

Synthesis and photophysical properties of aromatic L-amino acids functionalized tricyanofuran (TCF) derivatives

Gayatri Jagdale^a, Dnyaneshwar D Ugale^{a,b}, Sudhir D Jagadale^a, Dinesh N Nadimetla^c, Avinash L Puyad^d, Shailaja B Jadhav^e, Sheshanath V Bhosale^f & Sidhanath V Bhosale^{*a,b}

^a Polymers and Functional Materials Division, CSIR-Indian Institute of Chemical Technology, Tarnaka, Hyderabad 500 007, Telangana, India

^b Academy of Scientific and Innovative Research (AcSIR), CSIR-HRDC Campus, Postal Staff College Area, Sector 19, Kamla Nehru Nagar, Ghaziabad 201 002, Uttar Pradesh, India

^c Department of Catalysis and Fine Chemicals, CSIR-Indian Institute of Chemical Technology, Tarnaka, Hyderabad 500 007, Telangana, India

^d School of Chemical Sciences, Swami Ramanand Teerth Marathwada University, Nanded 431 606, Maharashtra, India

^e Department of Pharmaceutical Chemistry, P. E. S. Modern College of Pharmacy, Nigadi, Pune 411 044, Maharashtra, India

^f Department of Chemistry, School of Chemical Sciences, Central University of Karnataka, Kadanaganchi, Kalaburagi 585 367, Karnataka, India

E-mail: bhosale iict@csir.res.in

Received 6 February 2026; accepted (revised) 2 April 2026

Fluorescent labelling using chemical dyes is extensively used in biological and medicinal research. The amino acid incorporated chromophores with significant fluorescence properties are commonly used as fluorescent imaging agents allowing to tap a wide range of biological and biophysical processes. The dyes with large size can disrupt protein folding and function. Therefore, the development of new fluorophores remains a challenging task for the design of new fluorescent probes. To achieve the desired applications, small fluorescent chromophores are required. Herein, inspired by the earlier reports on fluorescent fluorophore, a new class of small organic chromophores is reported, containing (*E*)-2-(4-(4-aminostyryl)-3-cyano-5,5-dimethylfuran-2(5*H*)-ylidene) malononitrile (TCF-1) that can be conjugated with the natural aromatic amino acids *i.e.* L-phenylalanine, L-tryptophan and L-tyrosine. In this connection, a series of six TCF-1 fluorescently labeled aromatic amino acids have been designed and synthesized. At first, the theoretical calculations have been performed to establish the frontier molecular orbitals and energy band gap. Further, the synthesized aromatic amino acid functionalized TCF-1 have been evaluated with respect to their spectroscopic properties using UV-Vis absorption and fluorescence spectroscopic techniques. The promising photophysical properties of Boc protected derivatives Boc-L-Phe-TCF-1, Boc-L-Tyr-TCF-1 and Boc-L-Trp-TCF-1 have been observed in different solvents. Moreover, the Boc deprotected derivatives L-Phe-TCF-1, L-Tyr-TCF-1 and L-Trp-TCF-1 show different photophysical properties at various pH ranging from 3 to 11.

Keywords: Fluorescent fluorophore, Amino acids, TCF, UV-Vis, Photophysical properties