Chapter-2

Problem Statement & Objectives

2. Problem Statement and Objective of Research

2.1. Problem Statement and Research Gap

The auxochrome units play a crucial role in manipulating the light-emitting properties of fluorescent dyes. Even a minor alteration in the auxochrome units can exert a significant impact on the photophysical behaviour of these dyes. Traditionally, hydroxyl and amine auxochromes have been extensively utilized as auxochromes to various classes of fluorophores such as, coumarins, rhodamines, fluoresceins, naphthalimides, nitrobenzoxadiazoles and so many more. However, the past decade has seen the discovery of azacyclic amines, ranging from aziridines and azetidines to spirocyclic as well as azaspiroketal amines as alternative auxochromic units, with improved light-emitting properties as well as physicochemical features, in comparison to their amine and dialkylamine counterparts. However, it is important to highlight that these azacyclic amines lack a point of attachment for a recognition moiety, a vital element in the development of fluorescent probes for biomarker detection. As of now, the attachment of recognition units for various biomarkers still relies on the classical -OH or -NH_2 groups as the auxochrome units. Therefore, the developed fluorescent probes suffer from inferior fluorogenic properties as well as subpar physical and chemical features (figure 2.1). This prompted us to find new auxochromes that would provide all the benefits of the previously discovered advanced amino auxochromes and would also have a centre for further chemical modification into a fluorescent probe.

2.2. Research Objectives

In light of this issue, our goal was to identify new auxochromes that provide several benefits (figure 2.2), including:

- Resistance to TICT, leading to decreased non-radiative energy loss

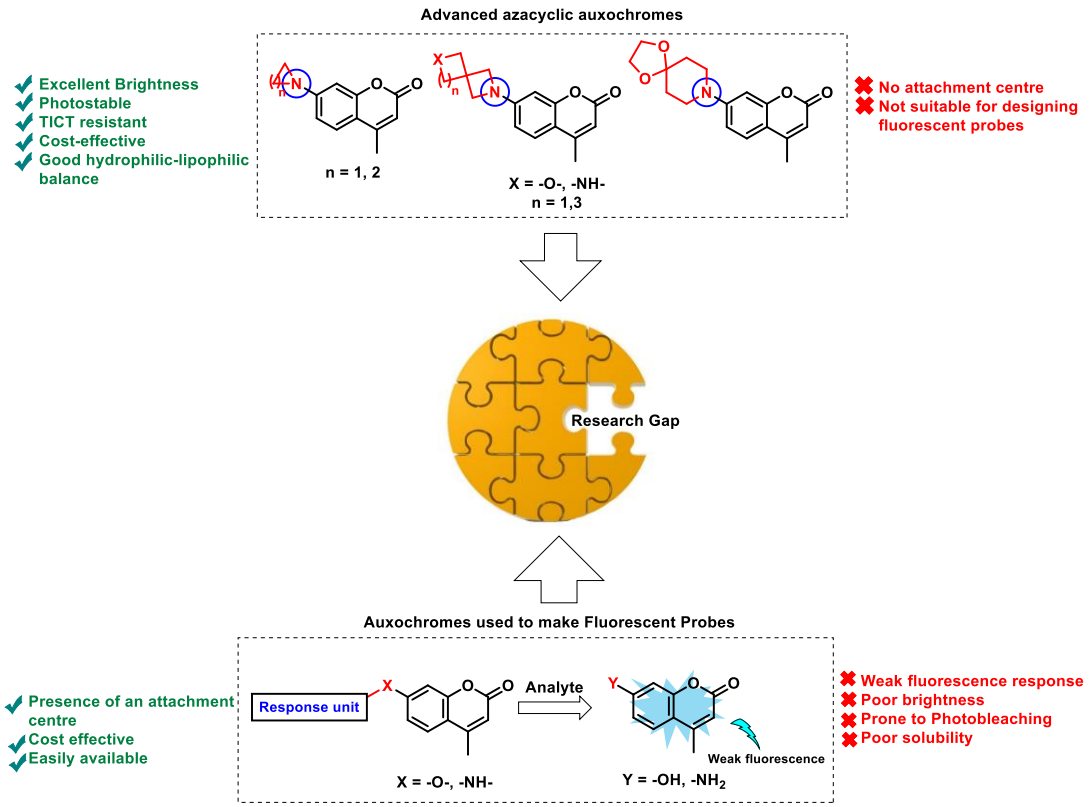

Figure 2.1. An illustration depicting the problem statement and the potential gap in the concerned research field.

- Simplified synthesis process resulting in a higher yield of the resulting dye molecules

- Convenient availability and cost-effectiveness of starting materials

- Enhanced quantum yields

- Improved brightness

- Excellent pH stability over a wide range

- Adequate photostability

- High biocompatibility and cell permeability

- Provision of an attachment site for further synthetic modifications and incorporation of a response unit for biomolecule detection.

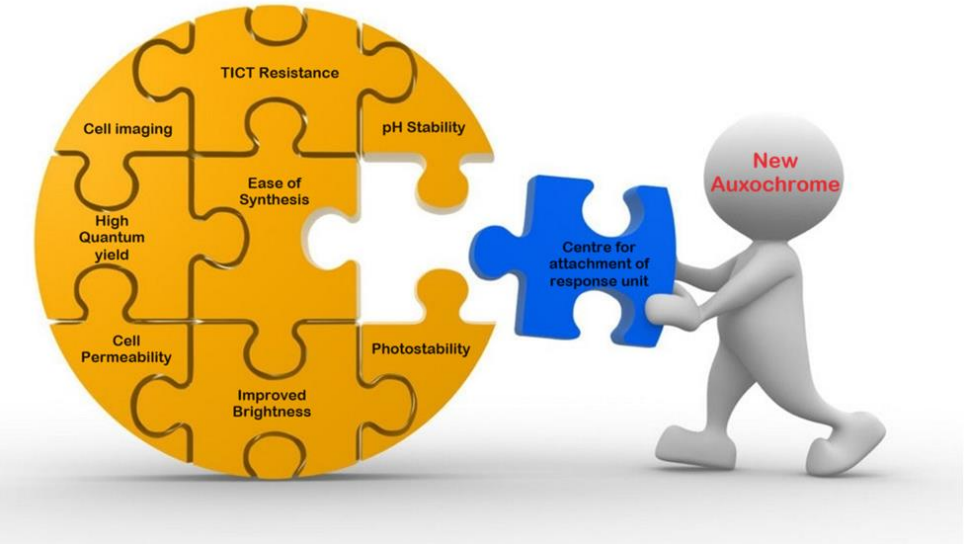

Figure 2.2. Illustration demonstrating the aim and objective of the research.