**RESEARCH PROPOSAL: PROBING THE EFFECT OF ACTIVE EDIBLE OIL COATING ON SAFETY, SHELF STABILITY AND QUALITY OF SOFT CHEESE**

1S M Nazmuz Sakib (Orchid- <https://orcid.org/0000-0001-9310-3014>) ([sakibpedia@gmail.com](mailto:sakibpedia@gmail.com))

1 Graduate of BSc in Business Studies

School of Business And Trade

Pilatusstrasse 6003, 6003 Luzern, Switzerland

1 Student of LLB(Hon’s)

Department of Law

Dhaka International University

House # 4, Road # 1, Block - F, Dhaka 1213

**Abstract**

Consumers' demand, perception, and preference for high quality, safe food, and awareness of health hazards of synthetic and chemical preservatives have attracted the food processors, food technologist's and industries to develop innovative techniques with the incorporation of natural components and minimal processing. Developing and utilizing the active edible coatings for shelf stability of the semi-perishable foods is one of these new innovative techniques. That's why the present study is planned to develop active edible coating using clove and peppermint essential oils as active ingredients and whey powder as the base material. Essential oils of peppermint and clove possess the antioxidant and antimicrobial properties. It is supposed that these properties of essential oils may enhance the safety, quality, and shelf stability of the cheese during storage. Soft cheese will be prepared, and these coatings will be applied to it. Then products will be stored at 4 and 25 ℃ for 15 days and will be analyzed every 3rd day for various safety, quality, and shelf stability attributes. All the obtained data will be statically analyzed to check the level of significance of these coatings.

Keywords: Soft cheese, Edible Oil Coating, Food Stability, Food Quality, Food Science, Food Engineering

1. **Introduction**

Nowadays, food processors are confronting problems against using synthetic and chemical preservatives to increase the shelf stability of dairy products due to their health hazards and consumer awareness. Now, consumers preferences, perception, and desire to take high quality and safe food has compelled the food processors and food scientists to develop innovative techniques. Innovative technologies like microfiltration, high-pressure processing, high-intensity ultrasound, and edible coatings are best alternate to combat these challenges. These are green food processing techniques and are principally designed for energy efficiency, simplicity, and economy.

Cheese is a dairy product that is liked and consumed directly or indirectly due to its nutritional benefits and therapeutic significance around the globe (Mallia *et al.,* 2008). Cheese is very popular for its flavor, nutritional, texture value, flavor, and functionality. Soft cheese is biochemically and biologically active due to its high moisture content. Consequently, it undergoes alteration of texture, loss in moisture, functionality, flavor, and safety profile that eventually causes deterioration (Fox *et al.*, 2000).

The major problem of the dairy sector is low storage stability due to the rancidity, microbial activity, and oxidation degradation. Presently these issues are avoided by utilizing chemical or synthetic preservatives. Now, as said earlier, consumers have become more aware and conscious about the selection of diet due to the harmful and toxic effects of artificial preservatives on the health (Mazzocchi *et al.,* 2008). This has attracted the food processors' attention towards the natural antioxidants and antimicrobials agents because of their harmless nature and ability to enhance food stability (Campos *et al.,* 2011).

The reduction of the utilization of conventionally used chemical and synthetic preservatives has now become a challenge for food industries for the production of the safe end product. One of the modern-day tactics to reduce the utilization of these chemical and synthetic preservatives is the utilization of edible coatings and films (Soliva and Martin, 2003). The development of edible coating and their use to combat food safety and quality issues has now become a burning topic. Edible coatings are semi-permeable thin layer covering the food surface. They can be eaten as a part of the product and are biodegradable, non-polluting, and provide an appealing look to the food (Kang *et al.,* 2013).

Different natural ingredients like polysaccharides, proteins, and lipids, and by adding plasticizer and surfactants are used to develop edible coatings. Their efficiency depends on the adherence capacity and application method. Bruising, dipping, and spraying are the commonly used methods to coat the surface of foods. These semi-permeable membranes prevent the gaseous exchange and minimize the loss of moisture from food (Lin and Zhao, 2007).

Nowadays, a new technology, the active edible coating, is used to prolong the quality and enhance the safety of processed as well as fresh food and food products. Active edible coatings are prepared by incorporating the active ingredients (antimicrobials, antioxidants, and phenolic compounds) to the simple edible coating ingredients (Sánchez-González *et al*., 2011). These active ingredients may be natural, like vitamin C, Vitamin E, essential oils, plant extracts, and several other compounds or synthetic. The natural ingredients can be used individually or in combination as a replacer of the synthetic one because of their antimicrobial and antioxidative properties (Perdones *et al.*, 2014). However, the synthetic ones like TBHQ, dodecyl gallate, octyl gallate, P.G., BHA, and BHT, *etc.,* require legal approval as nontoxic to humans for use (Andre *et al*., 2010).

Water, lipids, and casein are the major constituents of the cheese, making it a very complex product. Many uncontrolled factors during processing, handling, and storage results in the quality losses of cheese. Unhygienic conditions and high moisture content make things easy for microbial activity that deteriorate the product. Microbes degrade flavor and structure of the cheese and thus results in the reduction of demand by the consumers and cause substantial economic losses to industries.

