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Quality Control of Puff Pastry Sheet Production Process at CV. PRS Bali

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A B S T R A C T

Puff pastry is a pastry product made from a mixture of flour, sugar, salt and fat/butter. To produce good quality Puff Pastry, good quality raw materials are needed. Quality control are techniques or operational activities used to meet quality requirements. Quality control of the production process can be considered to be correct if the quality is in accordance with the quality criteria, the performance of equipment, processes and products and if the deviations are identifiable or reportable. Puff pastry sheet production process carried out at CV. PRS includes: the process of preparing materials, weighing materials, mixing materials, cutting and weighing dough according to standard weights, plastic packaging, cooling dough, flattening dough, molding and cutting according to standard sizes, cooling and packaging of products.

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INTRODUCTION

Puff pastry is a pastry product made from a mixture of flour, sugar, salt and fat/butter which is either added to the recipe (in the dough) or added outside the recipe as laminated fat which is used to make layers (layering). The characteristic of Puff pastry products is the formation of volume caused by the evaporation of water in the dough due to the effect of the baking process. Puff pastry is widely marketed in the form of small sheets or often called Puff pastry sheets (Patil and Nikam, 2018). Puff pastry is a pastry that has a dough without yeast. The ingredients used to make puff pastry are the same as those for making bread, but the puff part is made using corsvet butter or folding fat which can produce multiple-fold dough (Subagjo, 2007). The typical way of making the Puff pastry dough is that the fat is added to the base dough through the folding process, in other words, it is a pastry with layers of fat between the layers of dough so that during baking an open network is formed in the layers.

Puff pastry dough is the same as Danish and Croissant dough, because they both use the dough folding technique in processing. This means that the lamination process uses fat / corsvet which is also carried out on Puff Pastry in each layer of dough. However, unlike Danish, Puff Pastry does not use yeast. It is the steam from the liquid mixture of the heating/burning process that causes inflation, to produce a special product called Puff pastry (Gisslen, 2005). The general characteristics of Puff pastry refer to its composition and production method. Puff pastry should be fluffy, have crispy skin, have soft crumb, sweet aroma, yet it is usually less sweet than other bakery products. CV. PRS is a pastry company that has been established since 2000 and is adequately experienced in producing pastry and determining quality control and appropriate marketing strategies to face competitive market competition. the product of CV. PRS is the Grand Paties Puff Pastry Sheet which has been widely marketed in many supermarkets and hotels throughout Bali.

LITERATURE REVIEW

Puff pastry folding technique and method according to Faridah *et al*. (2008) explains that one way to determine a successful pastry product is with proper rolling and folding techniques. The maximum number of folds in Puff pastry is 6 times; the minimum is 3-4 times. There are 4 methods of folding the dough, namely: the English method, in which the corvette forms a layer covering 2/3 of the flattened dough surface, then folds it into three before the milling and folding process. Furthermore, in the French method, corsvet forms a completely flattened layer, followed by a rolling and folding process. In addition, the Dutch method (Dutch Method) involves combinations of corsvet with flour (1/3 of the whole wheat flour dough used as dusting). The last method is the Scottish method (Scotch Method) in which a corsvet in the form of a dice is inserted directly into the dough. This method is also called the quick method or blitz puff dough.There are 2 pastry folding techniques, namely: Single Fold and Double Fold. In the Single Fold technique, the dough should have an equal thickness and be able to wrap around the corsvet layer. The dough to be folded is rolled into four rectangular shapes with the same pressure from the rolling pin. Next is the

Double Fold Technique in which the dough is rolled back into four finger-thick rectangular layers.

