International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.11 No.08, pp 364-380, 2018

Effect of Combination Treatment Of Concentration Liquid Smoke, Immersion Duration, Packaging And Old Type Storage Different Levels Of Phenol And Carbonil Nila Fish Fillet (*Oreochromis niloticus*)

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Abstract : This study aims to determine the fenol and carbonil content of fillet of tilapia (*Oreochromis niloticus*) given preservation with liquid smoke derived from a combination of liquid smoke treatment concentration, soaking time, types of packaging and storage time are different. This study was conducted experimentally using factorial experiment with a completely randomized design patterns (RAL) 5 x 3 x 3 x 5 with 3 replicates in order to obtain 675 experimental units. A factor consists of the concentration of liquid smoke consisting of Control (smokeless liquid / 0%), 5% and 10%, 15% and 20%; factor B consists of soaking time with liquid smoke is composed of three (3) levels ie soaking time 5 minutes, 10 minutes and 15 minutes; factor C consists of the type of packaging consists of three (3) levels ie without packaging (control), packaging polyethylene (PE) and packaging of polypropylene (PP) and factor D consists of the storage time (days) consists of 5 (five) levels ie 0 , 3,6,9 and 12 days. The parameters measured were the levels of fenol and carbonil content. Results of research on the analysis of variance showed 1) the combination of the two treatments on fillet of tilapia which different concentrations of liquid smoke with different types of packaging showed no interaction on the percentage of phenol content, while for two, three and four combinations of other treatments did not show any significant differences (no interaction). 2). levels of phenol fillet of tilapia on a combination of four treatments, namely prolonged submersion, different concentrations of liquid smoke, types of packaging and storage time shows the results of phenol levels low enough that a value ranging from .00 to 0.0025% and already meet the quality requirements of fish fillets smoked tilapia. 3) content carbonyl tilapia fillet between the two combination treatments with a concentration difference types of packaging, keep the concentration difference with storage time and packaging differences with storage time showed their interactions, while the two other treatment combinations that no further interaction interaction occurs in three combined treatment difference concentration, types of packaging and storage of different treatment combinations while three others and four other treatments no interaction. 4). levels of carbonyl tilapia fillet of 4 treatment combinations that different concentrations, dipping time, types of packaging and storage time ranged from 0.00 to 12.01%.
Key words: fish fillet, immersion, concentration, packaging, storage, fenol, carbonil.

I Ketut Budaraga/International Journal of ChemTech Research, 2018,11(08): 364-380.

DOI= http://dx.doi.org/10.20902/IJCTR.2018.110843

I. Introduction

Among the species of freshwater fish are now being developed and grown in the provinces of West Sumatra are Tilapia (*Oreochromis niloticus*). The potential of aquaculture land estimated area of 12,300 hectares [1]. This is because these fish easy life, fast breeding, the meat is white and it was quite tasty. Processing methods can be developed against the fish is a fish processing fish. Result fillet processing such as fillets of fish including food very quickly decompose (high perishable food). As perishable foodstuffs, then the quality of the fish must be maintained as much as possible to get into the hands of consumers. For that we need good handling and preservation and processing into products ready to be eaten but durable power longer. One way of processing that has long been known to the public is the curing of fish.

Fumigation is a technique of embedding and incorporating various chemical compounds of smoke into foodstuffs [2]. Fogging was intended to extend the shelf life of a material, but in line with the increase in public acceptance of the product smoke then that goal began to turn to the flavor, which gives aroma and distinctive taste and prevents rancidity of the meat due to the oxidation of fat. Fumigation can be done traditionally or in modern [3]. Traditional fumigation can be done in the cold and heat by burning wood or sawdust, where the smoked fish direct contact with the smoke. While modern fumigation using liquid smoke (steam dispersion in the fluid as a result of condensation of smoke from wood pyrolysis) as media smoking. Generally wider community, especially the coastal communities do fumigation with traditional fumigation techniques. Though the technique of curing it has a lot of shortcomings, among other things take a long time, is not efficient in the use of firewood, the uniformity of the product to produce color and flavor desired difficult to control, environmental pollution, and the most dangerous is the residual tar and hydrocarbon compounds polycyclic aromatic (*benzo(a)pyren*) deposited in food that can be harmful to health. In areas producing smoked fish, in order to meet the source of the smoke (wood) many people who cut down trees, even be protective coastal mangroves were not spared from logging target. These circumstances make alternative use of firewood has to be considered as well as fogging technique was time to be replaced with modern fumigation.

The use of liquid smoke broader application to replace the traditional way of curing. With the provision of liquid smoke aroma smoke on fish would be more practical because only by spraying or dipping the fish in a solution of liquid smoke, followed by heating. The development of liquid smoke more rapidly in the preservation of foodstuffs, due to the costs required for timber and equipment manufacture more efficient smoke, harmful components can be separated or reduced before being used in food as well as the composition of the liquid smoke is more consistent for repeated use [4].

Modern fogging is fumigation with the gas phase (gas phase smoke) or fumigation with liquid smoke (liquid smoke). Fumigation with the liquid smoke made by soaking the product in liquid smoke that has been disbursed through the process of pyrolysis and distillation [4]. Fumigation this way can improve the quality of products in terms of health because of carcinogenic compounds such as benzo (a) pyren contained in the liquid smoke can be absorbed and reduced in number, while the tar can be separated by using sedimentation and filtration [5].

Some research on the production and use of liquid smoke has been carried out include the determination of the temperature and time of pyrolysis of rubber wood to produce liquid smoke quality [6], the study of raw materials cinnamon at a temperature pyrolysis 400^{o}C produce quality liquid smoke [7] and the dominant containing compound acetic acid and phenol [8], a materials research cinnamon with temperature pyrolysis of 400^{o}C at concentrations of 1500 ppm showed antioxidant teringgi amounted to 35.091% [9], the determination of antibacterial properties of liquid smoke produced from several kinds of soft wood [10], the preservation of the tongue smoke with liquid smoke produced from teak [11]. Budaraga research results *et al*, [12] to get the dominant content of liquid smoke coconut husks, coconut shell and cinnamon contains acetic acid and phenol. Further research Budaraga et.al., [13] to get the cytotoxic properties (the ability to kill Artemia salina) liquid smoke cinnamon at 400^{o}C temperature pyrolysis of 19.048%. These studies all utilize hardwood and softwood separately. Whereas softwood with low lignin content will be very effective to extend the lasting power of fish and produce flavor which is not typical [14] when combined with other wood (hardwood).

Based on the above research, the cinnamon is ideal to use as a preservative. The results of further research Budaraga *et al*, [15] to get the purification of liquid smoke cinnamon on the distillation temperature of 140^{o}C have undetectable levels of benzo (a) pyrene. Further research Budaraga *et al*, [16] to get the liquid smoke toxicity cinnamon purified by precipitation during the 3-day 83.75%. Results antioxidant liquid smoke cinnamon in a manner different purification produces antioxidants that are strong enough (<50 ppm) Budaraga *et al*, [17]. Furthermore, the results of research Budaraga et.al., [18] to get the measurement results on the antibacterial properties of *Escherichia coli* liquid smoke cinnamon purified by precipitation for 3 days resulted in inhibition diameter 34.129 mm/ppb. Their immersion in liquid smoke concentration cinnamon right would affect the levels of antioxidants and so far there is no information about it.

