatment of drying temperature of 140 °C and maximum storage time 3 days with a pH value of 5, water content 28.470% and 3.120% protein content*

**Keywords:** Smoked flour; maltodextrin; microencapsulated; liquid smoke

### ABSTRACT

Perlu adanya bahan pengawet alami yang aman dikonsumsi untuk menambah lama daya simpan pada produk makanan. Asap cair merupakan bahan pengawet pangan yang alami. Asap cair jika dibiarkan lebih lama dalam penyimpanan akan mengurangi daya simpan produk pangan. Perlu adanya pengembangan teknologi dengan merubah asap cair menjadi tepung melalui teknologi mikroenkapsulasi sehingga akan meningkatkan daya simpan produk pangan. Penelitian ini bertujuan untuk menentukan lama waktu penyimpanan dan suhu pengeringan yang optimal dalam pembuatan larutan mikropartikel terhadap kualitas produk pangan. Pada penelitian ini melakukan proses pirolisis dan pemurnian asap cair dari tempurung kelapa dengan menggunakan alat pirolisis, destilasi serta proses filtrasi dengan menggunakan zeolit aktif dan karbon aktif. Kemudian membuat larutan enkapsulasi, pengeringan, pembentukan mikropartikel dengan penghancuran dan pengayakan, setelah itu diaplikasikan pada produk pangan. Hasil penelitian pada pembuatan tepung asap yang optimal yaitu pada perlakuan suhu pengeringan sebesar 140 °C dan waktu penyimpanan maksimal 3 hari dengan nilai pH 5, kadar air 28,470% dan kadar protein 3,120%.

**Kata kunci:** Tepung asap; maltodekstrin; mikroenkapsulasi; asap cair

### INTRODUCTION

In the production of food and beverages usually require preservatives into its products because of the long-selling needs. In addition, it is required to maintain the durability of products that are all practical and pay attention to the attractive appearance of packaging. There needs to be

problem solving to improve the quality of durable products with the addition of preservatives that are safe to use

Food quality parameters are usually to maintain nutritional value along with texture, taste and color. Food preservation in products is able to maintain the quality of food value well. One way to maintain the quality of food is to prevent the growth of microorganisms so that the longer the shelf life of the product.. Many ways to obtain food preservatives taken by various food industry players, but on the basis of economic interests, where the resulting food preservatives are made cheap so as to reduce the operational costs of the food industry, but not infrequently selected food preservatives are harmful to human health.

In the increasingly advanced era, many food vendors also commit fraud that results in poisoning for consumers.. The fundamental problem of this is because of the lack of knowledge about how to process food properly and usually constrained by the need by ignoring the nutritional value of food quality. Some cases that often occur is the addition of food preservatives that are not worth using such as formalin and borax mixed into food processing without thinking about side effects to public health this is as a consumer. Need technology to protect consumers from various food safety problems, namely by using liquid smoke technology.

Liquid smoke is the result of condensation through the process of burning biomass with little oxygen decomposed into wood eating compounds.. The development of liquid smoke in Indonesia is certainly very potential, because the basic material of its manufacture is biomass waste which is actually quite a lot in Indonesia Liquid smoke contains phenol group compounds that act as antioxidants, acids as antimicrobials and carbonyls that give the influence of discoloration. and insecure to the environment [1]. Liquid smoke has a flavor, pH and shelf life longer because of the content of phenols which is the main factor serves as antioxidants and antibacterials so as to affect the shelf life of food products and the main source of flavor. Phenol compounds and organic acid compounds are bacteriostatic compounds that determine the influence of control on bacterial growth. In the process of pyrolysis lignin produces phenol compounds while the process of cellulose pyrolysis and hemicellulose produces organic acid compounds [2].

Liquid smoke if left longer in storage will reduce the quality of liquid smoke so that it will also reduce the shelf life of food products. Liquid smoke is easily damaged during storage because it contains volatile compounds that are volatile and phenol compounds are easily oxidized and the color gradually changes.. Therefore, to improve stability to the quality of liquid smoke during storage, it is necessary to have a method that helps the problem by encapsulation.

