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IOP Conference Series: Earth and Environmental Science PAPER • OPEN ACCESS Characterization of Edible Film Whey with Addition of Curcuma Extract (Curcuma domestica val.) on Moisture, Water Vapor Absorption, Solubility Time, and Antioxidant Activity To cite this article: I Juliyarsi et al 2020 IOP Conf. Ser.: Earth Environ. Sci. 515 012050 View the article online for updates and enhancements. This content was downloaded from IP address 110.137.103.135 on 29/06/2020 at 13:39 Characterization of Edible Film Whey with Addition of Curcuma Extract (Curcuma domestica val.) on Moisture, Water Vapor Absorption, Solubility Time, and Antioxidant Activity I Juliyarsi1, M Tanifal1, S Melia1, Arief1, A Djamaan1, and E Purwati1 1 Study Program of Animal Science, Division of Technology of Animal Products, Faculty of Animal Science, Andalas University, Padang, West Sumatera, Indonesia. Laboratory Biota, Andalas University, Padang, West Sumatera, Indonesia. Corresponding author's e-mail address: indrijuliyarsi@ansci.unand.ac.id Abstract. Edible film is a thin layer made from edible material as a packaging material or coating for food products. The addition of curcuma extract (Curcuma domestica Val.) is a spice ingredient that is useful as an antioxidant in edible films. This study aims for determine the effect of adding curcuma extract (Curcuma domestica Val.) to moisture, water vapor absorption and solubility time edible film whey. This research is using 1300 ml of whey, 1000 g of curcuma 3% glycerol and 1% Carboxymethyl Cellulose (CMC). The method used is a Randomized Block Design (RBD) method consisting of 4 treatments and 5 replications. The treatment in this study was the addition of curcuma extracts namely A (0%), B (0.2%), C (0.4%) and D (0.6%). The result of the research showed that edible film whey with the addition of curcuma extract had no effect (P>0.05) on moisture, water vapor absorption and solubility time, but has a significant effect (P<0.05) in antioxidant activity. Keywords: Edible Film, Whey, Curcuma Extract, Antioxidant 1. Introduction Lassy Dairy Farm is a dairy farm located in Nagari Lasi, District of Agam. The number of cattle farmed at Lassy Dairy Farm is 50 cows consisting of 30 cows during lactation and 20 tiller cows. Livestock products on the farm are pure milk and mozzarella cheese. Cheese production on the farm is included in the scale of home production. Cheese production is carried out three times a day. Every activity producing cheese requires at least 50 L of cow's milk and produces 5 kg of cheese. Every day Lassy Dairy Farm produces at least 15 kg of mozzarella cheese. In the cheese processing, there is a

process of separation of curd and whey. Curd is used as an ingredient in making cheese and whey is a by-product. For one day of cheese production, Lassy Dairy Farm produces as much as 50 L whey. Utilization of cheese waste (whey) has not been used optimally. Utilization only provides some as animal feed and it is used more as a waste product. The solution of these problems is to make it one of the processed ingredients for whey biodegradable edible film packaging. Along with the development of science and technology, found another alternative of food packaging material called edible film. Edible film is biodegradable that can be degraded by decomposing microorganisms because the constituent materials of edible films are organic materials Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI. Published under licence by IOP Publishing Ltd 1 that are environmentally friendly and are renewable materials. This is the reason that the use of edible film will be an alternative for the use of plastics that are not environmentally friendly. Besides edible film it also provides better product quality, because it is made from natural ingredients and non-toxic so that it can be eaten directly and it may be contaminated with small food. According to [1], whey protein can be used to make film that is transparent, elastic and has no taste that makes it can be used to make edible film. Edible film components can be divided into 3 categories: hydrocolloids, lipids and mixtures thereof. Hydrocolloids such as protein, pectin and starch can be used to control evaporation. Fat is used as a barrier if the evaporation occurs. The processing of whey edible films has been developed by many researchers to improve the quality of the whey edible films. [2] found that the processing of edible films from whey showed the best quality with the addition of 1% carboxymethyl cellulose and glycerol as a plasticizer as much as 3%. The research of [3] also showed that the addition of 4% glycerol was optimal for reducing protein and increasing shelf life, pH and thickness of edible whey films. Furthermore, [2] added lactic acid bacteria isolated from tempoyak in the production of edible film whey. In the manufacture of edible films it can also be added some additional ingredients such as materials tanti-microbial substances, antioxidants and other ingredients. One ingredient that contains antimicrobials and antioxidants is turmeric. In this case, turmeric (Curcuma domestica Val.) is an herb that is useful as an antioxidant and antimicrobial. The benefits of turmeric have been known for thousands of years to be consumed as a cooking spice or traditional medicine such as herbal medicine. Turmeric is useful as an antioxidant and antibacterial that can treat cholesterol disease and cure acute and chronic gastritis, overcome rheumatism and gout, treat diabetes mellitus and prevent colon cancer and prevent as well as treat cataracts and other diseases. Turmeric contains essential oils that can provide antimicrobial and curcumin effects as anti-inflammatory effects, improve the work of digestive organs [4]. 