The next process followed by drying the fillets of tilapia resulting in decreased water levels expected product microbial activity is inhibited, resulting in a longer lasting power products. During this time the nature of the community is still traditional fish processing, fish fillet products in the form of beef jerky is usually not packaged properly so easily contaminated by microorganisms which will result in reduced power durable besides that do not pay attention shelf. Besides the water content of the product is still relatively high. To obtain a lower water content, then fillet products were not made in the form of a thick but in the form of thin slices. It is intended that the liquid smoke cinnamon can more rapidly penetrate into slices of fillet of tilapia, as well as the drying process faster. With the form of the product in the form of thin slices of fillet, hoped no bones were shipped, all the edible parts and form a thin more attractive for consumers. Contamination with microbes and other damage can be prevented by packing with a plastic bag. It remains no information about the type of packaging and storage right on levels of phenol and carbonyl tilapia fillet stuffed with liquid smoke. The results of the study [19] showed no packaging was good at cooking spices during storage will cause a loss of quality. The purpose of this study to determine the levels of phenol and carbonyl smoked fillet of tilapia given combined treatment of liquid smoke concentration, soaking time, types of packaging and storage time are different.

II.Raw and Methods

The materials used for the manufacture of fish fillets ie tilapia black bought at the market bottom of the crocodile with an average weight of 250 grams / fish, alcohol 70%, salt, water and liquid smoke cinnamon purified by distillation temperature of 140^{o}C and chemicals for analysis of phenol and carbonyl. The tools used in this study are: a. Equipment for the manufacture of preservative solutions flask, glass beaker, beakers, pipettes, and mixer. b. Equipment for the manufacture of fish filet was basins, pans, mixers, stainless steel knives, water heating, cutting boards, work desks, spray equipment, pan drainer, freezer, and analytical scales. c. Equipment for drying of tilapia fillets: briquette stove heat resistance [20], a drying oven tool length 240 x width 100 x height 80 cm measurement device 200^{o}C [21]. d. Equipment for packaging and storage: storage shelves, polyethylene, polypropylene plastic, paper labels, paper plates for a fillet. Another tool used in this study such as, refrigerator coolers, freezers, flask, cup petridist, electric stove, filter paper, oven, burette, incubators, ovens, porcelain dish, desiccator, filter, thermometer, erlenmeyer 125 ml and 500 ml, beaker, filter paper, soxhlet, vortex, test tubes, micro burette, pipette, pipette volumetric flask of 250 ml.

2.1.Method Research

The experimental design used in this study using factorial pattern in a completely randomized design (CRD) is a combination of liquid smoke concentration with soaking time, types of packaging and storage in order to obtain 5 x 3 x 3 x 5 x 3 trial replications = 675 experimental units. The first factor consisted of 5 (five) level is the concentration of liquid smoke control, 5% and 10%, 15% and 20%; The second factor of soaking with liquid smoke is composed of three (3) levels ie soaking time 5 minutes, 10 minutes and 15 minutes; The third factor type of packaging consists of three (3) levels ie without packaging, packaging polyethylene (PE) and polypropylene packaging (PP) and the factor of the place of storage time (days) consists of 5 (five) levels ie 0,3,6,9 and 12 days. The observed data in the form of phenol and carbonyl analyzed by analysis of variance on the real level of 5%, when dilanjutnya significantly different by Tukey's test at 5 percent significance level [22].

2.2. Implementation Research.

2.2.1.Preparation liquid smoke.

Before the pickling process fillet of tilapia with liquid smoke cinnamon purified by distillation temperature of 140^{o}C first prepare liquid smoke subsequent dilution with distilled water. The concentration of preservative liquid smoke used is smokeless liquid (control), 5%, 10%, 15% and 20%.

2.2.2.Make fillet of tilapia and preservation with liquid smoke

The process of making fillets of tilapia and preservation with liquid smoke cinnamon well as packaging and storage done in this study are as follows: In the conduct of research activities begins with the preparation of materials and tools such as a desk, knives, cutting boards that have been sterilized with alcohol 70% and cinnamon liquid smoke that has been purified. Prepared aqudest (control), liquid smoke concentration of liquid smoke 5%, 10%, 15% and 20%, Tilapia been in fresh condition refers to the SNI [23] on the specifications of fresh fish and SNI [24] on the requirements of the raw material with the characteristics raw materials are clean, free of any odor indicating decay, is free of signs of decomposition and forgery, free from other natural properties that can reduce the quality and not harmful to health. Organoleptic characteristics of the raw material has a freshness: a) appearance: intact, convex eyes, bright white cutlet; b) The smell: specific fresh fish; c) texture: Solid, compact and elastic, with a weight of 250 ± 10 grams. As for how to manufacture fillets of tilapia as follows: Cultivated using fresh fish that has passed through the phase freezing (rigor mortis) and cleanliness is always maintained by weeding the scales of a fish, discarding the entrails, feces, and lining the wall of the stomach is black, then do the washing up clean to remove any remaining dirt, blood, loose scales and slime. Already clean then performed an incision behind the gill fins to the back of the head; front heads toward keekor incision along the dorsal fin using a stainless steel knife and a knife made parallel so separated from the ribs when taking fillet.

Turn the fish, cut off the back fin gills until the head backward; The cut of the tail toward the head. Open the fillet by cutting towards the head with a knife close to the ribs, cutting through the bone of thorns. Furthermore fillet obtained immediately put into the freezer -20°C as soon as possible. To prevent a decline in quality, cleanliness fillet is always maintained and in working to make fillets have to really pay attention to sanitary aspects such as using gloves, head, working table knife would have been made sterile by sprayed and rinsed with alcohol before starting the job.

In this study using fish fillets in the form of block ie boneless fillets. Avoid contamination which can easily infiltrate into the meat tissue and muscle meat that has been open to the whole fish. In the process of handling for each stage of work to keep the fish stay fresh is to protect from the sun, wind, other heat source to increase the temperature of the fish and once made fillet put in the freezer. To reduce drip (water from the muscle tissue is lost in the frozen product melted) fillet do immersion in pure saline solution 15% for 20 seconds.

This fillet construction work done quickly but carefully to avoid spoilage, contamination and defects due to carelessness which may adversely affect the product and to anticipate these things put in feezer. Waste obtained from pemfilettan be removed from the processing to avoid contamination of the product.In blocks, fillets transported easily stored and handled SNI [25]. Furthermore, fish blocks are cut in the form of stick (size of ± 5 x 10 cm with a thickness of ± 2 cm) and are given treatment liquid smoke is a concentration of 5%, 10%, 15%, 20% and control (without liquid smoke) and combined with the long immersion different ie 5 minutes, 10 minutes and 15 minutes. After completion of the immersion, the fillet is removed and drained and winds up dry fillet surface. Fillet of tilapia further arranged on the shelves of the oven so evenly, and dried at 70 ° C for 6 (six) hours.

After the fillets of tilapia smoked dry due to heating, fillet cooled at room temperature for ± 20 minutes to cool placed in a clean container styreform and hygienic [26], and then inserted into the packaging polyethylene (PE), polypropylene (PP) and without packaging shall be retained and held at room temperature observations began days 0, 3 days, 6 days, 9 days and 12 days to phenol [27] and [28] as well as the levels of carbonyls [27] and [29].

III.Result and Discussion

3.1. Phenol Content (%)

In the analysis of variance showed a combination of the two treatments concentration difference with the kind of different packaging showed no interaction of the phenol content (%) ($P < 0.05$), while for two, three and four combinations of other treatments did not show any significant differences (no interaction). The average value of phenol levels tilapia fillets treatment differences in concentration, soaking time, types of packaging and different storage time is presented in Table 1 and Figure 1 below.

Table 1. The average value of the levels of phenol (%) of tilapia fillets treatment differences in the concentration of liquid smoke, prolonged submersion, types of packaging and storage time.

