CARBONIC ANHYDRASE 9-TARGETED COMPOUND-LOADED NANOFIBER FOR EVALUATING ANTI-CANCER POTENTIAL ON PROSTATE CANCER CELL LINE

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Carbonic anhydrase 9(CA9) assumes a pivotal role in cancer therapy, emerging as a target due to its upregulation in response to tumor hypoxia, fostering cancer progression and resistance. This study delves into the realm of CA9 inhibition, exploring nitro compounds as potential inhibitors. Utilizing molecular docking, Lead-D3 and five lead molecules (D1, D2, D4 -D6) were identified, with Lead-D3 exhibiting a promising binding score of -8.295 Kcal/mol. Recognizing the significance of nanofibers in drug delivery, we encapsulated Lead-D3 in cellulose acetate (CA) and poly (ethylene oxide) (PEO) nanofibers (Lead-D3@CA/PEO). Characterization confirmed Lead-D3 incorporation, and in-vitro validation through MTT assay demonstrated heightened cytotoxicity against PC3 cancer cells while sparing HEK293 normal cells, showcasing selective targeting. Additionally, DNA fragment assay and gene expression studies revealed the apoptotic potential of Lead-D3@CA/PEO, as evidenced by apoptotic bodies and downregulation of downstream target genes under hypoxic conditions induced by $CoCl_2$. This multifaceted approach, integrating molecular docking and nanofiber synthesis, emphasizes the synergistic impact of selecting lead compounds via computational studies and delivering them through advanced drug delivery systems. In conclusion, our findings underscore the potential of Lead-D3-loaded nanofibers (Lead-D3@CA/PEO) as an effective strategy in cancer therapy, demonstrating selective targeting, sustained release, and apoptotic induction. This comprehensive approach bridges computational and experimental domains, paving the way for advanced personalized cancer treatments.