Chapter 1

Introduction

1.1 Background

Complex multivitamin formulations require extensive analysis due to their diverse ingredients and potential interactions (Rakuša et al., 2021). Each component's unique properties must be assessed to ensure accurate dosing, effectiveness, and safety. Furthermore, interactions between ingredients can affect absorption and stability, necessitating thorough testing to meet regulatory compliance, including precise labeling and contamination checks. Stability testing is also vital to maintain product quality throughout its shelf life.

Comprehensive testing is necessary to ensure that the product contains the correct active ingredients and the absence of harmful contaminants. The 2022 ethylene glycol contamination incident in Indonesia underscores the importance of rigorous analysis in pharmaceutical production, including multivitamins (Fijri & Firmansyah, 2023). This case demonstrated the severe health risks posed by toxic substances in medications. Advanced techniques such as LC-MS/MS are essential for accurately identifying and quantifying ingredients, reinforcing the necessity of stringent quality control.

The multi-target method in analytical chemistry allows for the simultaneous detection and quantification of multiple vitamins, which is crucial for quality control in multivitamin products (Mornar et al., 2020). However, challenges such as matrix effects can complicate accurate analysis, requiring careful optimization and validation of method. Analytical method development plays a fundamental role in this process, as it is a fundamental aspect of ensuring the reliability of multivitamin formulations. This process involves designing and optimizing methods that can accurately detect and quantify the active ingredients in complex matrices.

Current studies in Indonesia show significant advancements in analytical techniques, including visible spectrophotometry and HPLC, for accurately measuring vitamins in supplements (Sulasmi et al., 2023; Kurniawan et al, 2024). These developments contribute to improved quality assurance and ensure the efficacy of nutritional products in Indonesia.

1.2 Objective

This research aims to develop an analytical method for identifying and quantifying various vitamins, from vitamin B to vitamin C, using liquid chromatography tandem mass spectrometry (LC-MS/MS). The goal is to develop a single method that can analyze water soluble multivitamins simultaneously.

1.3 Hypothesis

The hypothesis of this research is that an analytical method for simultaneous identification and quantification of water soluble vitamins using liquid chromatography tandem mass spectrometry (LC-MS/MS) is developed.