Type Packaging	Long (K) soaking (minute)	Concentration (L) liquid smoke (%)	Long storage (S) (day) 0 (S_0)	3 (S_1)	6(S_2)	9(S_3)	12(S_4)	Mean (L)/(K)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		0 (L_0)	0.002	0.0015	0.0037	0.0034	0.0016	0.00
	5 (K1)	5 (L_1)	0.0143	0.0138	0.0160	0.0157	0.0129	0.01
		10 (L_2)	0.0213	0.0208	0.0227	0.0224	0.0206	0.02
		15 (L_3)	0.0200	0.0195	0.0214	0.0211	0.0207	0.02
		20 (L_4)	0.0204	0.0176	0.0193	0.0188	0.0187	0.02
	Mean 5 minute		0.02	0.01	0.02	0.02	0.01	0.02
Packaging		0 (L_0)	0.0017	0.0014	0.0036	0.002	0.0015	0.00
KK	10 (K2)	5 (L_1)	0.014	0.0137	0.0159	0.0133	0.0128	0.01
		10 (L_2)	0.021	0.0207	0.0226	0.021	0.0205	0.02
		15 (L_3)	0.0197	0.0194	0.0213	0.021	0.0206	0.02
		20 (L_4)	0.018	0.0175	0.019	0.0187	0.0186	0.02
	Mean 10 minute		0.01	0.01	0.02	0.02	0.01	0.02
		0 (L_0)	0.0016	0.004	0.0035	0.0017	0.0014	0.00
	15 (K3)	5 (L_1)	0.0139	0.0163	0.0158	0.013	0.0127	0.01
		10 (L_2)	0.0209	0.023	0.0225	0.0207	0.0204	0.02
		15 (L_3)	0.0197	0.0194	0.0213	0.021	0.0206	0.02
		20 (L_4)	0.0177	0.0174	0.0189	0.019	0.0185	0.02
	Mean 15 minute		0.01	0.02	0.02	0.02	0.01	0.02
	Mean	0 (L_0)	0.00	0.00	0.00	0.00	0.00	0.00
	concentration	5 (L_1)	0.01	0.01	0.02	0.01	0.01	0.01
	liquid smoke	10 (L_2)	0.02	0.02	0.02	0.02	0.02	0.02
		15 (L_3)	0.02	0.02	0.02	0.02	0.02	0.02
		20 (L_4)	0.02	0.02	0.02	0.02	0.02	0.02
	Mean	5 (K_1)	0.02					
	long	10(K_2)	0.02					
	soaking (minute)	15(K_3)	0.02					
	Mean long storage		0.02	0.02	0.02	0.02	0.01	0.02
	Mean packaging kontrol (KK)		0.02					
		0 (L_0)	0.0184	0.0029	0.0033	0.0035	0.0037	0.01
	5 (K1)	5 (L_1)	0.0034	0.0116	0.013	0.0125	0.0127	0.01
		10 (L_2)	0.0124	0.0016	0.004	0.0035	0.0027	0.00
		15 (L_3)	0.0024	0.0136	0.016	0.0155	0.0147	0.01
		20 (L_4)	0.0144	0.0186	0.021	0.0205	0.0197	0.02
	Mean 5 minute		0.01	0.01	0.01	0.01	0.01	0.01
Packaging		0 (L_0)	0.0033	0.0028	0.003	0.0027	0.0036	0.00
PP	10 (K2)	5 (L_1)	0.012	0.0115	0.0127	0.0124	0.0126	0.01
		10 (L_2)	0.002	0.0015	0.0037	0.0034	0.0026	0.00
		15 (L_3)	0.014	0.0135	0.0157	0.0154	0.0146	0.01

		20 (L_4)	0.019	0.0185	0.0207	0.0204	0.0196	0.02
	Mean 10 minute		0.01	0.01	0.01	0.01	0.01	0.01
	15 (K3)	0 (L_0)	0.003	0.0027	0.0029	0.004	0.0035	0.00
		5 (L_1)	0.0117	0.0114	0.0126	0.013	0.0125	0.01
		10 (L_2)	0.0017	0.0014	0.0036	0.003	0.0025	0.00
		15 (L_3)	0.0137	0.0134	0.0156	0.015	0.0145	0.01
		20 (L_4)	0.0187	0.0184	0.0206	0.02	0.0195	0.02
	Mean 15 minute		0.01	0.01	0.01	0.01	0.01	0.01
	Mean concentration liquid smoke (L)	0 (L_0)	0.01	0.00	0.00	0.00	0.00	0.00
		5 (L_1)	0.01	0.01	0.01	0.01	0.01	0.01
		10 (L_2)	0.01	0.00	0.00	0.00	0.00	0.00
		15 (L_3)	0.01	0.01	0.02	0.02	0.01	0.01
		20 (L_4)	0.02	0.02	0.02	0.02	0.02	0.02
	Mean long soaking (minute) (K)	5 (K_1)	0.01					
		10(K_2)	0.01					
		15(K_3)	0.01					
	Mean long storage		0.01	0.01	0.01	0.01	0.01	0.01
	Mean packaging kontrol (PP)		0.01					
Packaging PE	5 (K1)	0 (L_0)	0.0194	0.0223	0.0247	0.0242	0.023	0.02
		5 (L_1)	0.0227	0.0256	0.028	0.0275	0.0267	0.03
		10 (L_2)	0.0264	0.0129	0.0153	0.0138	0.014	0.02
		15 (L_3)	0.0137	0.0179	0.0193	0.0192	0.0194	0.02
		20 (L_4)	0.0191	0.0186	0.0203	0.0188	0.019	0.02
	Mean 5 minute		0.02	0.02	0.02	0.02	0.02	0.02
	10 (K2)	0 (L_0)	0.0194	0.0223	0.0247	0.0242	0.023	0.02
		5 (L_1)	0.0227	0.0256	0.028	0.0275	0.0267	0.03
		10 (L_2)	0.0264	0.0129	0.0153	0.0138	0.014	0.02
		15 (L_3)	0.0137	0.0179	0.0193	0.0192	0.0194	0.02
		20 (L_4)	0.0191	0.0186	0.0203	0.0188	0.019	0.02
	Mean 10 minute		0.02	0.02	0.02	0.02	0.02	0.02
	15 (K3)	0 (L_0)	0.0227	0.0222	0.0244	0.0241	0.0229	0.02
		5 (L_1)	0.026	0.0255	0.0277	0.0274	0.0266	0.03
		10 (L_2)	0.0133	0.0128	0.015	0.0147	0.0139	0.01
		15 (L_3)	0.0183	0.0178	0.019	0.0187	0.0193	0.02
		20 (L_4)	0.019	0.0185	0.02	0.02	0.0189	0.02
	Mean 15 minute		0.02	0.02	0.02	0.02	0.02	0.02
	Mean concentration liquid smoke (L)	0 (L_0)	0.0224	0.0221	0.0243	0.0233	0.0228	0.02
		5 (L_1)	0.0117	0.0114	0.0126	0.013	0.0125	0.01
		10 (L_2)	0.013	0.0127	0.0149	0.0143	0.0138	0.01
		15 (L_3)	0.018	0.0177	0.0189	0.0197	0.0192	0.02
		20 (L_4)	0.0187	0.0184	0.0199	0.0193	0.0188	0.02
	Mean long soaking (minute) (K)	5 (K_1)	0.02					
		10(K_2)	0.02					
		15(K_3)	0.02					
	Mean long storage		0.02	0.02	0.02	0.02	0.02	0.02
	Mean packaging		0.02					

kontrol (PE)

CV = 32,85

Description: Figures followed by different letters in the same row or column showed significant differences (P <0.05).