Many studies have been conducted to combat this deterioration of the cheese that includes the utilization of synthetic antimicrobial agents like potassium sorbate, sorbic acid, and benzoic acid, *etc.* (Cha and Chinnan, 2004). From the above-given discussion, it can be supposed that active edible coatings can be useful for enhancing microbial safety and maintain the quality of the cheese throughout storage. That's why the present study is designed to develop whey powder-based coatings clove and peppermint essential oil as active ingredients with the following objectives.

* Developing active edible oil coatings by incorporating clove and peppermint essential oil
* Studying the properties of active edible oil coatings
* Preparation and coating of soft cheese with active edible oil coatings
* Assessment of safety, quality and shelf stability of coated cheese

1. **Materials and Methods**
   1. **Procurement of raw material**

Raw buffalo milk, essential oil of clove and peppermint, xanthan gum, glycerol, lecithin, and whey powder will be procured from the local market of Al-Ahsa, Saudi Arabia. Soft cheese will be manufactured by the method of (Mansour and Zaki, 2018). It will be coated with active edible coating prepared according to the treatment plan of table 2.1. After coating, products will be stored 2-5 ℃ for 15 days. Products will be analyzed for various physicochemical, microbial, antioxidant, and sensory character on every third (3rd) day. The following treatment plan will be formulated to achieve the goals.

Table 2.1. Treatment plan for formulation of edible coatings

|  |  |  |
| --- | --- | --- |
| **Treatment** | **Coating** | |
| **Peppermint oil** | **Clove oil** |
| To ­(Control) | - | - |
| T1 | 0.5% | - |
| T2 | 0.75% | - |
| T3 | 1% | - |
| T4 | - | 0.5% |
| T5 | - | 0.75% |
| T6 | - | 1% |

* 1. **Edible coating development for soft cheese**

Edible coating for soft cheese will be developed by the method Yongling *et al.* (2011) with a little modification. 4 g of whey powder will be used as the base material for coating, 2 g of will be used to increase the viscosity and 0.5 g lecithin as an emulsifier. All these things will be taken in a 250 mL beaker, and 8 mL of glycerol will be added to it, and the final volume will be raised to 100 mL by adding the distilled water. The mixture will be homogenized by continuous stirring using a magnetic stirrer to make the coating solution uniform and viscous. Then beaker will be covered with aluminum foil and allowed to cool at room temperature. Afterword, three different concentrations of peppermint and clove oil will be added in the coating solution as an active ingredient as per the treatment plan.

* 1. **Analysis of edible coating**

The edible coating will be analyzed for pH (Ong *et al*., 2007), acidity (AOAC, 2016), viscosity (Gassem and Frank, 1991), and water activity (El-Nimr *et al*. 2010).

* 1. **Analysis of Cheese**
     1. **Physicochemical analysis**

Moisture content, crude fat, crude protein, ash content, and pH will be analyzed by the method of AOAC (2016). Water activity will be determined by following the procedure of El-Nimr *et al*. (2010). The texture of the cheese will be analyzed by texture analyzer according to the method described by Zisu and Shah (2007).

* + 1. **DPPH and Peroxide Value analysis**

DPPH will be analyzed by the method of Ghafoor *et al.* (2010), while peroxide value that is an indication of fat oxidation will be examined by the method of AOAC (2016).

* + 1. **Proteolysis Assessment by RP-HPLC**

The proteolysis assessment of the sample will be assessed by RP-HPLC according to the procedure of Verdini *et al.* (2004).

* + 1. **Microbial Analysis**

Total viable count and *E. coli* will be examined by the method of (Effat *et al.*, 2020) and (Limoges and Donnelly, 2019), respectively.

* 1. **Statistical Analysis**

The data will be statistically analyzed using the Minitab 18.1 software to assess the effectiveness of the different types of edible coatings. The means will be compared using Tukey's multiple range test (Montgomery, 2017).

1. **Study Duration**

The study will take six weeks four weeks for the procurement of material and lab experiments while the remaining two weeks for analyzing the results and writing the report.

1. **Expected Results**

The products coated with the active edible coating will have a better-quality retention than the control. Natural essential oils present in the coating will positively impact the safety and quality of cheese. In this way, the shelf stability of the cheese will be prolonged the shelf stability as the essential oils can restrict the microbial activity and oxidative stability of the cheese. The presented study will be a landmark in increasing shelf life, enhancing safety (total plate count and *E. coli* status), and maintaining quality characteristics (moisture, ash, protein, texture, and fat, *etc.*) of soft cheese.

1. **Conclusion**

Consumers demand safe and healthy food without chemical and synthetic preservatives; that's why it's the dire need of the time to develop innovative techniques. Active edible films can be such a new and efficient technique to extend shelf stability, increase safety, and maintain the quality of soft cheese with attraction for the consumers due to its natural components.

**References:**

Andre, C., I. Castanheira, J.M. Cruz, P. Paseiro and A. Sanches-Silva. 2010. Analytical strategies to evaluate antioxidants in food: A review. Trends Food Sci. Technol. 21:229-246.

