International Journal on Advanced Science Engineering Information Technology

Vol.5 (2015) No. 2
ISSN: 2088-5334

Applications of Liquid Smoke Powder as Flavor and Food Preservative (Case Study : Sponge Cake)

Maryam

Agro-Industrial Engineering, Polytechnic of ATI Padang, Jl. Bungo Pasang-Tabing, 25171, Padang, West Sumatra, Indonesia
E-mail: iyam_cb@yahoo.co.id

***Abstract*— Liquid smoke is converted into powder will provide ease of mobilization and storage. At this time should be developed as an application of liquid smoke powder as flavor and food preservative. The purpose of this study was to determine the effect of adding liquid smoke powder to the flavor and shelf life of food. Samples of food used is a sponge cake. The method used to observe the shelf life is the ESS (Extended Storage Studies). Observations flavor food with organoleptic test was used to respondents. Addition of liquid smoke powder treatment performed at the level of 0%, 2%, 4% and 6% of the weight of flour. The addition of liquid smoke powder to give effect to flavor foods and can increase shelf life. Liquid smoke contains phenolic compounds which in addition to contributing smoke flavor, also has antioxidant and bactericidal action on food. Optimal conditions of manufacture liquid smoke powder by using a spray dryer is on the treatment concentration of 5% and a inlet temperature of 160 °C. The addition of optimum is at the level of 2% which can increase the shelf life of food to 8 days and the flavor is still received by respondents.**

***Keywords*— liquid smoke powder, flavor, shelf life, phenolic**

I. INTRODUCTION

Food preservatives are included in the group of food additives which are pharmacologically inert (effective in small quantities and not toxic). The use of preservatives is very broad. Almost all industries use it, including the pharmaceutical industry, cosmetics, and food. The use of liquid smoke to preserve fish, meatballs, tofu, noodles and other food products is easy, safe and effective when used according to a predetermined level. Product development and food preservation process with the use of liquid smoke technology continues to be done in order to produce a product that has the taste of smoke, durable and safe for consumption.

Several studies have shown that liquid smoke can extend product shelf life by preventing damage caused by the activity of spoilage and pathogenic bacteria. Supporting antibacterial compounds in distillate liquid smoke are phenolic compounds and acids [5]. Compounds smoke gives the flavor of smoke characteristic that cannot be replaced by any other means. Phenol is a compound that is most responsible for the formation of the desired specific scent on smoke products, especially phenols with medium boiling point as guaikol, eugenol and siringol [6]. Phenol in conjunction with sensory properties have cresol pungent odor, sweet, smoky and burning [4].

Form of liquid smoke is converted into powder will provide mobility and ease of storage. Liquid smoke powder can be generated by comparing a ratio of 3 parts redistilat liquid smoke and 1 part maltodextrin [3]. With this smoke based on powder products is developing fast spices like seasoning dazed, barbecue sauce and table ready use. Drying with spray dryer is method of choice in the process of drying the product with the end result in the form of powder and a drying method most widely used in industry, especially the food industry.

II. MATERIALS AND METHODS

A. Materials and Equipment

The materials that used in this study were liquid smoke, dextrin, flour, eggs, butter, sugar, and food additives. The equipment used spray dryer, oven, mixer and glassware.

B. Purification of Liquid Smoke

Purification of liquid smoke made to obtain liquid smoke does not contain harmful ingredients that are safe for food preservatives. Liquid smoke derived from the condensation of smoke in the process of hydrolysis was deposited during the week. Deposition process is very effective because it can precipitate the tar up to 90%. Further separation is done by

filtering the smoke tar liquid using filter paper. The purification process is then performed with the redistilled.

The purification process is done by distillation at a temperature of 150°C. Results distillate filtration process is carried out with the active zeolite. The process is intended to obtain the active substance which is really safe from harmful substances. Distillate liquid smoke flowed into active zeolite column and the obtained filtrate liquid smoke safe from hazardous materials and can be used for non-carcinogenic food preservative.

Active zeolite filtration process filtrate with activated carbon intended for liquid smoke with the smell of smoke that is lightweight and does not sting. The filtrate from the active zeolite filtration flowed into the column containing activated carbon so that the filtrate obtained smoke smell mild and do not sting. Liquid smoke as a food preservative that is safe, effective and natural has been ready for use.

C. Making Liquid Smoke Powder

One way that can be used for the manufacture of powder smoke is the spray dryer. Spray drying technology is an economical method to protect the active compounds by means of trapping in a carrier. This study designed used a completely randomized design with treatments and 3 replications. The treatments that used in this study were A (dextrin concentration), and B (inlet temperature).