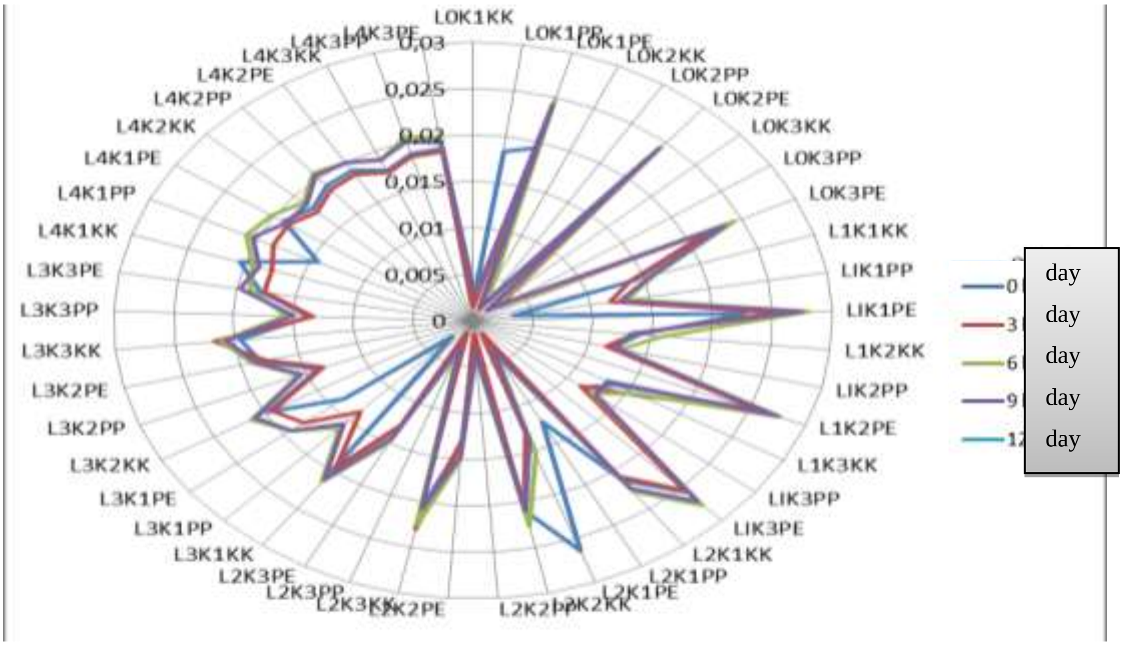

Figure 1. The average value of the levels of phenol (%) of tilapia fillets treatment differences in the concentration of liquid smoke, prolonged submersion, types of packaging and storage time.

Based on Table 1 and Figure 1 above that phenol combination of four treatments, prolonged submersion (K), the concentration difference (L), the type of packaging (KK, PP, PE) and storage (S) shows the results of phenol levels low enough value ranges between 0.00 to 0.0025%. This means that the content of phenols contained in tilapia fillet is quite low. The low content of phenols contained in tilapia fill*et al*legedly due to the small component liquid smoke cinnamon stick. According to the research Mela E. *et al*, [30] stating potential content contained in the liquid smoke is phenol, 2,6 dimethoxy phenol, 2 methoxy phenol, methyl propyl 2 butanoic acid ester, nitro 2 2 methyl butane, 9 -octadecenoic acid (Z) - tetradecyl ester (oleic acidtetradecyl ester) - $C_{32}H_{62}O_2$, 2-lauro 1-3 dodecoin- $C_{35}H_{66}O_6$, 1,2,3-propanetriyl dodecanoid acid esters (glyceryl tridodecanoate) - $C_{39}H_{74}O_6$, octanoid acid 1.2, 3, propanetriyl ester- $C_{27}H_{50}O_6$, alkyl aryl ether, and acetic acid.

Furthermore, the value of the interaction of the average value of phenol (%) fillet of tilapia in the treatment of liquid smoke concentration with different packaging types is presented in Table 2 and Figure 2 below.

Table 2. Average value interactions phenol (%) of tilapia fillets treatment differences in the concentration of liquid smoke to the type of packaging

Packaging (B)	Concentration (L)					Mean L	Interaction L*B
	0 (L0)	5 (L1)	10(L2)	15(L3)	20(L4)		
KK (B1)	0.0023 e	0.0143 d	0.0214 bc	0.0205 bc	0.0186 c	0.015	-0.007
PP (B2)	0.0042 e	0.0117 d	0.0033 e	0.0138 d	0.0193 c	0.010	-0.003
PE (B3)	0.0230 ab	0.0264 a	0.0148 d	0.0184 c	0.0192 c	0.020	0.006
Mean (B)	0.010	0.017	0.013	0.018	0.019	0.015	
Interaction (B*L)	0.001	0.001	0.000	0.000	0.000	0.000	

Description: Figures followed by different letters in the same row or column showed significant differences (P <0.05).

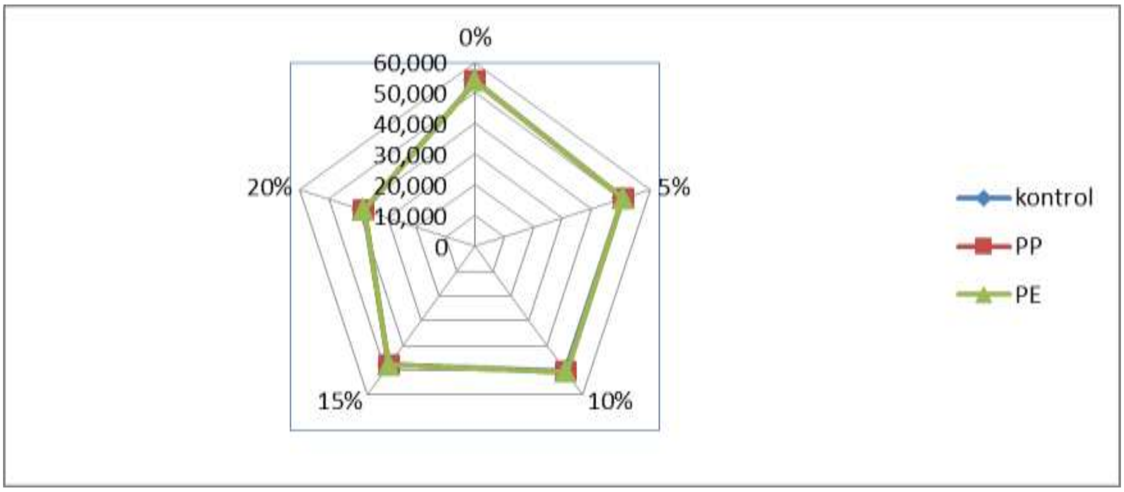

Figure 2. Average value interactions phenol (%) of tilapia fillets treatment differences in the concentration of liquid smoke to the type of packaging

The average yield of phenol levels in Table 1 and Figure 2 shows the interaction between different concentrations of the types of packaging on tilapia fillet phenol and phenol levels range produced ranged from 0.0033% - 0.0264%. These results show that by increasing the concentration of liquid smoke used in different types of packaging, a tendency to produce more fish fillet phenol levels rising. This is presumably because the more the amount of phenol is absorbed by fish meat led to levels of phenols contained in fish getting up. In addition the use of raw material liquid smoke also determine the quality of the used phenol and phenol content in smoked fish fillet comes from liquid smoke solution used at the time of immersion. According Girrad [31], stated that the amount of phenol in the product safe limit evaporation ranging from 0.06 mg / kg to 5000 mg / kg or 0.006 to 0.5%. Judging from the maximum limit of phenol levels in tilapia fillet smoke generated in this study fit for consumption and meets the quality requirements of tilapia fillet smoked. According Sundari [32], phenol has acidic properties, easily oxidized, volatile, sensitive to light, and oxygen as well as an antiseptic. Phenol levels will decline, among others, with the treatment of washing, boiling, and further processing of products ready to be consumed.

