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Chemro Kit: A Solution in Food Chemical Technology

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Abstract*: The combination of chemicals from various additives, flavors, and seasonings in daily food products can have a health impact on society. A mixture of various chemicals combined will have long-term and short-term effects depending on the endurance of a consumer. This process of mixing and combining, if not controlled, will cause consumers exposed to the chemical dangers of food to the health of consumers. This chemical mixing process needs to have the appropriate formulation so that health risks reduced. In line with this urgent need, the application innovation of the use of the right mixed formula introduced.* ***CHEMRO KIT*** *is an informative and pictorial Kit specially created for entrepreneurs and students who want to start becoming a bakery entrepreneur so that the use of chemicals in food used correctly. This innovation brings together several features such as reading materials related to food preservatives, where each type of preservative included complete with pictures and quantities that should be used on a product mix (including formulation calculations) and equipped with a customer-friendly QR Code. With this* ***CHEMRO KIT****, entrepreneurs and students can apply appropriate preservatives and the right amount of formulation for their products without hesitation. They can produce products that are safe for the market.*

Keywords: *Food Chemistry, Preservatives, Food Flavors, Food Flavors, and Food Composition*

I. Introduction

The development of processing technology has contributed to the food preservation industry replacing traditional methods from the ways of our ancestors. Therefore, additives or also known as food chemicals, are used to solve the problem of food production and year-round production of a product (Berg, T., A. Petersen, G.A. Pedersen, J. Petersen & C. Madsen, 2000). These additives are said to be safe to eat if used in small quantities (National Chemistry Department, 2018). These ingredients are not classified as vitamins and minerals (Ministry of Health Malaysia, 2009). According to the Food Regulations 1985, the types of food additives allowed are from the categories of preservatives, dyes, flavorings, flavor enhancers, antioxidants, and food conditioners (Department of National Chemistry, 2018).

The reason for the use of preservatives in the product is that it is fast or can be damaged after a certain period (Sinar, 2010). Spoiled food will change its appearance and taste and need alternatives to prolong its life. It has one or more characteristics: unpleasant odor, unpleasant taste, discoloration, appearance, and fungus (Ministry of Health Malaysia, 2009). As a result, consumers can experience food poisoning as a result of eating spoiled food. This food spoilage occurs due to the reaction of microorganisms between food with bacteria and fungi

(Department of National Chemistry, 2018). Due to this need, the use of chemicals has become a must in many products to meet consumers' needs.

1.1 PROBLEM STATEMENT

Food chemicals are scientific or laboratory or synthetic foods that are added to food to inhibit food decomposition, fermentation or acidification (Kantiani, Lina, Llorca, Marta, Sanchis, Josep, et al. 2010, Ministry of Health Malaysia, 2009). These synthetic substances are not part of nutrition but act as flavor enhancers, retainers, and stabilizers to food products (U.S. Food and Drug Administration, 2007). At the same time, natural preservatives have the nutritional value that can be utilized. In terms of food technology, these food chemicals are intentionally incorporated into or into food in small quantities to affect the storage quality, texture, consistency, appearance, odor, taste, alkalinity or acidity of the food, or indirectly during processing, storage or packaging (U.S. Food and Drug Administration, 2007).

The use of these chemicals reported bringing many problems to consumers (Lau, K.W. McLean, Williams. P, and Howard.C.V, 2006). Chemical abuse and mixing with higher dosage rates often occur due to a lack of social responsibility of producers as well as less clean production practices practiced by producers (Ministry of Health Malaysia, 2009). Often cases of chemical poisoning come out in the media of the time that frightens consumers to buy and use processed foods (Kosmo, 2008). It is because manufacturers still do not understand how to use formulations for these raw materials (Kantiani, Lina, Llorca, Marta, Sanchis, Josep, et al. 2010). It is also seen when manufacturers do not know how to use the appropriate chemicals for their products (U.S. Food and Drug Administration, 2007). The problems faced by these manufacturers also hit new producers and food technology students to apply the right mix of chemicals as well as the exact calculation formulation to produce their new products. It is a severe problem for a product entrepreneur's food. Many entrepreneurs are unaware of the food chemistry chapter, especially about the types of preservatives used in their products.

Moreover, food chemistry knowledge is also less exposed, causing entrepreneurs to use banned preservatives such as boric acid in the production of yellow noodles. (Sinar, 2010)This proves that this lack of exposure and knowledge of chemicals makes them unable to take advantage of safe chemical technology.

ISSUES OF THE USE OF PRESERVATIVE MATERIALS FROM A RELIGIOUS VIEW

Traditional foods derive from natural sources without the addition of other elements is like sugar and salt. The traditional technique used to make food is just mixing dough or raw materials only such as using salt to preserve meat and fish. Therefore, the Muslim community does not doubt the halal status of food.

