



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI  
PhD-17 SHORT ABSTRACT OF THESIS

Name of the Student : SHUBHANGINI SINGH VERMA

Roll Number : 206106020

Programme of Study : Ph.D.

Thesis Title: **Peptide-Based Biocompatible Hydrogels for Biomedical Applications**

Name of Thesis Supervisor(s) : Prof. Nitin Chaudhary

Thesis Submitted to the Academic Division : Biosciences and Bioengineering

Date of completion of Thesis Viva-Voce Exam : 02-03-2026

Key words for description of Thesis Work : Native, Peptide, Hydrogel, Injectable, Tau, Ac-PHF6, Ac-PHF6\*, Aliphatic, Aromatic, Electron-Withdrawing, Retropeptide, Bola-amphiphile, Cytocompatible, Drug/Dye-Release

---

**SHORT ABSTRACT**

Hydrogels are soft, water-rich materials with significant potential in biomedical applications, driving interest in the development of biocompatible hydrogelators. Peptides have emerged as promising candidates due to their structural versatility, ease of synthesis, and well-defined self-assembly mechanisms. However, many reported peptide-based hydrogelators rely on non-natural aromatic groups such as Fmoc or naphthalene to promote gelation via  $\pi$ - $\pi$  interactions, raising concerns regarding their biocompatibility. This has led to increasing efforts toward designing hydrogelators composed entirely of natural amino acids. Amyloidogenic peptides, known for their ability to self-assemble into  $\beta$ -sheet-rich fibrillar networks, represent an attractive class of such materials. In this study, the hydrogel-forming ability of Ac-PHF6, a peptide fragment derived from the human tau protein associated with Alzheimer's disease, was systematically investigated. Ac-PHF6 turned out as a promising injectable hydrogelator that forms a viscous solution in water but causes instant gelation of phosphate-buffered saline and cell culture media. A series of aromatic and aliphatic analogs were designed and synthesized to examine the role of specific residues, particularly the aromatic tyrosine residue, in governing self-assembly and gelation. Additionally, the hydrogelation of Ac-PHF6\*, a native peptide similar to Ac-PHF6 lacking aromatic residues, was explored to understand the contribution of aromatic interactions in hydrogel formation. The tyrosine residue was found to be superfluous for Ac-PHF6 self-assembly and hydrogelation. The thesis also investigates the role of terminal charge coupling in Ac-PHF6 and Ac-PHF6\* analogs harboring a lysine residue at the N-terminus.