CURRICULUM VITAE

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Educational Qualifications:

Degree	University/Institution	Year	Subjects/Department	Percentage/ CPI
Secondary (10^{th})	Central Board of Secondary Education	2005	English, Sanskrit, Mathematics, Science, Social Science	73.8 %
Senior Secondary (12^{th})	Central Board of Secondary Education	2007	English, Physics, Chemistry, Biology, Physical Education	80 %
B.Sc. Biotechnology	Punjab Technical University, India	2010	Instrumentation, Biochemistry	83.02 %
M.Sc. Bioelectronics & Instrumentation	Jamia Hamdard University, India	2013	Bio-Instrumentation	82 % (University Rank 1)
Ph.D.	Indian Institute of Technology Indore, India	2021	Biosciences and Biomedical Engineering	CPI 7.6 out of 10

Ph.D. Thesis Title:

"Synthesis and Characterization of pH-Sensitive Hydrogel and Magnetic-Hydrogel: Properties and Applications".

Work Experiences:

Department of Biosciences and Biomedical Engineering, Indian Institute of Technology Indore, Indore, India
(Senior Research Fellow from 22nd June, 2016 to 1st February, 2021)

Department of Biosciences and Biomedical Engineering, Indian Institute of Technology Indore, Indore, India
(Junior Research Fellow from 21st June, 2015 to 21st June, 2016)

Employment History:

Department of G.I. Surgery, All India Institute of Medical Sciences, New Delhi, India
(Junior Research Fellow from 23rd Feb, 2014 to 31st March, 2015)

Department of G.I. Surgery, All India Institute of Medical Sciences, New Delhi, India
(Project Assistant from 01st Sept, 2013 to 22nd Feb, 2014)

Honors & Awards:

- ✓ 'INSPIRE Fellowship' award in the field of 'Basic and Applied Sciences' from Department of Science & Technology (DST), Government of India in October, 2014, Award No. IF150378.
- ✓ General Course on Intellectual Property (DL-101), World Intellectual Property Organization, Geneva, Switzerland in April, 2015.

Research Experiences

- ✓ Knowledge of instrument handling (UV-Vis Spectroscopy, Fourier-transform infrared spectroscopy (FTIR), Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), Raman Spectroscopy, Thermogravimetric Analysis (TGA), Glove box
- ✓ Working knowledge of LabVIEW and ELVIS (from National Instruments)
- ✓ Worked on Keil, Dev C++, Professional Proteus, Arduino IDE in C
- ✓ Working knowledge of interfacing RFID reader with Android phone

- ✓ Knowledge of interfacing non-contact temperature sensor with Arduino
- ✓ Knowledge of interfacing magnetic field sensor, force sensor with Arduino
- ✓ Understanding of patents

List of Publications *(papers published in SCI Journals, in year wise descending order).*

S. No.	Author(s)	Title	Name of Journal	Volume	Page	Year
1.	**R. Singh**, V. Munya, V. N. Are, D. Nayak, S. Chattopadhyay*	A Biocompatible, pH-Sensitive, and Magnetically Separable Superparamagnetic Hydrogel Nanocomposite as an Efficient Platform for the Removal of Cationic Dyes in Wastewater Treatment	ACS Omega	6	23139	2021
2.	**R. Singh**, D. Pal, S. Chattopadhyay*	Target specific superparamagnetic hydrogel with excellent pH sensitivity and reversibility: A promising platform for biomedical applications	ACS Omega	5	21768	2020
3.	**R. Singh**, D. Pal, A. Mathur, A. Singh, M. A Krishnan, S. Chattopadhyay*	An efficient pH sensitive dye adsorbing hydrogel, with biocompatibility and high reusability for the removal of methylene blue dye from aqueous solution	Reactive and Functional Polymers	144	104346	2019
4.	N.S. Samarasingha, S. Zollner, D. Pal, **R. Singh**, S. Chattopadhyay*	Thickness dependence of infrared lattice absorption and excitonic absorption in ZnO layers on Si and SiO2 grown by atomic layer deposition	Journal of Vacuum Science & Technology B	38	042201	2020
5.	A. Mathur, D. Pal, A. Singh, P. Rajput, R. J. Chaudhary, **R. Singh**, S. Chattopadhyay*	Confinement induced variation of composition ratio in amorphous silicon carbide thin films and effect in optical properties	Journal of Non-Crystalline Solids	536	120009	2020

