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(71)**Name of Applicant :**
1)Dr. Harpreet Singh
Address of Applicant :Professor, School of Pharmaceutical Sciences, Faculty of Pharmacy, IFTM University, Moradabad - 244102, Uttar Pradesh, India Uttar Pradesh India
2)Dr. Nirmala Sisodia
3)Dr. Preeti Chaudhary
4)Dr. Pratik N Chauhan
5)Debadatta Sahoo
6)Dr. Hemlata Bhatt
7)Dr. Ashish Kumar
8)Prof. Prashant Singh
9)Dr.Abhishek Pathak
10)Dr. Kuna Ramu
11)Prof. Kavi Shanker Varshney
(72)**Name of Inventor :**
1)Dr. Harpreet Singh
2)Dr. Nirmala Sisodia
3)Dr. Preeti Chaudhary
4)Dr. Pratik N Chauhan
5)Debadatta Sahoo
6)Dr. Hemlata Bhatt
7)Dr. Ashish Kumar
8)Prof. Prashant Singh
9)Dr.Abhishek Pathak
10)Dr. Kuna Ramu
11)Prof. Kavi Shanker Varshney

(57) Abstract :
The present invention relates to a nanocarrier-based chemical composition for targeted therapeutic molecule delivery, comprising a biodegradable poly(lactic-co-glycolic acid) (PLGA) polymeric core matrix encapsulating doxorubicin hydrochloride at 5-20% w/w with an encapsulation efficiency of not less than 75%. The nanocarrier surface is functionalized with folate-conjugated polyethylene glycol (PEG-folate, MW 2,000-5,000 Da) and anti-HER2 monoclonal antibody fragments to enable dual-ligand active targeting of folate receptor and HER2-overexpressing cancer cells via receptor-mediated endocytosis. The composition exhibits a hydrodynamic diameter of 80-250 nm, a zeta potential of -20 to -30 mV, and pH-responsive drug release releasing less than 15% at pH 7.4 and more than 80% at pH 5.0 within 72 hours. An optional theranostic variant incorporates Fe_3O_4 magnetic nanocrystals at 10-30% w/w enabling simultaneous MRI-guided drug delivery with r2 of not less than 150 $mM^{-1}s^{-1}$. The composition achieves 5.6-fold enhanced cytotoxicity in MCF-7 breast cancer cells compared to non-targeted nanoparticles, demonstrating significant therapeutic advancement for precision oncology applications.

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