Phenols include various compounds derived from plants and have the same features, which has an aromatic ring containing one or two hydroxyl groups. Flavonoids are phenolic biggest, but it also contained some kind of other phenols such as phenol simple monocyclic, phenylpropanoid and phenolic quinones. The aromatic group owned by phenol compound can absorb strongly in the UV light spectrum. Phenol compounds tend to easily dissolve in water because often binds to sugars as glycosides and is usually found in the vacuole cells [33]. Tests using solvent Follin phenol-Ciocalteu and gallic acid used as a comparison [34]. The working principle Follin-Ciocalteu method is the reaction of phenol with Follin-Ciocalteu reagent. This reaction involves the oxidation of phenolic groups (ROH) with a mixture of acid and acid fosfotungstat molybdate reagent, to form quinoid (R = O).

Reduction Follin-Ciocalteu reagent This produces a blue color according to the levels of total phenols react. Furthermore, this color is calculated intensity at a wavelength of 765 nm. Gallic acid used as a standard of measurement due to gallic acid is a polyphenol compound found in almost all plants. Phenol content of these organic acids are pure and stable [35]. The total value of phenol obtained from the measurement and calculation of absorbance values using linear regression equation gallic acid.

From the observations of the average results of phenol levels are quite small almost zero. This is presumably due to the small phenolic compounds left on fillet of tilapia during immersion. In fact, for without soaking the phenolic compounds are also present. The phenol compound is derived from the alleged fillet material itself, and is thought to arise during the drying oven. But no harm to health standards. According Utomo *et al*., [36] states use smoke liquid smoke product is considered safe for health because it does not contain PAH compounds. World Health Organization (WHO) to regulate the content of PAH in foods should not exceed 1 ppb [37].

3.2. Carbonyls Content (%)

In the analysis of variance showed that there was a significant interaction (P <0.05) between the two treatment combined with a concentration difference types of packaging, keep the concentration difference with storage time as well as differences in the packaging with the storage time, while the two other treatment combinations that no interaction. Interaction occurs also for three different concentrations of combined treatment, types of packaging and storage of different treatment combinations while three others and four other treatments no interaction (P> 0.05) on levels of carbonyl. The average value of the number of carbonyl fillet of tilapia at different concentrations of liquid smoke, prolonged submersion, types of packaging and different storage time is presented in Table 3 and Figure 3, below.

Table 3. Observations average levels of carbonyl (%) fillet of tilapia based treatment of different concentrations of liquid smoke, prolonged submersion, types of packaging and storage time.

Type Packaging (B)	Long (K) soaking (minute)	Concentration (L) liquid smoke (%)	Long storage (S) (day)					Mean (L)/(K)
			0 (S_0)	3 (S_1)	6(S_2)	9(S_3)	12(S_4)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Packaging KK (B1)	5 (K1)	0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.000
		5 (L_1)	3,007	3,006	2,998	2,999	3,090	3,020
		10 (L_2)	6,010	6,010	6,213	6,213	6,080	6,105
		15 (L_3)	9,093	9,093	9,043	9,043	9,020	9,058
		20 (L_4)	11,900	11,900	12,013	12,013	11,973	11,960
	Mean 5 minute		6,002	6,002	6,053	6,054	6,033	6,029
	10 (K2)	0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.000
		5 (L_1)	3,007	3,006	2,910	3,090	3,090	3,021
		10 (L_2)	6,010	6,009	6,213	6,080	6,080	6,078
		15 (L_3)	9,093	9,093	9,043	9,020	9,020	9,054
		20 (L_4)	11,900	11,899	12,013	11,973	11,973	11,952
	Mean 10 minute		6,002	6,001	6,036	6,033	6,033	6,021
	15 (K3)	0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.000
		5 (L_1)	3,006	3,000	2,910	3,090	3,089	3,019
		10 (L_2)	6,010	6,213	6,213	6,080	6,079	6,119
		15 (L_3)	9,093	9,043	9,043	9,020	9,019	9,044
		20 (L_4)	11,900	12,013	12,013	11,973	11,973	11,974
	Mean 15 minute		6,002	6,054	6,036	6,033	6,032	6,031
	Mean concentration liquid smoke	0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.000
		5 (L_1)	3,007	3,004	2,939	3,060	3,090	3,020
		10 (L_2)	6,010	6,077	6,213	6,124	6,080	6,101
		15 (L_3)	9,093	9,076	9,043	9,028	9,020	9,052
		20 (L_4)	11,900	11,937	12,013	11,986	11,973	11,962
	Mean long soaking (minute)	5 (K_1)	6,029					
		10(K_2)	6,021					
		15(K_3)	6,031					
	Mean long storage		6,002	6,019	6,042	6,040	6,032	6,027
	Mean packaging kontrol (KK)		6,027					

		0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.000
	5 (K1)	5 (L_1)	3,005	3,004	2,998	2,997	3,088	3,018
		10 (L_2)	6,008	3,004	3,003	2,997	2,996	3,602
		15 (L_3)	3,087	6,007	6,007	6,210	6,210	5,504
		20 (L_4)	6,077	9,090	9,090	9,040	9,040	8,467
	Mean 5 minute		3,635	4,221	4,220	4,249	4,267	4,118
Packaging		0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.000
PP (B2)	10 (K2)	5 (L_1)	6,008	3,003	3,003	2,997	3,087	3,620
		10 (L_2)	6,008	3,003	3,003	2,997	3,087	3,620
		15 (L_3)	3,087	6,007	6,006	6,210	6,077	5,477
		20 (L_4)	6,077	9,090	9,090	9,040	9,017	8,463
	Mean 10 minute		4,236	4,221	4,220	4,249	4,254	4,236
		0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.000
	15 (K3)	5 (L_1)	3,004	2,998	2,998	3,088	3,087	3,035
		10 (L_2)	6,008	3,003	2,997	2,997	3,087	3,618
		15 (L_3)	3,086	6,007	6,210	6,210	6,077	5,518
		20 (L_4)	6,076	9,090	9,040	9,040	9,017	8,453
	Mean 15 minute		3,635	4,220	4,249	4,267	4,254	4,125
	Mean	0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.000
	concentration	5 (L_1)	4,006	3,002	3,000	3,027	3,087	3,224
	liquid smoke	10 (L_2)	6,008	3,003	3,001	2,997	3,057	3,613
		15 (L_3)	3,087	6,007	6,074	6,210	6,121	5,500
		20 (L_4)	6,077	9,090	9,073	9,040	9,025	8,461
	Mean	5 (K_1)	4,118					
	long	10(K_2)	4,236					
	soaking (minute)	15(K_3)	4,125					
	Mean long storage		3,835	4,220	4,230	4,255	4,258	4,160
	Meanl (PP)		4,160					
		0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.000
	5 (K1)	5 (L_1)	9,017	11,897	11,897	12,010	12,010	11,366
		10 (L_2)	11,970	6,008	6,211	6,211	6,078	7,296
		15 (L_3)	9,091	9,091	9,041	9,041	9,018	9,056
		20 (L_4)	11,898	11,897	12,011	12,011	11,971	11,958
	Mean 5 minute		8,395	7,779	7,832	7,855	7,815	7,935
Packaging		0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.000
PE (B3)	10 (K2)	5 (L_1)	9,017	11,897	11,896	12,010	11,970	11,358
		10 (L_2)	11,970	6,007	6,211	6,078	6,078	7,269
		15 (L_3)	3,087	9,091	9,041	9,018	9,018	7,851
		20 (L_4)	11,898	11,897	12,011	11,971	11,971	11,950
	Mean 10 minute		7,194	7,778	7,832	7,815	7,807	7,685
		0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.000
	15 (K3)	5 (L_1)	9,016	11,897	12,010	12,010	11,970	11,381
		10 (L_2)	11,970	6,211	6,211	6,078	6,077	7,309
		15 (L_3)	9,091	9,041	9,041	9,018	9,017	9,042
		20 (L_4)	11,898	12,011	12,011	11,971	11,971	11,972