METHODOLOGY

Quality Control

Quality control are techniques or operational activities used to meet quality requirements. Quality control includes monitoring a process, corrective action if there is a discrepancy and eliminating the cause of the emergence of unfavorable results at the relevant stages of the quality chain to achieve economic effectiveness (Kadarisman, 2013). Quality control of the production process can be said to be correct if the quality is in accordance with the quality criteria and equipment performance, the production results are stored in a hygienic place before being packaged, the production process information is always recorded, the workplace or production site is maintained in accordance with the maintenance standards, the process and products and their deviations are clearly identified or reported. Production processes and products are managed in accordance with company procedures. The resulting waste is collected and handled or recycled in accordance with the waste management procedures applied in the company as well. Based on the guidelines for Good Food Production Practices, the Home Industry production process must be properly controlled to produce safe products with high quality. This can be carried out in the following ways: a) determination of raw material specifications, b) determination of material composition and formulation, c) determination of production methods for raw materials, d) determination of the type, size and specifications of packaging, e) determination of complete information regarding the products including the product name, production date and expiration date.

Raw Material Preparation

To produce good quality Puff Pastry, the raw materials used must be the ones with good quality as well. If the raw materials used are not good, quality Puff Pastry will not be created regardless of how well the process is carried out. Therefore, the key to producing quality products is to select the right raw materials (Šimurina *et al*., 2015). All materials used in the production process in CV. PRS, both raw materials and additional materials (except water), are obtained from suppliers whose building is opposite the PRS building. Quality control is always carried out before receiving these materials in order to meet the standards that have been set. So that the occurrence of deviations in the quality of the final product can be avoided.

Machines and Equipment used

Machinery and equipment are very important production support tools. Machines and equipment are used as tools to simplify the processing process. There are manual, semi-manual and automatic tools in the manufacture of this product and CV. PRS certainly uses the appropriate equipment according to their necessity. The machines and equipment used are as follows:

Figure 1. Flattening Machine

Figure 2. Blast Freezer Machine

Figure 3. Dough Mixing

Figure 4. Flattening Process Stage 1

1. Mixer/Stirrer serves as the main tool for mixing the ingredients of bread dough. After all the ingredients are mixed, the mixer will produce a perfect and dense bread dough.
2. The dough sheeter (Figure 1) is a machine that is used to flatten the dough to the desired thickness which is then followed by the folding process by hand manually.
3. Blast Freezer is a machine used to freeze Puff pastry sheet dough, both before cutting and after cutting. This machine is usually at a temperature of -18^{o}C to -45^{o}C. The blast freezer machine can be seen in Figure 2.
4. Shrink Machine is a machine that is used to shrink plastic so that it can adjust to the shape of the Puff pastry sheet packaging. Shrink packaging functions as a seal to protect the Puff pastry sheet paper packaging from damage, as a result, the product inside is still safe and tightly sealed.

RESEARCH RESULT

Raw Material of Puff Pastry Sheet

The first raw material is flour. The flour used is a type of hard wheat flour because it is a flour with a high gluten content so it can produce a good quality product. Gluten is a protein contained in flour but is insoluble in water. These characteristics make hard wheat flour very suitable raw materials for various bread making because it is elastic and easy to ferment (Horra *et al*., 2018). Secondly, the other important material is Granulated sugar. In the production of puff pastry sheets, it serves to provide a sweet taste and to extend shelf life because sugar has hygroscopic properties which makes the product more durable, makes the puff texture softer and gives an attractive brown color to the outer shell of the puff pastry due to the caramelization process during the roasting process (Wibowo, 2009).

Next, Salt is another significant ingredient used to give Puff a savory taste. In making puff pastry sheets, salt serves to regulate the formation of carbon dioxide gas (CO_2) and basically salty puff pastry has a longer shelf life (Gisslen, 2013). In Puff pastry sheet processing, the company uses Unsalted butter products. This type of butter melts more easily when placed at room temperature because the texture is very soft, tastes delicious and has milky fragrance. Butter is suitable to be used in making puff pastry because the dough will become stiff and stable during the rolling and folding process (Farida *et al.,* 2008). The amount of water in a dough must match the amount of flour used as the main ingredient, therefore the concentration of water used in the process of making puff pastry sheets in the company is 12 liters each production. If the concentration of water usage exceeds the dose, the dough will become mushy. On the other hand, if too little water is used, the dough will become tough.