6.	A. Mathur, D. Pal, A. Singh, A. Sengupta, **R. Singh** and S. Chattopadhyay*	Violet Emission of ALD-Grown ZnO Nanostructures on Confined Polymer Films: Defect Origins and Emission Control via Interface Engineering Based on Confinement of the Bottom Polymer Template	Macromolecular Chemistry and Physics	220	1800435	2019
7.	A. Singh, A. Mathur, D. Pal, A. Sengupta, **R. Singh** and S. Chattopadhyay*	Near room temperature atomic layer deposition of ZnO thin films on poly (methyl methacrylate) (PMMA) templates: A study of structure, morphology and photoluminescence of ZnO as an effect of template confinement	Vacuum	161	398	2019
8.	A. Mathur, D. Pal, A. Singh, **R. Singh**, S. Zollner, and S. Chattopadhyay*	Dual ion beam grown silicon carbide thin films: variation in refractive index and band gap as a function of film thickness	Journal of Vacuum Science & Technology B	37	041802	2019
9.	D. Pal, A. Mathur, A. Singh, S. Pakhira, **R. Singh** and S. Chattopadhyay*	Binder-Free ZnO Cathode synthesized via ALD by Direct Growth of Hierarchical ZnO Nanostructure on Current Collector for High-Performance Rechargeable Aluminium-Ion Batteries	ChemistrySelect	3	12512	2018

Participation in International Conferences

- **Rinki Singh**, Sudeshna Chattopadhyay*, '*Efficient biocompatible hydrogel with high pH sensitivity as an effective dye adsorbent: potential applications in wastewater treatment',* 4th International Conference on Soft Materials, December 13-18, 2020, Soft Material Research Society Jaipur, India (Online Mode)

- **Rinki Singh**, Dipayan Pal, Aakash Mathur, Ajaib Singh, Anjan Das, Sudeshna Chattopadhyay*, *'pH Sensitive Hydrogel for Disease Diagnosis and Environmental Remediation'*, Symposium on Emerging Areas in Biosciences and Biomedical Technologies (eBBT-2018), January 5-6, 2018, IIT Indore, India

- **Rinki Singh**, Dipayan Pal, Aakash Mathur, Ajaib Singh, Anjan Das, Sudeshna Chattopadhyay*, *'Removal of Methylene Blue dye from Wastewater by pH Sensitive Hydrogel'*, Second International Conference on Sustainable Energy and Environmental Challenges (SEEC-2018), December 31, 2017-January 3, 2018, IISc Bangalore, India

Brief of Ph.D. Thesis work:

Soft condensed matter (or soft matter, for brevity) is a convenient term for material in states of matter that are neither simple liquids nor crystalline solids of the type studied in other branches of solid state physics [1]. As its name implies, soft matter science deals with materials that are easily deformed. These materials, which include polymers, gels, colloids, emulsions, foams, surfactant assemblies, liquid crystals, granular materials, and many biological materials, have in common that they are organized on mesoscopic length scales, with structural features that are much larger than an atom, but much smaller than the overall size of the material. Among these, nowadays, polymers are omnipresent in our daily life as well as in science, engineering, and medicine. Polymers are widely used in medical applications like drug delivery, tissue engineering, wound dressings, disposable syringes, catheters, artificial heart valves, joints, or suture material. The hydrogel is a special type of polymer, having porous three-dimensional polymeric network that can absorb a large amount of water without dissolving into it and have chemically responsive functional groups [2]. Hydrogels have existed for more than half a century, and today they have many applications in various processes ranging from industrial to biological. In the past few decades, stimuli-responsive hydrogels have gained significant attention. These hydrogels show dramatic changes in volume and / or shape properties in response to an external stimulus such as temperature, pH, ionic strength, electric field, etc. Their ability to swell and shrink according to the external condition (or surroundings) makes them attractive for use as intelligent materials (smart gels) [3]. For an example, a pH responsive hydrogel, having anionic (acidic) groups (e.g., carboxylic acid or sulfonic acid pendant groups) or cationic (basic) groups such as amine pendant group, can either accept or release protons respectively, in response to pH change, thus being capable of adsorbing ionic dyes and become useful for wastewater treatment [4]. In this regard, it should be noted that wastewater pH has been identified as one of the parameter that influence effective wastewater treatment [5].