Mean 15 minute		8,395	7,832	7,855	7,815	7,807	7,941
Mean	0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.000
concentration	5 (L_1)	9,017	11,897	11,934	12,010	11,983	11,368
liquid smoke	10 (L_2)	11,970	6,075	6,211	6,122	6,078	7,291
	15 (L_3)	7,090	9,074	9,041	9,026	9,018	8,650
	20 (L_4)	11,898	11,935	12,011	11,984	11,971	11,960
Mean	5 (K_1)	7,935					
Soaking time	10(K_2)	7,685					
(minute)	15(K_3)	7,941					
Mean long storage		7,995	7,796	7,839	7,828	7,810	7,854
Mean (PE)		7,854					
CV = 5,00							

Description: Figures followed by different letters in the same row or column showed significant differences (P <0.05).

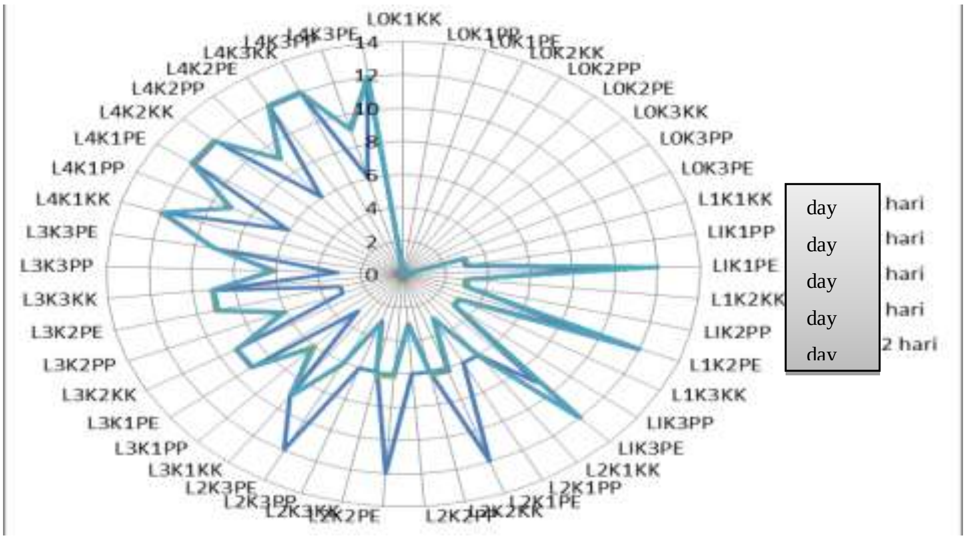

Figure 3. The observation of the average levels of carbonyl (%) fillet of tilapia based treatment of different concentrations of liquid smoke, prolonged submersion, types of packaging and storage time.

Based on Table 3 and Figure 3 shows the levels of carbonyls of a combination of 4 treatments, the concentration difference (L), prolonged submersion (K), the type of packaging (KK, PE, PP) and storage (S) ranged from 0.00 to 12.01 %. The presence of carbonyl content of the fillet of tilapia as a result of the use of liquid smoke. The use of liquid smoke with different concentrations and different soaking time will affect the content of carbonyl on fillet of tilapia. According to the research Lestari YI, *et al*, [38] to get the results of GC-MS analysis of liquid smoke grade 2 oil palm empty fruit bunches are 11 compounds of phenols, carbonyl and acid contained in the liquid smoke TKS grade 2 are compounds phenol, 2 -metilfenol, 4-metilfenol, 2-methoxyphenol, 3,5-dimetilfenol, 3-etilfenol, 2-methoxy-4-metilfenol, 2,6-dimetoksifenol, 2-methyl-2-siklopenten-on-1, 2,3 -dimetil-2-siklopenten-1-on and acetic acid.

Furthermore, the average value of the interaction of carbonyl value (%) fillet of tilapia in the treatment of liquid smoke concentration, types of packaging and different storage time is presented in Table 4 and Figure 4 below.

Table 4. The average interaction levels of carbonyl (%) fillet of tilapia based on differences in the concentration of liquid smoke, types of packaging and storage

Type Packaging (B)	Concentration (L) (%)	Long storage (S) (day) 0 (S_0)	3 (S_1)	6(S_2)	9(S_3)	12(S_4)	Mean L*B	Interaction L*B
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Kontrol (tanpa packaging) (KK) (B1)	0 (L_0)	0.0000 [e]	0.0000 [e]	0.0000 [e]	0.0000 [e]	0.0000 [e]	0.00	0.000
	5 (L_1)	3.0064 [d]	3.0041 [d]	2.9996 [d]	3.0597 [d]	3.0895 [d]	3.03	-0.038
	10 (L_2)	6.0098 [c]	6.0774 [c]	6.2129 [c]	6.1241 [c]	6.0975 [c]	6.10	-0.050
	15 (L_3)	9.0931 [b]	9.0763 [b]	9.0429 [b]	9.0275 [b]	9.0195 [b]	9.05	0.038
	20 (L_4)	11.900 [a]	11.973 [a]	12.013 [a]	11.986 [a]	11.973 [a]	11.97	-0.034
Mean (B1)		6.002	6.026	6.054	6.040	6.036	6.031	-0.114
Interaction (B1*L)		5.977	6.004	6.014	5.988	5.975	5.992	
Packaging PP (B2)	0 (L_0)	0.0000 [e]	0.0000 [e]	0.0000 [e]	0.0000 [e]	0.0000 [e]	0.00	0.000
	5 (L_1)	3.0044 [d]	3.0021 [d]	2.9976 [d]	3.0577 [d]	3.0875 [d]	4.81	1.741
	10 (L_2)	6.0078 [c]	3.0034 [d]	3.0011 [d]	2.9966 [d]	3.0567 [d]	3.61	1.984
	15 (L_3)	3.0865 [d]	6.0068 [c]	6.0744 [c]	6.2099 [c]	6.1211 [c]	5.50	-1.272
	20 (L_4)	6.0765 [c]	9.0901 [b]	9.0733 [b]	9.0399 [b]	9.0245 [b]	8.46	-1.172
Mean (B2)		3.635	5.995	4.229	4.261	4.258	4.477	-0.241
Interaction (B2*L)		2.447	2.458	4.243	4.246	4.217	3.522	
Packaging PE (B3)	0 (L_0)	0.0000 [e]	0.0000 [e]	0.0000 [e]	0.0000 [e]	0.0000 [e]	0.00	0.000
	5 (L_1)	9.0165 [b]	11.897 [a]	11.934 [a]	12.010 [a]	11.983 [a]	11.37	-1.215
	10 (L_2)	11.970 [a]	6.0754 [c]	6.2109 [c]	6.1221 [c]	6.0755 [c]	7.29	2.339
	15 (L_3)	9.0911 [b]	9.0743 [b]	9.0409 [b]	9.0255 [b]	9.0175 [b]	9.05	0.038
	20 (L_4)	11.898 [a]	11.935 [a]	12.011 [a]	11.984 [a]	11.971 [a]	11.96	-0.042
Mean (B3)		8.395	7.796	7.839	7.828	7.809	7.934	-0.127
Interaction (B3*L)		4.774	4.210	4.226	4.197	4.195	4.320	
Mean concentration liquid smoke (L)	0 (L_0)	0.000	0.000	0.000	0.000	0.000	0.00	0.000
	5 (L_1)	5.009	8.933	5.977	6.042	6.053	6.40	0.163
	10 (L_2)	7.996	5.052	5.142	5.081	5.077	5.67	1.161
	15 (L_3)	7.090	8.052	8.053	8.088	8.053	7.87	-0.399
	20 (L_4)	9.958	10.999	11.032	11.003	10.990	10.60	-0.416
Interaction (L)		4.399	4.223	4.428	4.810	4.796		
Mean Long Simpan (S)		6.011	6.606	6.041	6.043	6.034	6.147	
Interaction (B*L*K)		-1.197	-0.885	-0.893	-0.894	-0.887		
CV = 5,00								

Description: Figures followed by different letters in the same row or column showed significant differences (P <0.05).

