

# CHAPTER I

## INTRODUCTION

### 1.1 Background of the Study

The global food industry is grappling with a significant challenge: food waste, which not only represents a loss of valuable resources but also contributes to environmental degradation. According to the Food and Agriculture Organization (FAO), approximately one-third of all food produced for human consumption is lost or wasted, amounting to about 1.3 billion tons annually (FAO, 2011). This statistic underscores the scale of the issue, with by-products from food processing—such as vegetable stalks, seafood shells, and mushroom stems forming a substantial portion of this waste. These by-products are often discarded despite their potential nutritional value and usability, exacerbating resource wastage and environmental pollution. For instance, decomposing organic waste in landfills contributes to greenhouse gas emissions, particularly methane, which has a potent warming effect. This study addresses this critical issue by proposing to transform broccoli stalks, shrimp shells, and mushroom stems into a value-added ingredient for furikake, a traditional Japanese seasoning, thereby contributing to both sustainability and human health.

Broccoli (*Brassica oleracea* var. *italica*) is a widely consumed vegetable known for its high nutritional value, particularly in its florets. However, the stalks, which constitute a significant part of the plant, are frequently discarded despite having comparable nutrient content. The United States Department of Agriculture (USDA) nutrient database indicates that broccoli stalks contain similar levels of protein, lipids, carbohydrates, and essential minerals such as calcium, iron, magnesium, phosphorus, potassium, and zinc as the florets (USDA, 2018).

Shrimp is one of the most popular seafood items globally, with production reaching over 9 million tons in 2020, according to the FAO (2022). However, the processing of shrimp generates a substantial amount of waste, primarily in the form

of shells and heads, which can account for 40-50% of the shrimp's total weight (Sachindra et al., 2005). These shells are rich in chitin, a natural polymer that can be converted into chitosan, known for its antimicrobial and antioxidant properties (Younes & Rinaudo, 2015). Additionally, shrimp shells contain proteins and minerals that can be extracted and utilized, adding to their nutritional potential.

Mushrooms, particularly *Agaricus bisporus* (*champignon*), are cultivated extensively worldwide, with global production exceeding 10 million tons annually (FAOSTAT, 2020). During harvesting and processing, the stems are often removed due to their tougher texture, leading to significant waste. These stems, however, are nutritionally valuable, containing high levels of dietary fiber, proteins, and essential amino acids. For example, stems from *Flammulina velutipes* (*enoki*) have been found to contain 170.2 g kg<sup>-1</sup> dry weight of protein, with essential amino acids comprising 40.27% of the total amino acid content, as reported by Guo et al. (2022). Furthermore, mushroom stems are rich in bioactive compounds such as beta-glucans, which have immune-modulating properties, and ergosterol, a precursor to vitamin D2, enhancing their health benefits.

This study explores the potential of transforming broccoli stalk, shrimp shell, and mushroom stem an often-discarded by-product into a value-added ingredient for furikake, a Japanese seasoning. Furikake was selected as the ideal product for several reasons, firstly, its composition as a dry, powdered seasoning allows for the seamless incorporation of dehydrated and ground by-products like broccoli stalks, shrimp shells, and mushroom stems. Research demonstrates the feasibility of such an approach; for instance, Tanaka et al. (2022) successfully developed seasonings from vegetable trimmings and seafood waste, highlighting the potential for these materials to create flavorful and sustainable products. Secondly, furikake's traditional emphasis on umami and nutrient-dense ingredients aligns perfectly with the properties of these by-products. Shrimp shells provide a rich umami flavor (Lee et al., 2019), mushroom stems contribute earthy notes and bioactive compounds like beta-glucans (Johnson et al., 2021), and broccoli stalks

add fiber and essential minerals (Smith et al., 2020). Additionally, the growing global interest in Japanese cuisine and sustainable food products makes furikake an attractive medium for innovation. A study by Garcia et al. (2023) found that consumers are increasingly drawn to upcycled foods that offer both environmental benefits and unique flavors, suggesting a strong market potential for this product. By reimagining furikake with these by-products, this project not only reduces food waste but also delivers a nutritious, flavorful seasoning that meets the rising demand for eco-friendly and health-conscious options, offering benefits for both the environment and public well-being

## **1.2 Objectives of the Study**

The primary objectives of this study are:

1. To develop a furikake seasoning that incorporates dried broccoli stalks, shrimp shells, and mushroom stem as a key ingredient, optimizing the formulation for nutritional content and sensory appeal.
2. To analyze the nutritional content of the furikake, focusing on its fiber, vitamin, mineral, and bioactive compound levels.