Microencapsulation is a form of active ingredient that is entirely covered by encapsulants as a small-sized igniter material on a scale of 1 to 100  $\mu\text{m}$ . some advantages of using microencapsulated techniques include being able to maintain a war of bioactive functions during processing and not easily contaminated with an oxidized missal environment and hydrolysis, improving the quality of its sensory properties namely texture, color and taste that remains maintained, in addition to easier in handling products so that product stability is improved. The most important thing of microencapsulation technique is the bioactive wake of the compounds in liquid smoke so that it can play its function as antioxidants and antimicrobials and antibacterial.

Processing of liquid smoke into flour due to the addition or mixture of maltodextrin. Encapsulan techniques that correspond to the role of liquid smoke are chitosan and maltodextrin [3]. In the manufacture of flour smoke, a medium that can adapt liquid smoke is maltodextrin. Maltodextrin water content is so low that it can bind to liquid smoke. In addition, maltodextrin has other advantages, namely not reacting with chemical compounds that are tied, only physical bonding, no chemical reactions occur. Maltodextrin has a high solubility, has no taste and aroma. Maltodextrin in the encap-sulation process is expected to produce micro-encapsulants. In this study by using microparticle techniques in the processing of liquid smoke will increase the power of natural preservatives are high and safe for consumption by the community. This study aims to determine the optimal storage time and drying temperature in the manufacture of microencapsulation to the quality of food products.

## LIBRARY REVIEW

### Maltodextrin

Maltodextrin is a mixture of glucose, maltose and dextrin. Maltodextrin has the ability to absorb water or hygroscopic with high Dextrose Equivalent (DE). DE values range from 3-20. Maltodextrin is a thickening material or as a cold water emulsion. sifier so it will easily help in processed mixture of products as powder and easily dissolve in cold water. Maltodextrin helps the development of probiotic bacteria so that it can help facilitate the ducts of rnakn.the properties of maltodextrin anatar other is easy to dissolve and experience rapid dispersion, able to have a strong binding power and able to increase viscosity, texture and viscosity. In addition, another advantage of maltodextrin is that there is no chemical reaction, only physical bonding so it is safe to use [3].

### Encapsulation

Encapsulation serves to protect liquid or gaseous materials against damage due to the surrounding environment. In the encapsulation process use encapsulan as a protection of core materials. Encapsulation technology is applied to perishable materials.in encapsulant techniques usually in the form of microparticles or nanoparticles that will give longer shelf life, improve flavor, color, texture, product consistency, absorption and availability of bioactive components [4].

### Liquid Smoke

Liquid smoke is the result of condensation process of burning biomass containing cellulose, hemicellulose and lignin through decomposition, oxidation and polymerization reactions so that phenol compounds, acidic and carbonyl compounds that have a role as antioxidant and antimicrobial compounds [5]. In liquid smoke contains phenol, carbonyl and acid compounds. Phenol compounds act as antioxidants and acid compounds as antimicrobials and antibacterials while carbonyl affects discoloration [1]. These compounds have the ability as preservatives in food because they can inhibit the development of bacteria. Liquid smoke is more environmentally friendly so it does not pollute the air and is easy to apply and compounds that have volatile properties will be easier to control [6].

### Smoked Flour

Smoke flour is formed from liquid smoke liquid with a medium using maltodextrin that can adopt water in liquid smoke. Water content in maltodextrin is so low that it can bind to liquid smoke. According to Saloko research, et al., [5], liquid smoke flour has a phenol content of 70.79% and acetic acid of 11.10%, while the phenol component in liquid smoke is 24.03% and acetic acid is 57.70%.i water content ( $12.09 \pm 0.07$ )%, pH  $2.66 \pm 0.08$ , total acid ( $2.70 \pm 0.08$ )%, total phenol ( $4.40 \pm 0.05$ )%, and carbonyl content ( $9.76 \pm 0.04$ )%. Research on sponge cake shows that liquid smoke flour at a concentration of 2% has a shelf time of 8 days and is still preserved in taste [7]. While liquid smoke flour at a concentration of 5% is able to maintain the freshness of fish up to 48 hours at room temperature conditions [5]. The quality of food preservation is determined from the concentration of smoke flour, i.e. the higher the concentration, the more compounds in liquid smoke that play a role.