Puff Pastry Sheet Processing

Puff pastry sheet production process carried out at CV. PRS includes: the process of preparing materials, weighing materials, mixing materials, cutting and weighing dough according to the standard weights, plastic packaging, cooling the dough, flattening the dough, molding and cutting according to standard sizes, freezing and packaging the products. For more details, the flow chart for making Puff pastry sheet can be seen in Figure 5. All ingredients are weighed according to a recipe that has been determined by the company. The weighing of materials must be done properly so that there are no errors in the use of materials. Although salt, sugar, and butter are ingredients that are needed in small quantities, they are very important to pay attention to so that the resulting Puff Pastry can be of good quality, thus the weighing must be careful. In weighing, the use of spoons or cups as a measuring tool is not recommended to avoid errors in weighing the ingredients. Weighing must be done using analytical balances that have been provided by the company. The recipe for making Puff pastry sheets can be seen in Table 1.

Table 1. Recipe of *Puff Pastry Sheet* production

No	Ingredient	Total	Mass units
1	"*Cakra*" Wheat flour	25	kg
2	Sugar	500	g
3	Salt	500	g
4	Water	12	liter

Mixing Process

The next stage is the process of mixing the ingredients. All ingredients are mixed homogeneously to get a perfect mixture of carbohydrates and proteins. The objective of mixing is to create and develop adhesion to the dough. Mixing should continue until the water is absorbed to form a dough that has been smooth. The resulting Puff pastry dough texture must be appropriate and not too soft. Signs that the dough has kneaded are if it no longer sticks to the bowl nor in your hands and when the dough is stretched, a thin, elastic layer will form (Silow *et al*., 2017).The mixing process depends on the tools used and the mixing speed. The tool used has a capacity of 30 kg for one production process. Mixing time is generally around 8-10 minutes or 10-12 minutes. Over-mixing will cause the dough to heat up, which can damage the gluten composition. The addition of cold water with a temperature of approximately 5^{o}C at the time of mixing aims to reduce the temperature of the hot dough due to the excessive mixing process.

The process of mixing ingredients in making Puff pastry sheets can be seen in Figure 3.

1. Dough Weighing Process
   Furthermore, the process of weighing the dough is carried on with the dough that has been mixed until it is smooth. Before weighing, the Puff pastry sheet dough was cut into pieces weighing 2 kg which were then put into a plastic bag. The weighing process must be done quickly because the fermentation process continues. Weighing the dough must be done using a scale so that the weight of the Puff pastry sheet dough is equally the same.
2. Dough Cooling Process Stage 1
   The Dough Cooling Process is a temporary rest period given so that the Puff pastry sheet dough relaxes. It makes it easier for the dough to be reprocessed at the next stage. The cooling of the Puff pastry sheet dough in the first stage takes place in a blast freezer with a temperature of -30^{o}C to -40^{o}C with a duration of 30-35 minutes. the aim is to ripen the gluten and make the Puff pastry sheet dough frozen. The cooling process must be in accordance with the predetermined length of time.
3. Dough Flattening Process Stage 1
   Stage 1 of dough flattening is a process for flattening Puff pastry sheet dough using a dough sheeter machine. In this stage of flattening, 500 grams of butter is added to the 2 kg Puff pastry sheet dough which is then flattened with a dough sheeter machine. The main purpose of flattening the dough is to form a dough layer with a thickness of 12 cm and to form a thin surface of the dough

skin (film) without tearing. Flattening the dough using a dough sheeter is effective in producing a flat Puff pastry sheet dough so that the desired dough thickness is created. The process of flattening dough in making Puff pastry can be seen in Figure 4.