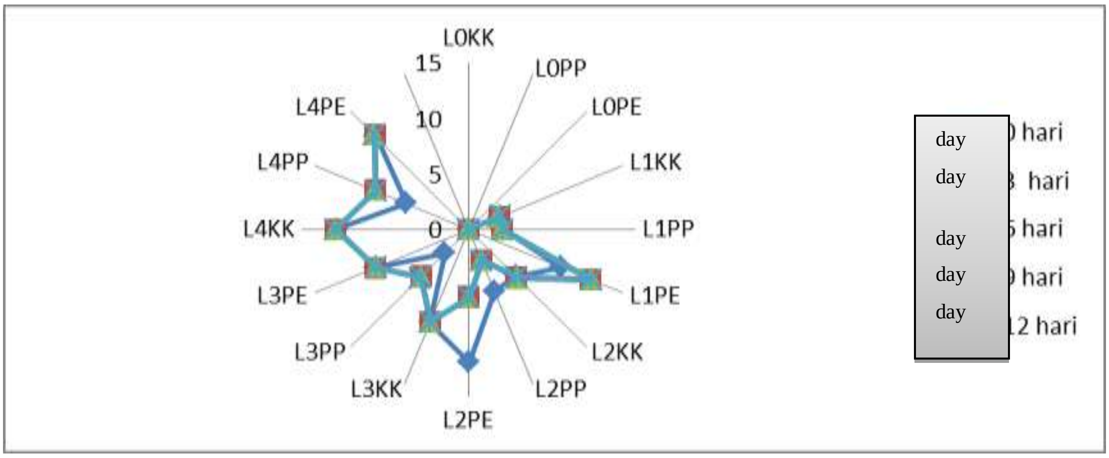

Figure 4. The interaction of the average levels of carbonyl (%) fillet of tilapia based on differences in the concentration of liquid smoke, types of packaging and storage

The average value of the numbers carbonyl fillet of tilapia in Table 4 and Figure 4 are given treatment at the smoke concentration of 20% without packaging and storage for six days giving the highest score (12.012%) and a statistically significant interaction of P <0.05. Results carbonyl smallest number occurred in the treatment without the use of liquid smoke on different packaging types with different storage time is equal to zero. This means that without the provision of liquid smoke on tilapia fillet accompanied by types of packaging and different storage time do not indicate levels of carbonyl on fillet of tilapia because the shredded materials used do not contain liquid smoke. The use of liquid smoke concentrations are higher tendency carbonyl figures showed higher mean on fillet of tilapia last absorbed so that the levels of carbonyl compounds carbonyl becomes high. Sari *et al.*, [39] states that the main component of liquid smoke adalah1,2-benzendikarboksilat acid and diethyl ester. Liquid smoke from teak, lamtorogung, mahogany, camphor, bangkirai, keruing and coconut stems produce acids (as acetic acid) between 4.27 to 11.30%, phenolic compounds (as phenol) from 2.10 to 5.13% and carbonyl compounds (as acetone) 8.56 to 15.23%.

Furthermore, the value of carbonyl (%) fillet of tilapia based treatment of different concentrations of liquid smoke to the type of packaging is presented in Table 5 and Figure 5 below.

Table 5. Value Average interaction levels of carbonyl (%) of tilapia fillets treatment differences in the concentration of liquid smoke to the type of packaging

Packaging	Concentration (L)					Mean	Interaction
(B)	0 (L0)	5 (L1)	10(L2)	15(L3)	20(L4)	L	L*B
KK (B1)	0.0000 J	3.032 i	6.101 f	9.052 c	11.962 a	6.029	-2.361
PP (B2)	0.0000 J	3.030 i	3.613 h	5.410 g	8.461 d	4.103	-0.617
PE (B3)	0.0000 J	11.368 b	7.291 h	9.050 c	11.960 a	7.934	-0.575
Mean (B)	0.000	5.810	5.668	7.837	10.794	6.022	
Interaction (B*L)	0.000	0.505	0.072	0.000	0.000		
CV = 5,00							

Description: Figures followed by different letters in the same row or column showed significant differences (P <0.05).

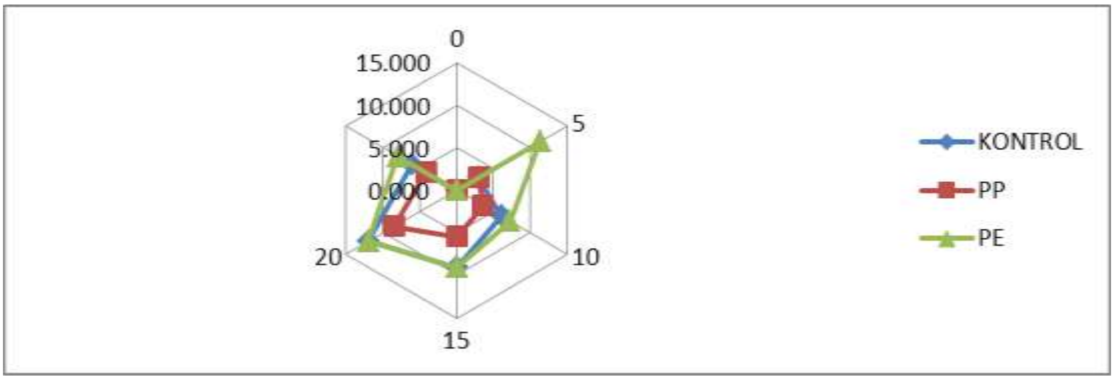

Figure 5. Average value interaction carbonyl content (%) of tilapia fillets treatment differences in the concentration of liquid smoke to the type of packaging

In Table 5 and Figure 5 shows the value of a negative interaction on the treatment difference in concentration by type of packaging to the content of carbonyl fillet of tilapia, while the column shows the value of positive interaction in treatment type of packaging with a concentration of 5 and 10 percent and the value of the interaction of zero on the treatment type of packaging at concentration of 0.15 and 20 percent. Values of positive interaction means both treatment factors together provide a response to the ash content. While the value of a negative interaction means that both factors are not the same response.

Furthermore, the value of carbonyl (%) fillet of tilapia by treatment with different concentrations of liquid smoke storage time is presented in Table 6 and Figure 6 below.