## METHOD

This research begins by preparing raw materials in the form of coconut shell by cleaning first and then cut into smaller pieces up to a size of 5-8 cm. Then the material as much as 3 kg is inserted into the reactor for pyrolysis process with combustion with a temperature of 3000C The combustion result will enter the condenser pipe and come out as grade 3 liquid smoke. Precipitation is carried out for a week then taken the top. Doing the distillation process to get grade 2 liquid smoke and the result is flowed into the active zeolite filtration column and activated carbon column so that it will get grade 1 liquid smoke. then performed analysis, pH

and content of benzo(A)pyrene using GCMS and LCMS. After grade 1 liquid smoke is obtained, then applied the manufacture of encapsulation solution. Maltodekstri 40% dissolved in liquid smoke as much as 225 mL. Then it is stirring at a speed of 200 rpm for 30 minutes at room temperature. After the encapsulation solution is formed a homogenization process is carried out at a speed of 2000 rpm for 2 minutes.

The encapsulan solution is fed to the oven tool for drying. The encapsulated solution is dried at a temperature of 135,140,145,150°C. Encapsulan powder that has been formed, then carried out destruction and enrichment. The result of smoked flour is then wrapped in aluminum foil for 2 hours before characterization. Quality parameters in smoke flour include pH value, protein content and water content. Then the smoked flour is applied to the siomay dough with the addition of a smoke flour concentration of (5%) and the length of shelf time (0th day, 1st day 2nd day and 3rd day). From each variable length of storage time in siomay carried out analytical parameters include water content. and protein levels.

## RESULTS AND DISCUSSIONS

In this study, the results obtained in the form of smoked flour products, analysis of smoke flour content consists of protein content, water content, and pH and the results of analysis of smoke flour content against the preservation of siomay (protein content, water content and pH). The results of smoke flour analysis that has been achieved can be seen in Figure 1 below.

### Protein Content

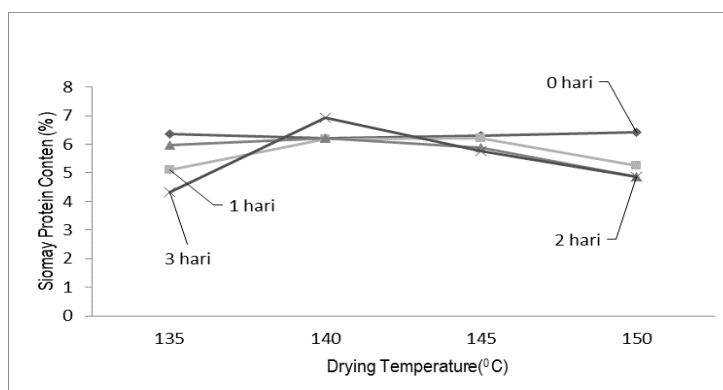


Figure 1 Percentage of Protein Content in Siomay using Smoked Flour

Figure 1 shows that yields that tend to increase later at 140°C experience a sharp drop. This is because the heating temperature affects the amount of water content contained in siomay. Water content will quickly evaporate at 140°C so that protein levels will increase. While the decrease in protein levels indicates that the influence of solid concentrations of materials so that the heat of drying is lower which causes moisture to cause protein levels to decrease. The increased water content causes microbes to appear so that it will damage the protein structure in food products. According to Herawati [8], a factor that greatly influences the quality of food products is the amount of water concentrates in food products. Water content contained in food products will result in the effect of long shelf life in room temperature conditions. This opinion is also supported by the opinion of Retnani et al.,[9] stating that high air humidity results in the process of absorbing moisture from the air so that the water content will increase.

Products that have a high moisture content, will not last long in storage because it undergoes a decay process and affects the stability of texture in siomay. Texture instability in siomay occurs will result in the growth of microbes so that the tesktur in food becomes damaged [9]. This can be seen in the food that there is mold on the surface, it contains a high moisture content that occurs in the food. According to Trisyulianti et al [10] that microorganism activity will be able to be stopped at water content by 12% to 14%, so that food will last longer in storage.