2. Methods Materials 1300 ml whey, 1000 g curcuma, 1300 ml ethanol 96%, 3% glycerol and 1% CMC (carboxy methyl cellulose). The design used was a Randomized Block Design method consisting of 4 treatments and 5 replications factorial x2 with 2 replications. Data were analyzed by ANOVA. 2.1 Curcuma extract preparation Turmeric powder as much as 500 g macerated with 96% ethanol solvent with turmeric powder and ethanol ratio of 1 : 3. The

powder was soaked and meserationed for 3 days. Turmeric and ethanol solution were filtered then concentrated with a rotary evaporator at a temperature of approximately (50 °C) until a thick extract was obtained, after that it was stored in a place that is not exposed to sunlight, in a clean bottle. 2.2 Edible film preparation Whey and etanol 96% 1 : 1 were mixed as much as 65 ml. Heated at 55°C, CMC (Carboxymethyl cellulose) was added as much as 1% of the volume of whey and ethanol. Glycerol was added as much as 3% of the total ingredients and the temperature was maintained at 400 C - 50°C for 30 minutes while stirring. Turmeric extract was added according to treatment. Poured into a glass plate mold measuring 20 cm x 20 cm with a total volume of material 130 ml. Put in the oven temperature 50 ° C for 24 hours, let stand for 18 hours, the film was removed from the mold (peeling). 3. Results and discussions 3.1 Water content test The average of edible film content test with the addition of turmeric extract can be seen in Table 1. Table 1. The Average Edible Film Water Content Test. Treatment Average (%) A 17.87 B 17.02 C 17.69 D 17.75 From table 1 showed the average water content of edible whey films with the addition of turmeric extracts ranging from 17.02% - 17.87%. After statistical analysis showed that the addition of turmeric extract had no significant effect (P> 0.05) on the edible film moisture content test of whey. Statistical test results showed that there was no significant effect between the addition of turmeric extract treatment in whey edible film on its water content. Not significantly different in the water content of edible film whey added turmeric extract due to the addition of turmeric in the form of liquid or paste extract. The water in turmeric extract will evaporate when edible whey film was in oven at 50 °C because because of making turmeric extract using ethanol. According to [5] ethanol has a colorless, volatile and easily soluble characteristics. The water content in this study was greater when compared to research conducted by [6] with edible films made from corn starch had a water content of 13.68% and in research conducted by [7] the water content in edible films of corn starch was 12,57%. However, this study contained lower water content in [8] research with a content of 20.85% which examined the effect of the addition of green betel leaf extract on whey edible films. Based on the Japanese Industrial Standard (JIS), the maximum water content in plastic films for films in the food packaging category is 13% [9]. The water content in this study was around 17.00% - 19.67% meaning that the water content in this study exceeds the maximum standard film for food packaging. The addition of turmeric extract up to 0.6% had no effect to reduce the water content of edible film so that it can meet the maximum standard of water content in edible film. The high water content in a food product will affect the growth of microbes because the free water content in food affects the resistance of food ingredients to microbial attack expressed by Aw that was the amount of free water that can be used by microorganisms for its growth. Water content contained in whey protein was 93.90%. Turmeric extract in the form of paste also had a high water content so that the edible film's water content was high and exceeds the maximum limit of the edible film's water content standard according to the Japanese Industrial Standard (JIS). The main components of turmeric that has medicinal properties are essential oils and yellow dyes (curcuminoids). Turmeric curcuminoids contain 3 components, namely curcumin, desmetoxicurcumin, and bis-desmetoxicurcumin [10]. 3.2 Water vapor absorption The average