D. Making Sponge Cake

Liquid smoke powder will be applied to add flavor and shelf life of the sponge cake. The addition of liquid smoke powder in food products will be tested at several levels of 0%, 2%, 4%, and 6%. The method used to observe the shelf life is the ESS (*Extended Storage Studies*). Determination of the shelf life of the product with ESS, which is also often referred to as the conventional method, is the determination of the expiration date by storing a series of products in normal conditions was observed to decrease while the quality (usable quality) until it reaches the level of quality expired. This method is accurate and precise, but at the beginning of the discovery and use of this method would require a long time and quality parameters analysis relatively large and expensive. Today the ESS method is often used for products that have an expiration period of less than 3 months [8]. Observations flavor food with organoleptic test was used to respondents.

III. RESULT AND DISCUSSION

A. Liquid Smoke Powder

Liquid smoke compounds containing phenol groups, carbonyl, and acid. Simultaneously all these compounds can act as an antioxidant and antibacterial and give effect to the color and distinctive flavor of smoked food products. The use of liquid smoke is considered impractical and difficult to handle, especially in relation to the distribution and transport of liquid smoke. Storage of liquid smoke for long periods can cause oxidation which indicates a decrease in quality. Therefore, liquid smoke should be maintained so that the active component is more durable. Making liquid smoke powder can be used to maintain the active compounds in the liquid acid.

The materials can be used as the carrier should have a high solubility capability, produces a highly concentrated solution with low viscosity. The materials are often used in research is maltodextrin, chitosan and gum arabic. Maltodextrin is a material that is soluble in water and is able to protect the compound from oxidation.

Spray drying technology is an economical method to protect the active compounds by means of trapping in a carrier. The use of a spray dryer capable of producing good quality powder with low water activity, ease of handling and storage, as well as able to protect the active compounds from reactions are undesirable [7].

Liquid smoke powder manufacture by using a spray dryer is on the treatment concentration of 5% and a temperature of 160 °C inlet Test results using GCMS liquid smoke can be seen in Table 1.

Liquid smoke compounds containing phenol groups, carbonyl, and acid. Simultaneously all these compounds can act as an antioxidant and antibacterial and give effect to the color and distinctive flavor of smoked food products. The use of liquid smoke is considered impractical and difficult to handle, especially in relation to the distribution and transport of liquid smoke. Storage of liquid smoke for long periods can cause oxidation which indicates a decrease in quality. Therefore, liquid smoke should be maintained so that the active component is more durable. Making liquid smoke powder can be used to maintain the active compounds in the liquid acid.

The materials can be used as the carrier should have a high solubility capability, produces a highly concentrated solution with low viscosity. The materials are often used in research is maltodextrin, chitosan and gum arabic. Maltodextrin is a material that is soluble in water and is able to protect the compound from oxidation.

Spray drying technology is an economical method to protect the active compounds by means of trapping in a carrier. The use of a spray dryer capable of producing good quality powder with low water activity, ease of handling and storage, as well as able to protect the active compounds from reactions are undesirable [7].

Liquid smoke powder manufacture by using a spray dryer is on the treatment concentration of 5% and a temperature of 160 °C inlet Test results using GCMS liquid smoke can be seen in Table 1.

Based on the above test results, that the used liquid smoke does not contain harmful compounds are compounds Polycyclic Aromatic Hydrocarbon (PAH). The process of filtration with activated carbon and zeolite produce liquid smoke smell mild and do not sting. This liquid smoke product called liquid smoke foodgrade, decent used as a food preservative.

TABLE I
COMPONENT LIQUID SMOKE COMPOUNDS COCONUT SHELL

No	Componen Liquid Smoke	Peak area (%)
1	2-Furanol, tetrahydro-	0,37
2	Furfural	2,97
3	2-Pentanone, 4-hydroxy-4-methyl-	0,52
4	Phenol	16,04
5	Phenol, 2-methyl-	0,74
6	Phenol, 2-methoxy-	2,41
7	Octanoic Acid	0,64
8	Phenol, 2-methoxy-4-methyl-	0,17
9	n-Decanoic acid	0,20
10	1,2-Cyclopentanediol, 3-methyl-	0,49
11	Dodecanoic acid	1,52
12	Hexadecanoic acid	0,36
13	Xylitol, 1-O-octanoyl-	0,56
14	Tetradecanoic acid	2,49
15	Stearic anhydride	5,39
16	Oleic Acid	1,32
17	1-(+)-Ascorbic acid 2,6-dihexadecanoate	27,72
18	8-Octadecanone	0,35
19	Stearic anhydride	2,27
20	Dodecanoic acid, 2-3-dihydroxypropyl ester	3,28
21	Oleic Acid	21,05
22	Octadecanoic acid	3,19
23	9-Octadecenoic acid, 1,2,3-propanetriyl ester	1,21
24	9-Octadecenoic acid, 1,2,3-propanetriyl ester	3,59
25	Hexadecanoic acid, 1-(hydroxymethyl)-1,2ethyl	0,39
26	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)	0,75