Table 6. The average interaction levels of carbonyl (%) fillet of tilapia treated with different concentrations of liquid smoke storage time

Concentration (K) (%)	0 (S_0)	3 (S_1)	6(S_2)	9(S_3)	12(S_4)	Mean S	Interaction S x K
	Long storage (S) (day)						
0 (L_0)	0.0000 ^{g}	0.0000 ^{g}	0.0000 ^{g}	0.0000 ^{g}	0.0000 ^{g}	0.000	0.000
5 (L_1)	5.0091 ^{f}	5.9676 ^{e}	5.9772 ^{e}	6.0424 ^{e}	6.0535 ^{e}	5.810	-0.159
10 (L_2)	7.9958 ^{c}	5.0521 ^{f}	5.1416 ^{f}	5.0810 ^{f}	5.0712 ^{f}	5.668	0.332
15 (L_3)	7.0902 ^{d}	8.0525 ^{c}	8.0528 ^{c}	8.0876 ^{c}	8.0527 ^{c}	7.867	-0.115
20 (L_4)	9.9580 ^{b}	10.998 ^{a}	11.032 ^{a}	11.004 ^{a}	10.989 ^{a}	10.796	-0.105
Mean (K)	6.011	6.014	6.041	6.043	6.033	6.028	
Interaction (K*S)	-3.826	-4.227	-4.232	-4.227	-4.208	-4.144	
CV = 5,00							

Description: Figures followed by different letters in the same row or column showed significant differences (P <0.05).

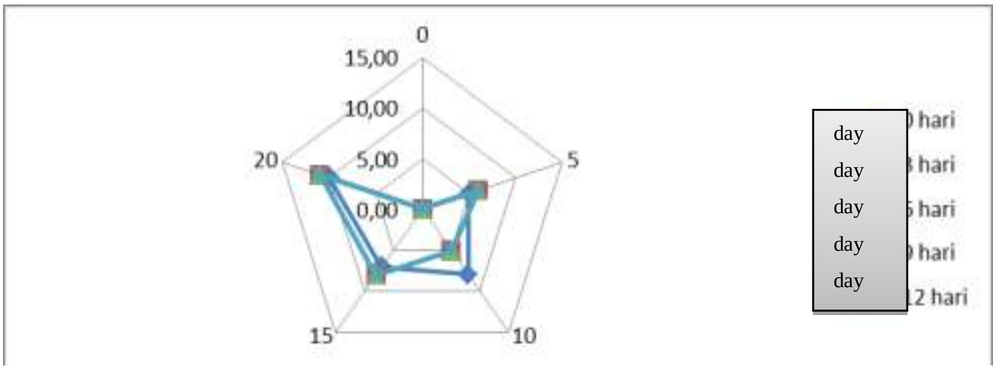

Figure 6. The average interaction levels of carbonyl (%) fillet of tilapia treated with different concentrations of liquid smoke storage time

In Table 6 and Figure 6 shows the value of a negative interaction at treatment concentrations of 5, 15, and 20% with different storage time and the value of positive interaction at concentrations of 0 and 10% on levels of carbonyl fillet of tilapia. Values shown by perlakuam negative interactions with different concentrations of different storage time. Values of positive interaction means both treatment factors together provide a response to the levels of carbonyls. While the value of a negative interaction means that both factors are not the same response.

Furthermore, the value of carbonyl (%) fillet of tilapia by treatment with different concentrations of liquid smoke storage time is presented in Table 7 and Figure 7 below.

Table 7. The value of the average interaction levels of carbonyl (%) in the treatment of different types of packaging with storage time

Type Packaging (B)	0 (S_0)	3 (S_1)	6(S_2)	9(S_3)	12(S_4)	Mean B*S	Interaction B*S
	Long storage (S) (day)						
KK (B1)	6.002 ^{c}	6.019 ^{c}	6.054 ^{c}	6.040 ^{c}	6.032 ^{c}	6.029	-0.021
PP (B2)	3.635 ^{e}	4.221 ^{d}	4.229 ^{d}	4.261 ^{d}	4.258 ^{d}	4.121	-0.077
PE (B3)	8.395 ^{a}	7.796 ^{b}	7.839 ^{b}	7.828 ^{b}	7.810 ^{b}	7.934	0.074
Mean (B)	6.011	6.012	6.041	6.043	6.033	6.028	
Interaction (B*S)	0.145	0.108	0.108	0.108	0.108	0.115	
CV = 5,00							

Description: Figures followed by different letters in the same row or column showed significant differences (P <0.05).

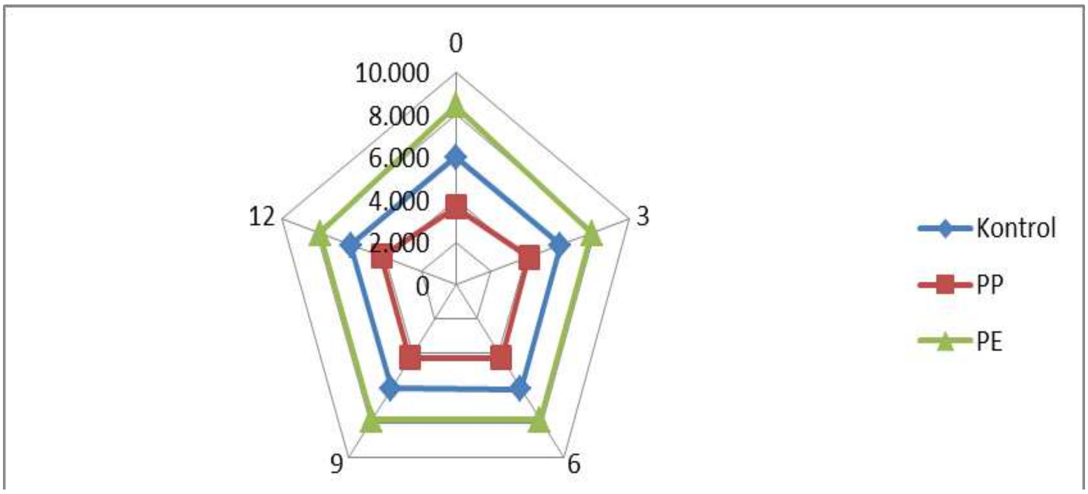

Figure 7. The value of the average interaction levels of carbonyl (%) fillet of tilapia treatment of different types of packaging with storage time

In Table 7 (lines) and Figure 7 shows the value of negative interactions in the treatment of different storage time at no packing and polypropylene (PP) and the value of positive interaction on the type of packaging Polyethylene (PE) to the carbonyl content of tilapia fillets. The next column shows the value of positive interaction of all the different types of treatments packaging with storage time. Values of positive interaction means both treatment factors together provide a response to the levels of carbonyls. While the value of a negative interaction means that both factors are not the same response.

IV. Conclusion.

1. The combination of the two treatments on fillet of tilapia which different concentrations of liquid smoke with different types of packaging showed no interaction on the percentage of phenol content, while for two, three and four combinations of other treatments did not show any significant differences (no interaction).
2. Levels of phenol fillet of tilapia on a combination of four treatments, namely prolonged submersion, different concentrations of liquid smoke, types of packaging and storage time shows the results of phenol levels low enough that a value ranging from .00 to 0.0025% and already meet the quality requirements of fish fillets smoked tilapia
3. Content carbonyl tilapia fillet between the two combination treatments with a concentration difference types of packaging, keep the concentration difference with storage time and packaging differences with storage time showed their interactions, while the two other treatment combinations that no further interaction interaction occurs in three combined treatment difference concentration, types of packaging and storage of different treatment combinations while three others and four other treatments no interaction.
4. Levels of carbonyl tilapia fillet of 4 treatment combinations that different concentrations, dipping time, types of packaging and storage time ranged from 0.00 to 12.01%.

Acknowledgement

We would like to thank Directorate General of High Education, Ministry of Education, in correspond to Implementation Agreement of Competitive Research Grant, National Priority, Rector of Ekasakti University, The Head of LPPM Ekasakti University, The Dean of Agriculture Faculty Ekasakti University, Laboratory team and staff that have provided help in this activity.

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