Further, stimuli-responsive hydrogels can achieve distinct mechanical reinforcement as well as optical, electronic, antimicrobial, photothermal, and/or photocatalytic properties, by incorporation of various nano- and micro-scale materials such as metal particles, magnetic nanoparticles or biological molecules into the hydrogel matrix [6]. Such

nanocomposites of responsive hydrogels can exhibit unique dual-responsive properties with the capability of actuation at a distance. In this context, magnetic carriers have recently attracted the attention of researchers due to the fact that they show several advantages, such as in vivo degradation into nontoxic ions, direct visualization by magnetic resonance imaging (MRI), and magnetic drug targeting in opportune sites under the influence of a magnetic field [7]. Among magnetic carriers, particular attention has been paid to magnetic hydrogels (or ferrogels). They are cross-linked polymer networks containing magnetic nanoparticles. The direct advantage of inclusion of magnetic nanoparticles into hydrogels is the achievement of magnetically guided drug delivery, which allows site-specific drug transport [8]. In this context, superparamagnetic iron oxide nanoparticles (Fe_3O_4) have gained the primary focus in the field of magnetic nanoparticles due to their large magnetic moments, excellent superparamagnetism, low toxicity and high stability in aqueous solution. Superparamagnetism, an important property, which indicates no retention of magnetism after the removal of an magnetic field, is crucial for many applications like detection of inflammatory cancer, MRI, magnetic hyperthermia and also for magnetic separation [9]. Among these stimulus-responsive magnetic nanocomposite hydrogels, pH-sensitive hydrogels have received immense interest in biomedical applications, such as in disease diagnosis, as polymeric drug carriers, as a contrast agent in magnetic resonance imaging (MRI), and as biosensors, because pH is an important environmental factor in the body and some disease states manifest themselves by a change in pH value [7]. A pH responsive magnetic hydrogels are also emerging as a new generation of adsorbent for environmental cleanup because they can be readily separated from dye solution by an external magnetic field after adsorption [10]. Compared with other traditional separation techniques such as filtration and centrifugation, the magnetic separation process is easy to operate with high separation efficiency and low cost [11].

Based on this background, in the thesis work, efficient pH sensitive hydrogel and dual-responsive (pH and magnetic-field) superparamagnetic hydrogel have been designed, synthesized and characterized thoroughly towards its versatile potential applications (as mentioned above). Particularly, applications of the synthesized pH-sensitive hydrogel and pH-sensitive superparamagnetic hydrogel, as efficient dye adsorbent for waste water treatment and as pH sensor for disease diagnosis, have been studied and presented in the thesis work. The dye adsorption kinetics and isotherm analysis have been conducted thoroughly to explore the detailed mechanism of the overall adsorption process, which paves the pathway to tune the system systematically. On the other hand, in the thesis work suitable prototype with pH-sensing capabilities has been demonstrated and schematic representation of designed envisioned application of the dual-responsive superparamagnetic hydrogel has been demonstrated to utilize the system efficiently for diagnosis purposes using impedance analysis, based on the change in permeability of the system, and in another effective way using the handheld magnetic probe technique.

References

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