B. Water Content

Based on Table 2 shows that the highest water content of 9.11% was obtained at a concentration of 10% and the treatment inlet temperature of 120 °C, while the lowest water content of 4.44% was obtained at treatment concentrations of 15% and a temperature of 160 °C inlet. The value of the product moisture content is not much different from the raw material moisture content of 5.17% dextrin. According to [2], the water content of a product is very important to control because it will determine the resistance or durability of the product in question at the time of storage.

TABLE II
WATER CONTENT OF LIQUID SMOKE POWDER

Treatment	Water Content (%)
Dextrin 10%, inlet temperatur 120°C	9,11e
Dextrin 10%, inlet temperatur 140°C	8,13d
Dextrin 10%, inlet temperatur 160°C	6,95c
Dextrin 15%, inlet temperatur 120°C	6,95cd
Dextrin 15%, inlet temperatur 140°C	6,61c
Dextrin 15%, inlet temperatur 160°C	4,44ab
Dextrin 20%, inlet temperatur 120°C	8,46e
Dextrin 20%, inlet temperatur 140°C	5,35bc
Dextrin 20%, inlet temperatur 160°C	5,07a

The figures in the column followed by the same lowercase letter are not significantly different according to DNMRT 5%

C. Bulk Density

Dextrin very smooth texture and small particles cause denstity high bulk value. The higher bulk density values indicate more solid product [1]. Based on Table 3 shows that smallest bulk density of 1.21 g / cm3 was obtained in 10% treatment concentration and inlet temperature of 160 °C, while most 1.35 g / cm3 was obtained in 20% treatment concentration and inlet temperature of 120 ° C.

TABLE III
BULK DENSITY OF LIQUID SMOKE POWDER

Treatment	Bulk Density (g/cm^3)
Dextrin 10%, inlet temperatur 120°C	1,24c
Dextrin 10%, inlet temperatur 140°C	1,29e
Dextrin 10%, inlet temperatur 160°C	1,21a
Dextrin 15%, inlet temperatur 120°C	1,25c
Dextrin 15%, inlet temperatur 140°C	1,31f
Dextrin 15%, inlet temperatur 160°C	1,33g
Dextrin 20%, inlet temperatur 120°C	1,35h
Dextrin 20%, inlet temperatur 140°C	1,29e
Dextrin 20%, inlet temperatur 160°C	1,26d

The figures in the column followed by the same lowercase letter are not significantly different according to DNMRT 5%

D. Solubility

Solubility liquid smoke powder produced quite high because of the raw material used is dextrin. Dextrin has hydrophilic properties which lead to having high solubility. The results of treatment showed a similar solubility values are used for the same dextrin is tapioca dextrin of standards for the food industry. Based on SNI 01-2593-1992 dextrin to the food industry has a solubility of at least 97%. Based on Table 4 shows that the highest solubility value of 98.64% in the treatment concentration of 15% and an inlet temperature of 140 °C, while the lowest was 98.56% in the treatment concentration of 15% and a temperature of 140 ° C inlet.

TABLE IV
SOLUBILITY OF LIQUID SMOKE POWDER

Treatment	Solubility (g/cm^3)
Dextrin 10%, inlet temperatur 120°C	98,63g
Dextrin 10%, inlet temperatur 140°C	98,61f
Dextrin 10%, inlet temperatur 160°C	98,58b
Dextrin 15%, inlet temperatur 120°C	98,60d
Dextrin 15%, inlet temperatur 140°C	98,64h
Dextrin 15%, inlet temperatur 160°C	98,56a
Dextrin 20%, inlet temperatur 120°C	98,59c
Dextrin 20%, inlet temperatur 140°C	98,61f
Dextrin 20%, inlet temperatur 160°C	98,60e

The figures in the column followed by the same lowercase letter are not significantly different according to DNMRT 5%

E. Yield

Based on Table 5 shows that highest yield of 69.49% in the treatment concentration of 10% and a temperature of 160 °C while the lowest inlet 50.41% in the treatment concentration of 15% and a temperature of 120 °C inlet. Values lower yield due to the performance of the tool where most of the powder sticks to the wall of the tube at each first operation. Attempts to improve the yield is collecting powder attached to the tube wall.