Observations made on smoked flour added with siomay dough showed that there was a decrease in protein levels in the sample. This is because smoked flour contains maltodextrin

compounds, maltodextrin itself is a group of compounds containing  $\alpha$ -D-glucose units that are mostly bound through a 1.4 glycosidic bond with ED (Dextrose Equivalent) that is no more than 20. ED is the percentage of reduced sugar content in dry form, and in the dough siomay itself contains water content of 30.24% if glucose reacts with water contained in the dough siomay, it will form a straight chained molecular structure. When a straight chain is formed, the carbonyl group contained in glucose will be reactive, which acts as a reduction. It is this reducing nature that causes the carbonyl group in glucose to react with the amine group found in the protein. So the conclusion is that the preservation of smoked flour against siomay is not only influenced by protein levels, but also influenced by glucose levels contained in maltodextrin and water content contained in siomay dough. It tends to have higher protein levels than the initial yield (without smoked flour) influenced by the influence of the role of acidity, and the content of glucose that binds to maltodextrin

The higher the levels of protein used will affect the reaction to glucose and amines that can affect the decrease in protein levels of the dough siomay. At the concentration of 5% protein compounds can only last up to 3 days this is because in the concentration 5% less reduction produced by maltodextrin compounds in smoked flour. The results of this analysis showed that smoked flour with a concentration of 5% temperature of 140°C is more effective to preserve the dough siomay compared to the temperature of 135°C, 145°C, 150°C, because at a temperature of 140°C with a 5% concentration increased protein levels by 13.15% with the preservation of siomay dough for three days.

### pH Value In Siomay added smoked flour

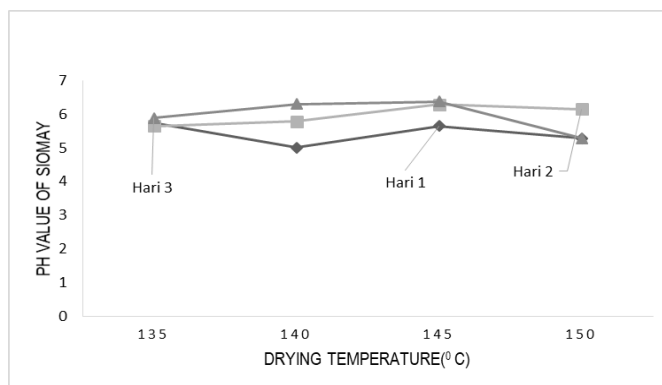


Figure 2. pH levels in Siomay

In Figure 2 shows that the higher the heating temperature, the higher the pH value in siomay. The pH value will continue to increase until the temperature is 145°C, the normality will drop at 150°C. According to David Hadrianus K [11], that in the process of long shelf time occurs decomposition of proteins become more alkaline in the form of ammonia. pH value in food products during the duration of shelf life will occur the process of decomposition of proteins by proteolytic enzymes through bacteria into carboxylic acid, sulfide acid, ammonia and other types of acids

The second analysis was the addition of siomay dough with smoked flour at a temperature of 140°C. At the time of storage for three days the pH rate again increased by 12.09% thus obtained pH content of 6.30%. This indicates that the third day of pH content has increased quite large compared to the previous day because the sample analyzed is still good and has not been damaged, causing the pH content to increase. Because the higher the condensation in the added smoke flour, the higher the pH content in siomay.

In the third analysis, the addition of siomay dough with smoke flour concentration at 145°C. At the time of storage for three days the pH level again increased by 12.67% thus obtained pH content of 6.30. Because this indicates that the third day of pH content has increased quite large compared to the previous day. The addition of flour to siomay with the same storage length will increase the pH in siomay, so that the siomay becomes less acidic. The higher the concentration of smoked flour added, the higher the pH in siomay

The fourth analysis was the addition of siomay dough with smoked flour at a temperature of 150°C. At the time of storage for three days the pH level again decreased by 0.87% thus obtained pH content of 5.28. This indicates that the third day experienced a decrease in pH levels, because the sample had already been damaged causing the pH content to decrease. The longer the storage time in the product, the lower the pH level because the sample has decayed, namely by the presence of bacteria absorbed or included in the product.