The issue of doubts about modern food is due to the source of chemical additives as well as the management of food processing by Islamic law or not. For example, L-Cysteine produced through synthetic means from inorganic sources such as petroleum or human hair, duck, or chicken feathers. The use is to reduce the time of mixing wheat dough, stop the pizza crust's shrinkage after thinning and produce flavored meat ingredients such as chicken and beef. The use of human hair in food is illegal. Although L-Cysteine found in many types of food, it is not listed as an ingredient on labels as it is unconsidered a food additive but as an aid in processing (Syed Rasheeduddin, 2001).

THE ISSUE OF ADDED CHEMICALS IN FOOD IN MALAYSIA FROM THE VALUE ASPECT

Sakarin is a sweetener that is about 400 times sweeter than regular sugar has been banned in Malaysia, Germany, Portugal, France, Israel, and Taiwan because it can cause cancer. Therefore, Aspartame has been used to replace Sakarin because the health value of consumers is emphasized in the daily diet. Besides, dyes such as Tartrazine and Carmoisine can cause allergic reactions, such as rashes, swelling, and runny nose. These dyes are

using at a predetermined rate based on safety and commercial value. However, both of these dyes have banned for use in Norway and Australia based on consumer health values (Gonen, 2010).

Therefore, the awareness and some effort should be made to solve this problem by giving the knowledge to students and manufacturers by providing a manual kit to handle misconduct and lack of knowledge on these food chemicals. In recognizing this problem and an urgent need, ***CHEMRO KIT*** is made to solve the issues and challenges faced by students and food product manufacturers. This kit will help them identify the appropriate chemicals and the exact calculation formulation for the quantity used.

Therefore, on the awareness that an effort should be made to help solve this problem so that knowledge can be given to students and manufacturers, then a manual kit should be introduced to curb misconduct and lack of knowledge on these food chemicals. ***CHEMRO KIT*** innovations are made to solve the issues and challenges faced by students and food product manufacturers. This kit will help them identify the appropriate chemicals and the exact calculation formulation for the quantity used.

As a result of the above problem statement, the researcher identifies in more detail some research questions namely;

1. Do *"Kolej Komuniti"* students majoring in Food Processing and Quality Control Certificates and Pastry and Confectionery Certificates know and identify preservatives that can be used in confectionery and pastry products and their formulas?

2. Do the participants of the "Kolej Komuniti" Short Course, especially prospective Bakery entrepreneurs, know the types of preservatives suitable and the appropriate quantity used for a product?

3. Is there any confusion in the use of preservatives approved and not approved by the Ministry of Health Malaysia as stipulated in the Food and Regulations Act, Act 281 through product manufacturers

Based on the questions of this study, an innovation ***CHEMRO KIT*** assistance kit was produced to help these three personnel in improving their products' capabilities in a safer way to eat. The Malaysian Ministry of Health only approves food additives when there is strong evidence that food additives do not harm human health. Ongoing monitoring programs carried out to ensure that food additives comply with the rates allowed under the Food Regulations 1985. All chemicals are halal except those mixed with feces, toxic, intoxicating, and harmful to health (JAKIM, 2011).

II. CHARACTERISTIC OF INNOVATION

CHEMRO KIT

An informative and pictorial kit created especially for entrepreneurs and students who want to start the process of becoming a bakery entrepreneur so that the use of chemicals in food can be used properly.

This innovation brings together some special features such as reading materials related to food preservatives - where each type of preservative is included along with pictures and quantities that should be used on a product mixture (including formulation calculations)

Equipped with customer-friendly QR codes

With this ***CHEMRO KIT***, entrepreneurs and students can apply preservatives that suit their products without hesitation and produce products that are safe for the market.

CHEMRO KIT is a must-have for every entrepreneur (like the book to start a food technology business) because it is: -

i. Small size

ii. Colorful and beautiful

iii. Complete pictures of preservatives that need to be used along with recipes and quantities used according to the Food Act.