absorption test of edible film water vapor with the addition of turmeric extract can be seen in Table 2. Table 2. Average Water Vapor Absorption of Edible Film. Treatment Average (%) A 35.39 B 33.16 C 32.17 D 35.22 From Table 2 above, it can be seen the average absorption of water vapor ranges between 33.16% - 35.29%. After statistical analysis showed that the addition of turmeric extract had no significant effect (P>0.05) on the absorption of edible water vapor from whey. The content of substances in turmeric extract that added was not a substance that can attract water in the air. High curcuminoid content in turmeric extract had a close relationship with antioxidant activity. Turmeric extract added was also limited to 0.6% at most in the treatment, so the effect was not visible. In this study, turmeric extract did not influence the absorption of water vapor because turmeric given did not have a physical effect other than the color of the film. [11] stated that water reliability from edible film is influenced by many factors, depending on its natural limiting components and the structure of the film itself such as homogeneity, emulsion, number of layers and others. It is also influenced by the physicality of the edible film such as shape, size and temperature. The durability of edible film in the absorption of water in the air will affect the quality of edible film. In the Japanese Industrial Standard (JIS), the maximum water content in plastic films for films in the food packaging category is 13% [9]. Water absorption has a relationship with edible film moisture content. [12] states that water absorption is related to the water content of the material, where the higher the water content, the water absorption is decreasing. Water absorption test is conducted to determine the ability of edible film to reabsorb water. 3.3 Solubility time test The average solubility time test of edible film water vapor with the addition of turmeric extract can be seenTable 3. Table 3. Average Solubility Time Test of Edible Film. Treatments Average (seconds) A 136.20 B 135.20 C 134.00 D 135.00 Viewed from the data of Table 3 above, the time required for edible whey film with the addition of water-soluble turmeric extract ranged from 134.00 - 136.20 seconds. Afterwards a statistical analysis of the data showed the addition of turmeric extract to the edible film whey had no significant effect (P> 0.5). Turmeric is practically insoluble in acidic and neutral pH [13]. The solvent used when extracting turmeric was 96% ethanol which is slightly alkaline. The relatively little used of turmeric extract in this study could not affect the dissolution time of whey edible films. Turmeric extract dissolves together with edible film-making ingredients such as glycerol, CMC and whey in which the volume of each ingredient was the same in each treatment. Turmeric is a natural compound that is mainly used for food coloring. The substances are then potential as pharmaceutical excipients. Turmeric has a stabilizing effect on certain photolabile drugs in solution [14]. Besides being used as a raw material for medicine, it is also used as a kitchen ingredient and natural coloring agent. Turmeric has an active compound namely curcumin which has the potential as an antioxidant [15]. The time that is taken for the edible film to dissolve is related to its solubility. The solubility of films is largely determined by the source of the film's base material. Edible film based on starch solubility level is influenced by the binding of starch hydroxy groups. [16] states the starch content in dried turmeric is 47-55%, but because it is added turmeric in the form of a paste extract will result in reduced starch content. [17] stated that the weaker the hydroxyl group of

starch, the higher the solubility of the film. Edible film with high solubility shows the film is easy to consume. From each treatment and this research group, the basic ingredients of making edible whey films (whey, ethanol, CMC and glycerol) had the same volume so that it does not provide a change in the solubility time of edible whey films. The addition of turmeric in each treatment did not give a difference in solubility time. 3.4 Antioxidant Activities The results of statistical analysis showed that the addition of turmeric extract in making edible whey film had a significant effect (P <0.05) on the antioxidant activity test. The average value of anticoxidant activity test with the addition of turmeric extract on edible whey film can be seen in Table 4. Table 4. The Average Activities of Edible Film Antioxidant. Treatment Average (% A 4.90a B 59.00b C 66.00bc D 73.00d Note: Different Superscript in each column that was significantly different (P<0.05) The results from Table 4 showed that the average antioxidant activity of whey edible films with the addition of turmeric extract (Curcuma Domestica Val.) Of 0% to 0.6% ranged between 4.9% - 73%. The highest average antioxidant activity in treatment D with the addition of turmeric extract by 0.6%, and the lowest average in treatment A with no addition of turmeric extract. The results of the analysis of variance showed that the difference in the level of concentration of turmeric extract significantly affected (P <0.05) the antioxidant activity of whey edible films. The higher addition of turmeric extract, resulting in antioxidant levels in whey edible films also increased. This is because turmeric contains curcuminoid compounds that function as antioxidants [18]. The lowest average antioxidant activity was found in treatment A without the addition of turmeric extract, the antioxidant activity contained in treatment A was 4.9%. The low content of antioxidant activity in treatment A compared to treatment B, treatment C, and treatment D was due to the absence of the addition of turmeric extract in making edible whey film. The appearance of antioxidant activity in treatment A with the lowest