ABSTRACT

Norabogori is a wild edible species of peach (*Prunus persica*) grow in Assam. The intended purpose of the current study is to explore the physiochemical and therapeutic, especially anti-inflammatory effect of norabogori fruit extract and its application. The research initiates from the extraction optimization of norabogori fruit by a microwave assisted extraction system. The extract was further characterized for its phytochemical contentsand quantify them by liquid chromatography techniques. The norabogori fruit extract was then investigated for their anti-inflammatory and anticancer activity in in-vitro environment. Previously identified phytocompounds are then targeted for their ability of anti-inflammatory marker gene inhibition by in-silico estimations. For efficient target site delivery of the extract, the optimized extract was encapsulated by ionic gelation method. The final aim of the study was to incorporate the encapsulates in a food model. A norabogori fruit leather was developed incorporating the fruit extract encapsulates producing a nutritionally enriched ready to eat food product. The product was further transferred to an industry partner for commercialization.

The organization of thesis is divided into 6 chapters for the consistent presentation of the research work along with the findings.

Chapter 1 comprises the introduction of the overall present research work. It includes the major detail about Norabogori fruit and its nutritional, phytocomponents, phytochemicals and health beneficial properties. It also comprises the detail of phytochemicals possessing health beneficial effects, efficient methods of phytochemical extractions, importance of optimization techniques, and its applications as direct incorporation in food model or incorporation of encapsulated phytochemicals in food models. Research gap, the hypothesis of the study and objectives of the present research works are also stated.

Chapter 2 detailed about the optimization of phytochemical extraction from Norabogori fruit by using novel techniques. For conventional solvent extraction, various solvents (ethanol, acetone, ethanol, hexane and chloroform)were used at a fixed concentration. A response surface methodology (RSM) based on Box-Behnken design (BBD) was utilized to assess the performance of microwave power, solvent concentration, solid-liquid ratio and time on the total phenolic

content of the norabogori extract using Microwave-assisted extraction method. High Resolution Liquid Chromatograph Mass Spectrometer (Hr-LCMS) and reverse-phase high-performance liquid chromatography (RP-HPLC) was used to evaluate the norabogori fruit extract and identify the bioactive compounds.

Chapter 3 highlights the *in vitro* anti-inflammatory activity of the screened compound. Effects of norabogori extract on human cell viability in THP-1 cell line and effects on the pro-inflammatory marker genes were the primary focus of this chapter. A positive effect of norabogori extract observed over anti-inflammatory response in LPS-stimulated cells illustrated quantifiably. The anti-cancer activity of the extract on SK-OV-3 (human ovarian cancer cell line) were also illustrated in the chapter.

Chapter 4includes the evaluation of the potent drug likeness properties for the extracted bioactive compounds from norabogori fruit. The structural characteristics and potential toxicity measures was predicted, and screening was done on the basis of Lipinski rule, Veber's rule, ADME (absorption, distribution, metabolism, excretion) properties and toxicity evaluation.

It will alsopresents the study of the in vitro anti-inflammatory activity of the screened compound. The crystal structures of pro-inflammatory target proteins were retrieved from the Research Collaboratory for Structural Bioinformatics (RCSB) Protein Data Bank and phytochemical compounds (ligands) from PubChem. Docking software like autodock vina results were also included from the molecular docking simulations to visualize the binding mode predictions in specific active sites. Molecular dynamics (MD) simulation of the protein and protein-ligand complexes with the best negative binding energy was also thoroughly detailed in this chapter.

Chapter 5mainly focused in developing a functional food product using norabogori extract. It includes microsphere beads preparation, incorporation in norabogori fruit leather prepared using hydrocolloids. It also presents the color, texture and sensory attributes of the developed fruit leather.

Chapter 6 consists of the conclusion of the study. It includes the specific objectives, salient findings, and future scopes of the present investigations. The microwave assisted extraction depends on the microwave power, solvent concentration and time for maximum yield giving high

phenolic content. The optimized extract showed high amount of some phytochemical compound which exhibit anti-inflammatory activity. The investigation showed that these phytochemicals present in norabogori extract are some potential drug-like compound which can effectively bind with pro-inflammatory markers both in *in-vitro* cell line or *in silico* estimation and thus in turn inhibit their action giving anti-inflammatory effect to the whole extract. Further, the norabogori extract can be encapsulated for these phytochemicals to reach their designated active sites to the inflammatory marker proteins. The encapsulation is a promising approach to save dietary compounds from getting digested by the GI tract enzymes and deliver to the targeted activity site like intestine. A value added product from the norabogori fruit incorporated with the encapsulates turned out to be a nutritionally enhanced food model.