iv. Reasonable price

v. User friendly

THE IMPORTANCE OF CHEMICALS IN FOOD

FOOD ADDITIONAL INGREDIENTS	FUNCTIONS	EXAMPLES OF FOOD CHEMICALS	EXAMPLE OF FOOD
Preservatives	Inhibits or slows down the growth of bacteria and fungi	Benzoic acid	Carbonated drinks, sauces, chili paste
		Propionic Acid	Bread, Cake
		Sulfur dioxide	Jam, Fruit juices
		Sodium Nitrite	Meat, Chicken, Fish
Food coloring	Colouring food	Metanil Yellow	Ice Cream, Carbonated drinks
		Caramel	Cake
	Maintains the color of food that lost during food processing	Azo / Trifenil Compounds	Canned Sardine, Canned Red Beans
Flavoring	Adds a delicious taste or smell	Monosodium glutamate (MSG)	Carbonated drinks, Instant Noodles
Antioxidants	Slows down the oxidation of fats	Ascorbic acid	margarine, Jam, Cultured Milk
	Prevents stinky smells of greasy or oily foods	Citric acid	Cooking oil
Sweetener	Gives a sweet taste to replace sugar	Saccharin	Carbonated drinks, ice cream
		Aspartame	Carbonated drinks, ice cream
		Xylitol	Dried fruits
		Sorbitol	Canned foods
Food Stabilizer	Inhibits the process of liquid deposition	Lecithin, Gelatine	Chili sauce, Oyster sauce
	Stabilize and smooth the food texture	Gum arabic	Ice cream
Thickening agent	Thickening the liquid	Gelatine	Soy Sauce, Oyster Sauce
Bleach	Fades or dyes food to look cleaner and purer	Benzoyl peroxide	Wheat flour, Rice vermicelli

Table 1 above shows the importance of food additives and their functions, with the examples of chemicals used in each food.

POSITIVE EFFECTS OF THE USE OF PRESERVATIVES (CHEMICALS) IN FOOD

Various chemical additives used in the food industry that brings benefits to consumers. Among them are: -

i. Food expiration dates extend

ii. Food unspoiled due to the action of microorganisms and

iii. Food oxidation makes food easy to store and market

iv. Preserved foods can maintain the original shape and taste of food over some time.

v. Food waste avoided as excess food can be stored in the refrigerator to be eaten at other times

vi. Adequate food supply because food can be eaten out of season, for example, durian fruit

NEGATIVE EFFECTS OF THE USE OF PRESERVATIVES (CHEMICALS) ON HUMANS

Some food additives found to be over the quantity allowed by the Food Act, which would be harmful to health. **Some preservatives are carcinogenic** and may cause cancer if consumed in large quantities. **Calcium dinatrium EDTA** is one of the preservatives that contribute to gastric disease, kidney damage, and muscle cramps. Excessive use of **dimethyl sulfate** as a **flavoring ingredient** in food will cause severe skin irritation, paralysis, and coma. At the same time, **amyl acetate** can lead to nervous system deterioration, chest pain, headaches, and fatigue.

GOVERNMENT'S ROLE

The Food Act 1983 only allows specific quantities of chemicals to be added to food. The Department of Chemistry Malaysia is continuously conducting research and analysis on foods in the market. The Food Act has also made it mandatory for manufacturers to label processed foods such as the manufacturer's name and address, type of food, food ingredients, food quantity, and expiration date.

The Food Regulations 1985 allow the use of chemical additives in preservatives, flavors, antioxidants, and others for positive samples at the levels specified in the Sixth Schedule, Food Regulations 1985.

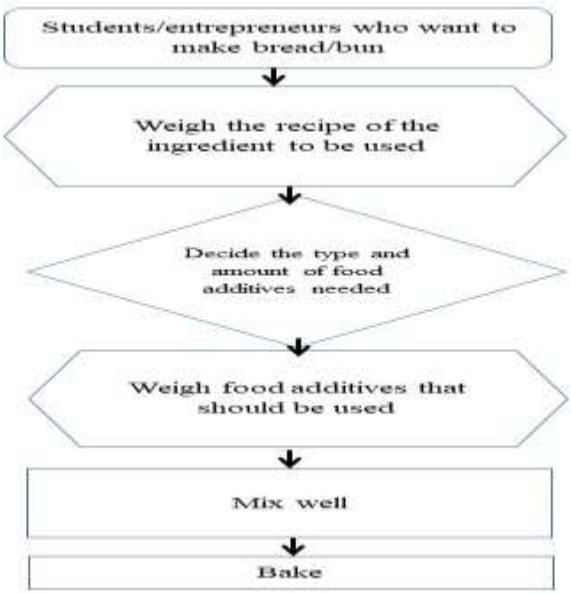
Food additives	The maximum quantity allowed in each kilogram of food
Benzoic acid (Preservatives)	350 mg
Ascorbic acid (Antioxidants)	2000 mg
Sulphur dioxide (Preservatives)	20 mg

Table 2: Some Examples of Food Additives According to the Maximum Quantity Allowed in Each Kilogram of Food

The Malaysian Ministry of Health only approves food additives when there is strong evidence that food additives do not cause harmful effects on human health. Ongoing monitoring programs are also carried out to ensure that the use of food additives complies with the rates allowed under the Food Regulations 1985. All chemicals are halal except those mixed with feces, toxic, intoxicating, and harmful to health (JAKIM, 2011).