average was due to the antioxidant activity content of edilbe whey film derived from waste mozzarella cheese (whey). According to Juliyarsi et al (2019) [19] whey has a number of lactose and protein that are still of high value. This is in accordance with the results of [20] that antioxidants in milk come from casein and also from whey, and in milk there are also molecules such as molecules of retinol, coverol and carotenoids which also contained antioxidants. So that treatment A had the lowest average than treatments B, C and D. The highest average antioxidant activity was found in treatment D with the addition of turmeric extract by 0.6%, the antioxidant activity contained in treatment D was 73%. The increase in the content of antioxidant activity in treatment D from treatment A, treatment B, and treatment C was due to the curcuminnoid compound content in turmeric which increased from treatment A, treatment B, and treatment C. According to [21] extraction of components (curcuminoid compounds) in ginger and turmeric with organic solvents is one alternative that can increase antioxidant levels. The increase in antioxidant activity was also influenced by the concentration of turmeric extract which was added also increased in each treatment. The levels of antioxidants produced by turmeric come from curcumin, curcuminn levels in turmeric range between 3-4% [22]. The level of antioxidant activity found in turmeric 92.45% [22]. The increase in the average value of antioxidant activity in edible whey films was caused by the administration of turmeric extract

which also increased in each treatment. 4. Conclusions The addition of turmeric extract (Curcuma domestica Val.) had no effect (P> 0.05) on the test of water content, moisture absorption, solubility time on whey edible films, but had an effect (P <0.05) on antioxidant activity. Acknowledgements The authors would like to thank the Dean of Faculty of Animal Science, Andalas University and Head of Laboratory Animal Products of Technology, Andalas University for funding this study. References [1] Krochta J M, Baldwin E A and M O N Carriedo. 1994. Edible Coatings and Film to Improve Food Quality. Echnomic Publication Company Inc. USA. [2] Juliyarsi I, S Melia and A Sukma. 2011. The Quality of Edible film by Using Glycerol as Plastisizer. Pakistan Journal of Nutrition 10 9 884-887. [3] Melia, S and S. N. Aritonang. 2014. Utilization of Milk Processing by Product (Whey) as Based of Edible Film Making with Glycerol Adding as Plasticizer. Pakistan Journal of Nutrition 13 6 327-330. [4] Winarto W P. 2004. Khasiat dan Manfaat Kunyit. Agromedia Pustaka. Jakarta. [5] Hambali E, Siti M, Armansyah H T, Abdul W P and Roy H. 2008. Teknologi Bioenergi. Agro Media, Jakarta. [6] Amalya R R. 2014. Karakteristik Edible Film dari Pati jagung dengan Penambahan Filtrat Kunyit Putih Sebagai Antibakteri. Jurnal Pangan dan Agroindustri 2 3. [7] Kusumawati D H. 2013. Karakteristik Fisik dan Kimia Edible Film Pati Jagung yang Diinkorporasi dengan Perasan Temu Hitam. Jurnal Pangan dan Agroindustri 1 1. [8] Pratama Y E. 2016. Karakteristik Edible Film Whey dengan Penambahan Ekstrak Daun Sirih Hijau (Piper betle L.) sebagai Antibakteri. Fakultas Peternakan Universitas Andalas, Padang. [9] Saputra C. 2015. An Edible Film Characteristic of Chitosan Made from Shrimp Waste as A Plasticizer. Juornal of Naturan Science Research 5. [10] Rukmana R. 1994. Kunyit. Penerbit Kanisius. Yogyakarta. [11] Morillon V. 2002 Factors affecting the moisture permeability of lipid-based edible films: a review. Critical reviews in food science and nutrition 42 1 67-89. [12] Septia R A. 2016. Pembuatan Tepung Biji Durian (Durio zibethinus, Murr) dan Aplikasinya pada Dakak-Dakak. Fakultas Teknologi Pertanian Universitas Andalas. Padang. [13] Tønnesen H H and Karlsen J. 1985. Studies on curcumin and curcuminoids VI. Kinetics of curcumin degradation in aqueous solution. Z. Lebensm-Unters.-Forsch. 180 402-404. [14] Thoma K. 1983. Verfahren zur Stabilisierung photoinstabiler Arzneistoffe sowie stabilisierte Arzneizubereitungen. Offenlegungsschrift, DE 3136282 A1. [15] Maehara S, Ikeda M, Haraguchi H, Kitamura C, Nagoe T, Ohashi K and Shibuya H. 2011. Microbial conversion of curcumin into colorless hydroderivatives by the endophytic fungus Diaporthe sp. associated with Curcuma longa. Chem Pharm Bull 59 8 1042-1044. [16] Rukmana R. 2004. Temu-temuan, Apotek Hidup di Pekarangan. Penerbit Kanisius. Yogyakarta. [17] Pitak N and Rakshit S K. 2011. Physical and antimicrobial properties of banana flour/chitosan biodegradable and self-sealing films used for preserving Freshcut vegetables. LWT - Food Science and Technology 44 10 2310-2315. [18] Tsai S, Huang S, Chyau C, Tsai C, Weng C and Mau J. 2011. Composition and Antioxidant Properties of Essential Oils from Curcuma Rhizone. Asian J. Arts side 2 57-66. [19] Juliyarsi I, Arief, A Djamaan and E Purwati. 2019. Characteristic based of edible film made from whey with isolated lactic acid bacteria from tempoyak as probiotics packagaging. IOP Conf. Ser. Earth Environ. Sci. 287. 012027. [20] Alenisan M A, H H Alqatta, L S Tolbah and A B Shori. 2017. Antioxidant Properties of Dairy Products Fortified White Natural Additives. Journal of The Association of Arab

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