AOAC. 2016. Official methods of analysis. The Association of Official Analytical Chemists International. 20th Ed. Arlington, VA, U.S.A.

Campos, C.A., L.N. Gerschenson and S.K. Flores. 2011. Development of edible films and coatings with antimicrobial activity. Food Bioprocess Technol. 4:849-875.

Cha, D.S. and M.S. Chinnan. 2004. Biopolymer-based antimicrobial packaging: A review. Critical Rev. Food Sci. Nutr. 44:223-237.

Effat, B.A., A.M. Mabrouk, Z.I. Sadek, G.A. Hussein and M.N. Magdoub. 2020. Production of novel functional white soft cheese. J. Microbiol. Biotechnol. Food Sci. 9:1259-1278.

El-Nimr, A.A., H.A. Eissa, M.M. El-Abd, A.A. Mehriz, H.M. Abbas and H.M. Bayoumi. 2010. Water activity, color characteristics and sensory properties of Egyptian, Gouda cheese during ripening. J. American Sci. 6:447-453.

Fox, P.F., T.P. Guinee, T.M. Cogan and P.L.H. McSweeney. 2000. Fundamentals of cheese science. Aspen Publishers, Inc. Gaithersburg, M.D., U.S.A.

Gassem, M.A. and J.F. Frank. 1991. Physical properties of yoghurt made from milk treated with proteolytic enzymes. J. Dairy Sci. 74:1503-1511.

Ghafoor, K., J. Park and Y.H. Choi. 2010. Optimization of supercritical carbon dioxide extraction of bioactive compounds from grape peel by using response surface methodology. Innovative Food Sci. Emerging Technol. 11:485-490.

Kang, H., S. Kim, Y. You, M. Lacroix and J. Han. 2013. Inhibitory effect of soy protein coating formulations on walnut (*Juglansregia L*.) kernels against lipid oxidation. Food Sci. Technol. 51:393-396.

Limoges, M. and C. Donnelly. 2019. F.D.A.'s cheese and cheese products compliance program guideline criteria for non-toxigenic *Escherichia coli*: A retrospective analysis of impacts on domestic and imported cheeses. Food Control. 106:106730.

Lin, D. and Y. Zhao. 2007. Innovations in the development and application of edible coatings for fresh and minimally processed fruits and vegetables. Compr. Rev. Food Sci. Food Safety. 6:60-75.

Mallia, S., P. Piccinali, B. Rehberger, R. Badertscher, F. Escher and H. Schlichtherle-Cerny. 2008. Determination of storage stability of butter enriched with unsaturated fatty acids/conjugated linoleic acids (UFA/CLA) using instrumental and sensory methods. Int. Dairy J. 18:983-993.

Mansour, A. and K. Zaki. 2018. Studies on the use of *Lactobacillus rhamnosus* in white soft cheese manufacture. Arch. Agric. Sci. J. 1:82-95.

Mazzocchi, M., A. Lobb, B.W. Traill and A. Cavicchi. 2008. Food scares and trust. A European study. J. Agri. Economics. 59:2-24.

Montgomery, D.C. 2017. Design and analysis of experiments. 11th Ed. John Wiley & Sons. Inc. Hoboken, NJ, U.S.A. 328-380.

Ong, L., A. Henriksson and N.P. Shah. 2007. Chemical analysis and sensory evaluation of Cheddar cheese produced with *Lactobacillus acidophilus, Lactobacillus casei, Lactobacillus paracasei or bifidobacterium* sp. Int. Dairy J. 17:67

Perdones, Á., M. Vargas, L. Atarés and A. Chiralt. 2014. Physical, antioxidant and antimicrobial properties of chitosan–cinnamon leaf oil films as affected by oleic acid. Food Hydrocoll. 36:256-264.

Sánchez-González, L., C. Pastor, M. Vargas, A. Chiralt, C. González-Martínez and M. Cháfer. 2011. Effect of hydroxypropylmethylcellulose and chitosan coatings with and without bergamot essential oil on quality and safety of cold-stored grapes.  Postharvest Biol. Technol. 60:57-63.

Soliva-Fortuny, R.C. and O. Martı́n-Belloso. 2003. New advances in extending the shelf-life of fresh-cut fruits: a review. Trends Food Sci. Technol.14:341-353.

Verdini, R.A., S.E. Zorrillaa, A.C. Rubioloa. 2004. Characterization of soft cheese proteolysis by RP-HPLC analysis of its nitrogenous fractions. Effect of ripening time and sampling zone. Int. Dairy J. 14:445-454.

Yongling, S., L. Liu, H. Shen and J. You. 2011. Effect of sodium alginate based edible coating containing different antioxidants on quality and shelf life of refrigerated bream (*Megalobrama amblycephala*). Food Control. 22:608-615.

Zisu, B. and N.P. Shah. 2007. Textural and functional changes in low-fat Mozzarella cheeses in relation to proteolysis and microstructure as inﬂuenced by the use of fat replacers, pre-acidiﬁcation and EPS starter. Int. Dairy J. 15:957-972.