# Chapter 1

# Introduction

## 1.1 Background

Fairy shrimp protein (FSP) is a product from *Branchinecta thailandesis*, is a promising novel protein due to its nutritional value and potential applications in food formulation due to it essential amino acids profile, digestibility and sustainability as an underutilized aquatic organism (Dararat et al., 2012; Awuchi et al., 2019). FSP is classified as myofibril protein that consists of 2 actin and myosin, the foundation of a muscle protein and commonly contributes to its emulsifying and interface-forming abilities (Gao et al., 2018). From these characteristics it can be seen that it has a potential source in the food system for their foam and emulsifying ability. However this protein is still unexplored especially on its functional properties that are crucial as it applies in the food industry. Therefore, incorporating a protein modification could alter the protein structure and lead to enhancing the foaming and emulsification of FSP and supporting the status of innovative food products as it applies in the food industry.

In recent years, protein modification has been used in conventional thermal processing such as boiling, pasteurization, and sterilization. However, these methods led to protein denaturation, aggregation and loss on essential functional groups, which negatively impacted on its solubility and reduced its performance. Thermal treatments also degrade the heat sensitive amino acid and damage protein secondary and tertiary structure, which leads to decreasing the nutritional and functional quality of the protein (Mirmoghtadaie et al., 2016). In contrast, non thermal processing technologies such as High pressure processing (HPP) and Pulsed electric field (PEF) have recently been used as an alternative due to its advantage (Arshad et al., 2020 ; Nor Hasni et al., 2020). Both of these methods can also modify the protein structure without any exposure of heat. This led to

preserving the originality of the food quality, overcoming nutrient loss and consuming less energy (Manzoor et al., 2019).

HPP works by applying pressure that usually ranges between 100-600 MPa for a short time. The pressure can rearrange the protein molecule, which later affects the interaction between water, lipid and other components in food. On the other hand, PEF uses a short burst of high voltage electricity that opens up tiny pores in the cellular membrane and slightly unfolds the protein by changing their charge and structure. Both of these treatments can change the protein secondary structure, especially α-helices, β-sheets, the content of random coils, that affect the functional properties like emulsifying, and foaming properties (Wang et al., 2022; Malik et al., 2024).

These methods have been studied in dairy, plant, and meat proteins, but their effects on FSP are still unknown. By exploring how PEF and HPP could impact the secondary structure and functional properties of FSP, this research could open new possibilities on using it in food applications. The success of this research is that the FSP could contribute to its potential in sustainable and functional food development.

## 1.2 Objectives

This research objective is to evaluate the effect of non-thermal processing methods on High pressure Processing (HPP) and Pulsed Electric Field (PEF) on the functional properties and secondary structure of fairy shrimp *Branchinecta thailandensis*) protein. For HPP, the research will investigate the impact of pressure intensities (200, 400, and 600 MPa) combined with different holding times (10, 15, and 20 minutes). For PEF, the study will assess the influence of combination of different electric field strengths (10 and 15 kV/cm) in combination with different numbers of pulses (3000, 6000, and 9000).

## 1.3 Hypothesis

The hypothesis for this experiment are:

Effect of HPP

$H_0$ : The different combination of pressure intensity and holding time use on HPP will not significantly affect secondary structure and functional properties of fairy shrimp protein

$H_1$ : The different combination of pressure intensity and holding time use on HPP will significantly affect secondary structure and functional properties of fairy shrimp protein

Effect of PEF

$H_0$ : The different combination of electric field strength and pulses use on PEF will not significantly affect secondary structure and functional properties of fairy shrimp protein

$H_1$ : The different combination of electric field strength and pulses use on PEF will significantly affect secondary structure and functional properties of fairy shrimp protein