2.1 OPERATIONAL FLOW CHART

How to use **CHEMRO KIT** is very simple and customer friendly.



IV. INNOVATION DIAGRAM

It is one of the pages of CHEMRO KIT, where it contains complete information on the type of preservative that is suitable to be used to produce bread that lasts for one week.

BREAD PRODUCTION

Under the Food Regulations 1985, bread is allowed to contain propionic acid, sodium, potassium, or calcium salts in amounts that must not exceed 2000 mg/kg of bread (Regulation 65 (2) a).

What is propionic acid?

Propionic acid is a white or crystalline powder, odorless, or slightly odorless propionic acid, and stable in heat and light. It controls fungi and bacteria in stored grains. In food, it used to preserve baked goods and cheese. Other forms of propionic acid (e.g., calcium and sodium propionates) are also added to foods to prevent fungi in dry baked foods.

CINNAMON BUN RECIPE

500 gm High Protein flour
10 gm castor sugar
5 gm of sugar
10 gm eggs
11 gm dry yeast
15 gm of powdered milk
5 gm improver
5 gm softener
60 gm of vegetable fat
250 gm of ice water
871 gm = mixed product of all ingredients

Calculation
1000 gm = 2% acid / preservative
871 gm X 0.002
= **1.74 gm**

V. IMPACT OF INNOVATION

IMPACT	ADVANTAGES
i. Results	***CHEMRO KIT*** is a much-anticipated kit because it provides many benefits to students and entrepreneurs. It was created to provide students and entrepreneurs knowledge about food chemistry (better known by entrepreneurs as a preservative). In addition to providing knowledge, it helps entrepreneurs to be able to produce products in a delicious, safe, and accordance with the approved Food Act. "Kolej Komuniti" students are also agents who help producers later when they graduate. It is seen as an added value (having skills and knowledge) about food chemistry. ***CHEMRO KIT*** clearly explains each preservative, appearance, and quantity that should be used in the production of a product.
ii. Saves time	With this, ***CHEMRO KIT*** can save time for students and lecturers when conducting practicals. They do not need to open the book of the Food Act 1983 (Act 281) & Regulations, every time they want to conduct a practical. It will also save the time of the instructor/lecturer when ordering raw materials. Also, the manufacturer can determine the rate of use of chemicals accurately without involving the search for information that will take time to develop their study.
iii. Saves costs	***CHEMRO KIT*** can save costs because it is convenient for its users and very cheap. Besides, the information equipped with a QR Code to help users who have a smartphone to read the information on a food chemical.
iv. Increase Productivity	Productivity also increases because the help of food chemicals that use the appropriate dosage will make the product safe and consumers' choice.
v. User-Friendly	***CHEMRO KIT*** is very User friendly because: - For students who have a smartphone, can apply the QR Code and data obtained easily . Furthermore, entrepreneurs who do not have a sophisticated smartphone can read the kit's printed version. The sentences used are also easy to understand, and the calculation methods are also included. For instructors/lecturers, this is innovation helps them and solves the problem because the ***CHEMRO KIT*** students will quickly understand the name, function, amount, or rate of use of a food chemical.

4.1 TOTAL COST AND COST PER UNIT

To produce ***CHEMRO KIT***, does not require a high cost. The production cost per ***CHEMRO KIT*** unit is RM 2.00

VI. SUGGESTED IMPROVEMENT, ORIGINALITY, ADAPTATION OR IMPROVEMENT OF EXISTING IDEAS

This CHEMRO KIT is not yet available in the Malaysian market. It is the first to be developed by researchers after seeing the difficulties and difficulties of entrepreneurs and newcomers in the food business (especially Community College students) who want to start a food-based business, especially bread, bun, and cake. CHEMRO KIT can provide input to them as a basis, but improvements need to be added to other products. Skills in determining the right food chemicals and at the right rate s an asset to individuals who can master these skills.

VII. CONCLUSION

It is the first project on food additives guideline, with a short time and relatively limited information, we are called upon to inspire this product. Through reading, discussion and research are done with different backgrounds between us to spark new ideas to be more able to make changes and innovations that can help many people, especially students and entrepreneurs, consisting of rural communities who are lack with knowledge - especially in the science of food chemistry. At least they can compete with the urban community and foreign entrepreneurs who are more advanced than them.

CHEMRO KIT has inspired us as a Community college instructor to continue to do research on food chemicals that can be used or not in the favorite food products of Malaysians. The Malaysian Ministry of Health advises consumers to read food labels before buying food. For consumers who are allergic to food or additives, consumers should read food labels and identify foods or additives that lead to allergies such as legumes, egg yolks, cow's milk protein, and excessive dyes. As consumers, we have rights to food purchased such as security rights, the right to information, the right to complain, the right to vote, the right to compensation and the right to consumer education.

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