4. Dough Cooling Process Stage 2
   Puff pastry sheet dough that has been flattened with a dough thickness of 12 cm is then cooled back in the blast freezer at a temperature of -12^{o}C to - 18^{o}C for 90-120 minutes with the aim of ripening the gluten and the frozen Puff pastry sheet dough. If done for too long, this stage 2 cooling process will cause the dough to harden so it is difficult to do the flattening process to make it puff pastry sheets. We recommend that the cooling process should be in accordance with the length of time that has been set.
5. Dough Flattening Process Stage 2
   After the second cooling process, the next process is the second stage of the Puff pastry sheet dough flattening process using a dough sheeter machine. The main purpose of flattening the Puff pastry sheet dough again is to flatten the butter in the previous stage 1 flattening process and to form a layer of Puff pastry sheet dough into a thin sheet with a sheet thickness of 2.5 mm and a sheet width of 34 cm. Flattening the dough with a dough sheeter is proven to be effective for producing flat Puff pastry sheet dough sheets. However, using the dough sheeter machine for too long will cause the pastry sheets to become too thin so they are not as expected. This happened due to operator error when operating the dough sheeter machine.
6. Puff Pastry Sheet Cutting Process
   Furthermore, the Puff pastry sheet is cut into a square with a size of 20 x 20 cm according to the standards set by the company. After cutting, the puff pastry sheet is then followed by freezing the sheet again to facilitate the packaging process that will be carried out next. The sheets were frozen in the blast at a temperature of -12^{o}C to -18^{o}C for 90 – 120 minutes.
7. Packaging, Packing and Storing Process
   The final stage of Puff pastry sheet processing is packaging. Sheets of puff pastry that have been cut are packed in plastic. Each plastic contains one sheet of puff pastry which is then repackaged into one plastic sheet containing 4 sheets of puff pastry. After going through the packaging process into plastic, the puff pastry sheet is then put into a paper pack and the shrinking process is carried out. The shrinking process aims to protect the Puff pastry sheet paper packaging from damage so that the product inside is still safe.

After going through the packaging and packing process, the Puff pastry sheet product is then stored in a cardboard box, in which the cardboard contains 12 packs of Puff pastry which will later be stored in a blast freezer with a temperature of -12^{o}C to -18^{o}C while waiting for the delivery process. The purpose of being stored in the blast is to keep the puff pastry sheet frozen and not damaged when distributed for long distances (Gerrard *et al*., 2000). The process of packaging, packing and storing can be seen in Figure 6.

