A novel pH sensitive Gum ghatti-*cl-poly*(Acrylic acid) Composite Hydrogel based on Graphene Oxide for Metformin Hydrochloride and Sodium Diclofenac Combined Drug Delivery Systems

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Supplementary Information

Table S1 Comparison of various drug delivery systems involving different hydrogels with their mechanism of release at different pH.

Sr. No.	Hydrogels	Polymerization technique	pH of release	Model Drugs	Kinetic model/mechanism	Ref.
1.	Gum ghatti-co-poly(acrylic acid-aniline) (Gg-co-poly(AA-ANI)	Graft copolymerization	9.2	Amoxicillin trihydrate	Non-Fickian	[1]
2.	Gum tragacanth and acrylic acid [Gt-cl-poly(AA)]	graft copolymerization	9.2	Pantoprazole sodium	Case II diffusion mechanism	[2]
3.	Gum ghatti-g-poly(acrylic acid-aniline) [Gg-g-poly(AA-IPN-ANI)]	Free radical polymerization	9.2	Amoxicillin trihydrate and Paracetamol	Fickian type	[3]
4.	Gum tragacanth, poly(acrylic acid) (PAA), and poly(acrylamide) (PAAm),		9.2	Losartan potassium	Non-fickian	[4]
5.	Chitosan graft Acrylamide microsphere (CS-g-AAm)	Free radical polymerization	6.8	Nitrendipine	Quasi-diffusion	[5]
6.	Chit-g-polymer (NIPAAM-co-AA) and Chit-g-polymer (NIPAAM-co-AN)	Graft copolymerization	9.4	Diclofenac sodium	non-Fickian diffusion	[6]
7.	(pNIPAAm–chitosan–PVA)	Freezing and thawing followed by gamma irradiation at a total dose of 20 kGy	9	Metformin HCl	-	[7]
8.	Montmorillonite clay	-	7.4	Diclofenac sodium	Anomalous diffusion or non-Fickian diffusion	[8]
9.	Poly(methyl methacrylate)-grafted-ghatti gum (GG-g-PMMA)	Free radical polymerization	6.8	Metformin HCl	Fickian diffusion and/or polymeric matrix erosion	[9]

10.	NIPA:AAc	Free radical polymerization	6.8	Ofloxacin	non-Fickian transport	[10]
11.	GGI-g-PAM-cl-MBA	microwave	7.4	5-Fluorouracil	Non-Fickian irregular diffusion	[11]
12.	Gum tragacanth–acrylic Acid (Gt-cl-poly(AA)	surface methodology approach	9.2	Cetirizine dihydrochloride	non-Fickian	[12]
13.	Poly-n-isopropylacrylamide (P(NIPA))-based gels (PNIPA-co-AM)	-	-	Prodigiosin	Fickian (case I) (n = 0.45) and non-Fickian diffusion (case II) (n > 0.45)	[13]
14.	SA/CMCS-ZnO	-	7.4	Diclofenac sodium	anomalous-transport	[14]
15.	Gg-cl-poly(NIPAco-AA)/CoFe2O4	free radical polymerization	7.4	Metformin hydrochloride	Specific case II transport	[15]
16.	Gg-cl-poly(NIPA-co-AA)/-o-MWCNT	Free radical polymerization	9.2	Metformin hydrochloride and Sodium Diclofenac	Fickian	[16]
17	Gum ghatti-cl-poly(AA)/-o-MWCNT	Free radical polymerization	7.4	Sodium Diclofenac	Fickian diffusion (Case-I diffusional)	[17]
18.	gum ghatti-cl-poly (AA-co-NIPAm)/GO		7.4	Metformin hydrochloride and Sodium Diclofenac	Fickian	[18]

Table S2. Different types of hydrogel systems with their applications.

Sr No	Type of Hydrogels	Applications	Ref
1	pH-stimuli Hydrogels	Oral Drug Delivery	[19]
		Non-cellulosic biopolymer for drug delivery	[20]
		Smart hydrogel from psyllium (Plantago ovata) for intelligent drug delivery	[21]
		Tissue engineering and other biomedical applications	[22]
		Fabrication and biomedical	[23]
2	Photosensitive Hydrogels	In Vitro Photodynamic Therapy of Breast Cancer	[24]
		Targeted drug delivery and 4D cell culture	[25]
		Light- thermo-pH-salt coupled stimuli for biomedical applications	[26]
		Peptide hydrogels as smart materials	[27]
		Cancer therapy	[28]
3	Injectable hydrogel	Therapeutic agents for disease treatment and tissue engineering	[29]
		Soft tissues drug delivery	[30]
		Drug delivery and tissue engineering applications	[31]
4	Magnetism-Responsive Hydrogels	Hyperthermia and Drug Delivery	[32]
		Soft tissue injuries	[33]
5	Thermo-stimuli Hydrogel	Chemo-/photothermal therapy monitored by cell imaging	[34]
		Tissue regeneration	[35]
		Smart drug delivery	[36]
6	Shear-sensitive hydrogels	Rheological and biological evaluation Sana	[37]
		Biomedical	[38]

Table S3. General characteristic properties of Gum ghatti.

Physical appearance	Pale yellow to light brown, free flowing powder
Loss on drying	NMT 10
Optical rotation	-30 to -40°
Colour of slurry	Light brown
Specific gravity	1.02–1.10
Clarity of solution	Slightly hazy
pH (25 % solution)	4.0–4.5
Heavy metals	20 ppm

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