TABLE V
YIELD OF LIQUID SMOKE POWDER

Treatment	Yield (%)
Dextrin 10%, inlet temperatur 120°C	53,41c
Dextrin 10%, inlet temperatur 140°C	56,16d
Dextrin 10%, inlet temperatur 160°C	69,49i
Dextrin 15%, inlet temperatur 120°C	50,41a
Dextrin 15%, inlet temperatur 140°C	64,17g
Dextrin 15%, inlet temperatur 160°C	66,91h
Dextrin 20%, inlet temperatur 120°C	52,61b
Dextrin 20%, inlet temperatur 140°C	60,53e
Dextrin 20%, inlet temperatur 160°C	63,23f

The figures in the column followed by the same lowercase letter are not significantly different according to DNMRT 5%

F. Color

Color is an important attribute in the food industry. Whiteness is a major quality factor of starchy. Whiteness of a material is the reflectance of the material against the light on its surface [9]. White degrees starchy products in general be one of the quality parameters. Starchy products are usually expected to have a high whiteness. Color measurement is done visually. Overall sample showed white, is not different from the color of the raw materials used dextrin.

G. Flavor and Shelf Life

Phenol is a major antioxidant and liquid smoke. Antioxidative role of liquid smoke is indicated by the high-boiling phenolic compounds which act as hydrogen donor against free radicals and inhibiting the chain reaction. Liquid smoke can be used as a preservative because it has a degree of acidity (pH) with a value of 2.8 to 3.1 so as to inhibit the growth of pathogenic bacteria.

The test results of the sponge cake liquid smoke powder can give effect to the flavor and shelf life as shown in Table 5. The addition of liquid smoke powder to give effect to the increase shelf life. The addition of optimum is at the level of 2% which can increase the shelf life of food to 8 days and the flavor is still received by respondents.

TABLE VI
THE TEST RESULTS OF THE SPONGE CAKE WITH LIQUID SMOKE POWDER

No	Treatment	Flavor		Shel life
		Flavor	Taste	
1	0 %	3,57	3,34	4 days
2	2 %	3,13	3,04	8 days
3	4 %	3,00	2,36	12 days
4	6 %	2,97	2,13	15 days

IV. CONCLUSIONS

Optimal conditions of manufacture liquid smoke powder by using a spray dryer is on the treatment concentration of 5% and a inlet temperature of 160 °C. The addition of optimum is at the level of 2% which can increase the shelf life of food to 8 days and the flavor is still received by respondents.

REFERENCES

[1] Anita, Sri. *Physicochemical properties Studies, Functional properties of carbohydrates, and Antioxidant Activity Wheat Sprouts Beans Hyacinth Bean (Lablab Purpureus L. Sweet)*. Essay. Faculty of Agriculture Engineering. Bogor Agriculture University. 2009.

[2] Collins,W.W. dan W.M. Walter, Jr. *Potential for Increasing Nutritional Value of Sweet Potato.* In Sweet Potato Proc. Of the first Int. Symp. R. L. Villareal and .D. Griggs (eds) p 355-63. AVRDC. Shanhua, Taiwan. 1982.

[3] Darmadji, P. *Optimation Process of Making Smoke Powder*. Agritech 22 (4) : 172-177. 2002.

[4] Daun, H. *Interaction of Wood Smoke Components and Foods, Food Technology*. (32): 66-71. 1979.

[5] Girard, J.P. *Smoking In Technology of Meat Products.* Clermont Ferrand, Ellis Horwood, New York. 1992

[6] Guillen, Md dan M.I. Ibargoita. *Relationship Between the Maximum Temperature Reached in the Smoke Generation Process from Vitis Viniera L Shoot Sawdust and Composition of the Aquaeus Smoke Flavoring Preparation Obtained*. J. Agric. Food. Chem. 44:1302-1307. 1996.

[7] Helena, C.F., Carneiro, Renata V., Tonon, Carlos R.F., Grosso, Miriam, D.,and Hubinger. *Encapsulation Efficiency and Oxidative Stability of Flaxseed Oilmicroencapsulated by Spray Drying using Different Combinations of Wallmaterials.* J. of Food Eng. 115 : 443–451. 2012.

[8] Herawati, Heny. *Determination of Shef Life Product.* Journal of Agricultural Research. 27 (4). BPTP Jawa Tengah. Bukit Tegalepek. Ungaran. 2008.

[9] Indrasti, F. *Utilization of Taro Flour (Xanthosoma sagittifolium) from Belitung in the Making Cookies.* Essay . Faculty of Agriculture Engineering. Bogor Agriculture University. Bogor.