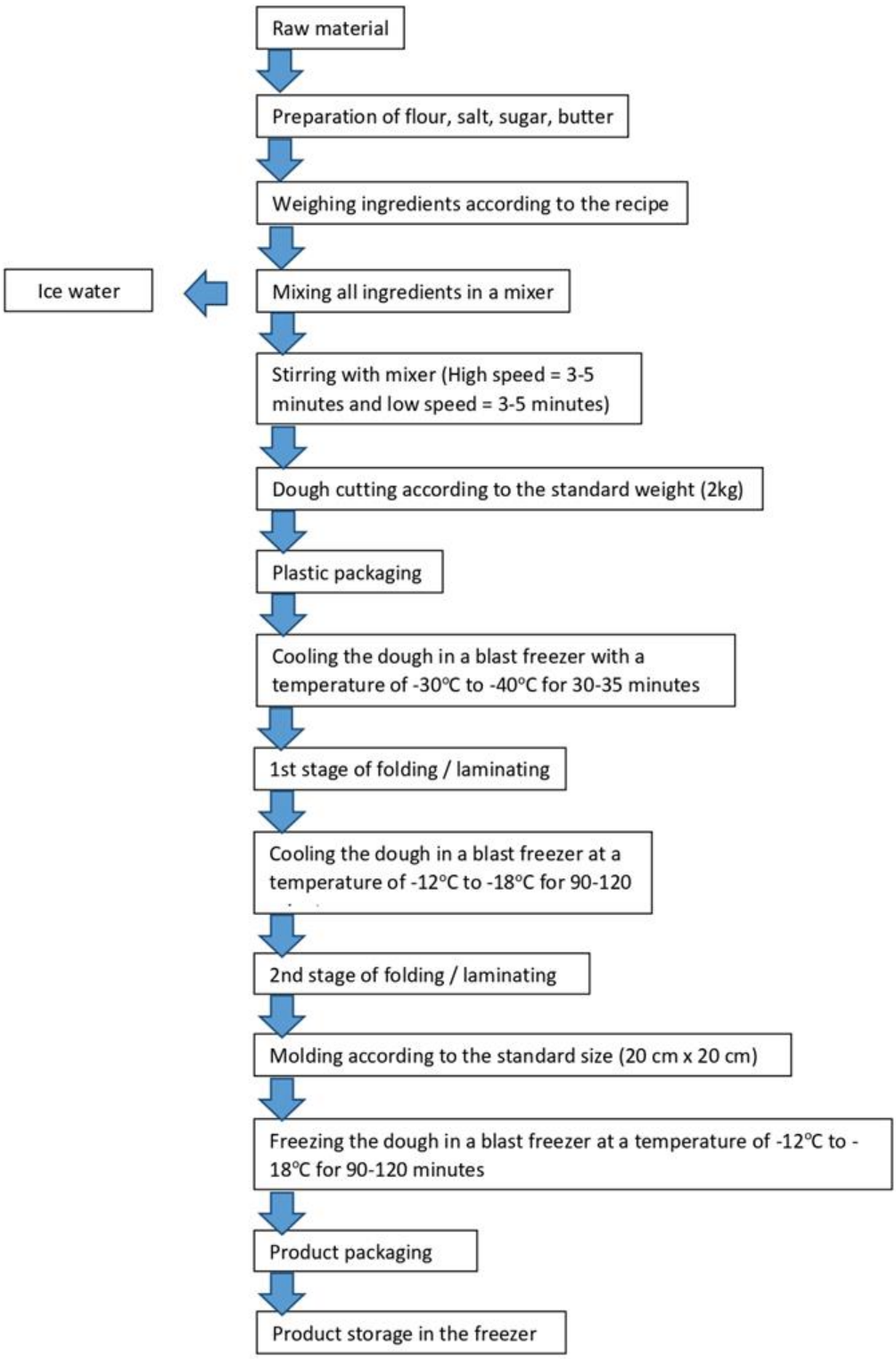

Figure 5. **Puff Pastry Sheet Production Process**

Quality Control

Quality control carried out in CV. PRS includes quality control of raw materials for Puff pastry sheet products, quality control of the Puff pastry sheet production process and quality control of the final Puff pastry sheet product. The following is the explanation of each quality control in the company.

Figure 6. The process of packaging, packing and storage

DISCUSSION

In the Puff pastry sheet production process, the first step is to weigh all the ingredients according to the measurements. Then the flour, sugar, butter and salt are mixed into a mixer which is then stirred evenly. As much as 13 liters of water is poured gradually while stirring with a mixer machine until the dough is smooth. The time needed to mix the dough is approximately 10 – 12 minutes; 3-5 minutes with a low speed and 3-5 minutes with a high speed. Quality control carried out in this mixing process is by paying attention to the duration of stirring. Prolonged stirring process will cause the dough to become hotter, which will damage the gluten composition. The water used in making puff pastry sheets is cold water, because the use of cold water can reduce the temperature of the hot dough due to the mixing process. The dough that has been mixed until smooth is then lifted to the table and then continued with the weighing process. The dough is cut and weighed as much as 2 kg before put in a plastic bag. The next process is the process of cooling the dough stage one. Puff pastry sheet dough is left in the blast freezer at a temperature of -30^{o}C to -40^{o}C for 30-35 minutes. Quality control in the first stage cooling process is carried out by monitoring the cooling time. Cooling time that is too long can cause the dough to harden making it difficult to flatten.

The first stage of the dough flattening process is the process of flattening the Puff pastry sheet dough using a dough sheeter machine. The dough is flattened by adding butter in the process, the goal is to keep the dough from sticking and giving it a buttery aroma when the puffs are baked. The main purpose of this dough flattening is to form a dough layer with a thickness of 12 cm and form a thin dough skin surface without tearing. Quality control in the first-stage laminating process is carried out while maintaining the thickness of the dough. The process of flattening using a dough sheeter for too long will cause the Puff pastry sheet to become too thin.The process is continued by cooling the flattened 12 cm thick Puff pastry sheet dough in a blast freezer at a temperature of -12^{o}C to -18^{o}C for 90-120 minutes. In this second cooling process, the color of the dough becomes increasingly pale. Quality control carried out in this second cooling process is to avoid cooling more than the specified time because it can cause the dough to become hard so that it is difficult to carry out the next flattening process.