### Protein Content in Smoked Flour

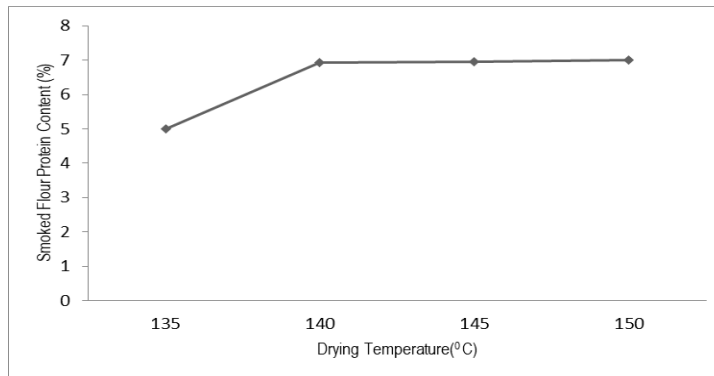


Figure 3. Percentage Value of Smoked Flour Protein

In Figure 3, analysis of protein levels shows that the higher the temperature and concentration of maltodextrin, the higher the protein content will increase. Drying with different temperatures indicates that the higher the heating temperature in the smoke flour, the higher the protein content contained in the smoke flour. This is because in the heating process there is damage to amino acids in the water content so that the protein in the smoke flour becomes increased.

### Result Optimization

Analysis data obtained using Minitab analysis obtained the optimal point for each value. In minitab analysis data obtained optimal point as follows :

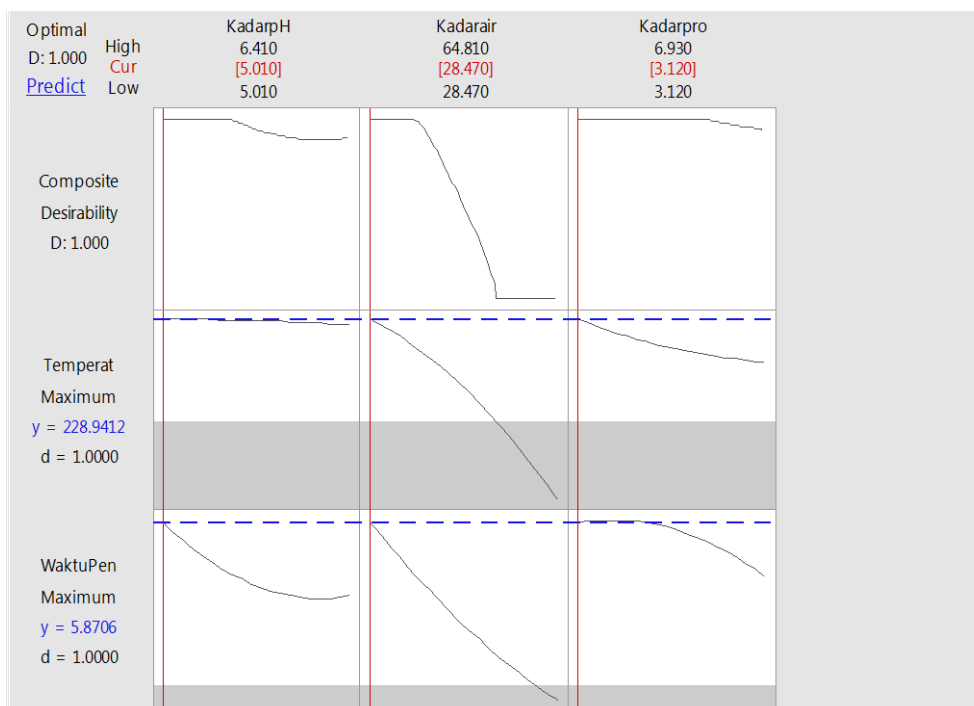


Figure 4. Graph of Optimal Point Analysis Results

In Figure 4. showed the results of optimization that can be from the value of protein in the minitab of 3,120 where the test results of protein levels in the optimal siomay is located at maltodextrin 40% with a temperature of 140oC during storage of 0 days to 3 days. In the results of optimization of water content in the minitab of 28,470 can be seen the most optimal value in the test results of water content is located at a temperature of 150°C with a concentration of 40% for 0-3 days. The result of optimization at pH level of 5,010 where the closest value in the pH level analysis is located on Day 1 at a temperature of 140°C.

So it can be concluded that the results of analysis of each optimal value during the storage period of 0 days - three days, namely pH levels of 5,010 with a temperature of 140oC during storage of 3 days, water content of 28,470 close to the value of water content on the second day at 150 oC and protein content value of 3,120 with maltodextrin concentration of 40% during storage 3 days.

## CONCLUSION

Based on the results of minitab analysis, that at a temperature of 140°C and a maximum storage time of 3 days is the optimal treatment, at pH level 5, water content of 28,470 and protein content of 3,120.

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