After the second stage of cooling is carried out, the next process is the process of flattening the second stage of Puff pastry sheet dough using a dough sheeter machine into thinner sheets. The main purpose of flattening the Puff pastry sheet dough again is to form the dough layer into a thin sheet with a sheet thickness of 2.5 mm and a sheet width of 40 cm. Quality control carried out in the second stage of the flattening process is to maintain the thickness of the dough and the position of the dough when it is flattened so that it is not too thin and torn (Rumjuankiat *et al*., 2016). The next step is cutting the Puff pastry sheet into a square with a size of 20 x 20 cm using a ruler which aims to uniform the shape and size of the Puff pastry sheet. After cutting, the Puff pastry sheet is re-frozen to ease packaging. Quality control carried out at this stage is to pay attention to the condition of the sheet, torn and dirty sheets are not used because it can reduce the quality of the Puff pastry sheet (Horra *et al*., 2015).

The common issue in the process of making Puff pastry sheets usually occurs during the stirring process. if the mixing time is too short then the dough will be too soggy, otherwise if the stirring process is done too long then the dough will be too hard. Therefore, checking the texture of the dough should be done regularly during the mixing process. CV. PRS has met the requirements contained in Good Food Production Methods for Home Industry in controlling the quality of the Puff pastry sheet production process, where the company has determined the specifications of the raw materials to be used, as well as determining the composition and standard formulation of the ingredients in each stage of its production (Wickramarachchi *et al*., 2015).

The Quality Control of The Final Product

The final quality control of Puff pastry sheet products is to pay attention to the physical condition and the packaging of the product. The physical condition is square shaped with a size of 20 x 20 cm, there are no tears on the sheet and no contamination (such as dirt) attached to the product. Whereas, in the packaging section, quality control is seen from the type of packaging used and the final condition of the packaging. Puff pastry sheets go through three packaging processes, the first is packaged using plastic and each plastic contains

one puff sheet. Next, the Puff pastry sheet is repackaged into a plastic bag containing four Puff sheets. After being packaged in plastic, the puff pastry sheet is then put into a paper box. Puff pastry sheet boxes used are equipped with product names, production dates and expiration dates which are very important for consumers. After being packaged in a pack, then the pack is repackaged using plastic without air, this process is called shrinking. The purpose of this process is to avoid damage to the Puff pastry sheet paper packaging. Puff pastry sheets are packaged when frozen, to cope with temperature changes in the product during the distribution process, so that the product does not get wet due to the high temperatures because this potentially could damage the paper packaging and also have an impact on the quality of the Puff pastry sheet.

Puff pastry sheet product expiration date is 6 months at low temperature. Puff pastry sheets are packaged while still frozen to avoid contamination and to make packaging easier. If the Puff Pastry Sheet is packaged unfrozen, its texture will turn to mushy and contain high water content. Consequently, bacteria will grow easily and spread out. Quality control in this packaging process is to maintain the cleanliness of the packaging table either before and after the packaging process. CV. PRS has implemented packaging quality control in accordance with the guidelines for good food production methods for home industries where the packaging used must be in good condition, clean and not torn.

CONCLUSIONS AND RECOMMENDATIONS

Various types of frozen products are produced by CV. PRS, such as croissant, danish, puff pastry, and others; breads (burger buns, hot dog buns, and assorted European buns); premix (easy pancake mix, muffin mix, etc.), pastry (cake, muffin, milk, donut, etc.). CV. PRS has carried out stages of process quality control including: raw material quality control, production process quality control which includes: material weighing process, mixing ingredients, weighing dough, cooling dough stage 1, flattening dough stage 1, cooling dough stage 2, flattening dough stage 2, cutting and forming dough, freezing and packaging processes. The quality control of the Puff pastry sheet production process has complied with the requirements contained in Good Food Production Methods for Home Industries.

ADVANCED RESEARCH

The next research that will be carried out is the manufacture of gluten free pastry for children with special needs (autism).

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