

Department of Chemistry
Tyre Compounding and Processing Techniques
Year of Enrolment - 2023

The Department of Chemistry conducted an additional Chemistry course "Tyre Compounding and Processing Techniques" in the academic year 2023-24. The course commenced on 07/08/2023. The number of participants in the academic year 2023-24 included 25. The course was imparted to the final year BSc Chemistry students. The students were evaluated, after each activity, through a verbal feedback system.

Assessment Structure:

1. Assignments and Problem Sets – 30%
2. Examination – 30%
3. Final Examination – 30%
4. Seminar/Project on Recent Advances –10%

The course had duration of 20 hours. The students were submitted assignments based on lectures given, taken two in-semester written examinations and a research proposal was submitted and presented before the group and an end semester final examination were conducted Grades were awarded on the following basis:

80% and above : A Grade

70 - 79% : B Grade

60 -69% : C Grade

Out of the 25 students who enrolled in the course, 15 students secured A Grade , 8 students secured B grade and 2 students was secured C grade

Classes were engaged by the following faculty members of the Department of Chemistry:

1. Dr. Diveshkumar K. V., Assistant Professor

Aim of the Course: "Tyre Compounding and Processing Techniques"

The aim of this course is to provide students with an in-depth understanding of the principles, materials, and technologies involved in tyre manufacturing. By focusing on the science of rubber compounding, tyre component processing, and quality testing, the course prepares students to design and produce high-performance tyres that meet industrial standards while addressing sustainability and innovation challenges in the tyre industry.

Course Outcomes (COs):

By the end of this course, students will be able to:

1. Demonstrate knowledge of tyre materials and their influence on performance and durability.
2. Apply rubber compounding principles to design optimized tyre formulations.
3. Explain and evaluate tyre manufacturing processes, including extrusion, calendaring, and curing.
4. Conduct and interpret tyre performance tests and quality assessments in compliance with industry standards.
5. Assess sustainability challenges and innovations in tyre production, including recycling and advanced materials.
6. Solve real-world engineering problems related to tyre performance and manufacturing.
7. Develop practical skills and expertise for careers in tyre manufacturing or polymer research.

Course Duration: 12-15 weeks (2 hours/week)

Tyre Compounding and Processing Techniques - Course Overview

Module 1: Introduction to Tyre Technology and Materials

- Overview of tyre types and structures (radial, bias-ply, tubeless, etc.)
- Functional components of tyres (tread, sidewall, bead, etc.)
- Materials used in tyre manufacturing:
 - Natural and synthetic rubber
 - Fillers (carbon black, silica)
 - Additives (antioxidants, accelerators, plasticizers)
 - Reinforcing materials (steel cords, polyester, aramid)
- Properties of rubber materials essential for tyres (elasticity, durability, etc.)

- Role of sustainability and renewable materials in tyre production

Module 2: Rubber Compounding Techniques for Tyres

- Fundamentals of rubber compounding
- Mixing methods: open mill mixing, internal mixer (Banbury mixer)
- Effect of fillers and their dispersion on tyre performance
- Optimization of rubber compounds for specific tyre properties:
 - Traction, abrasion resistance, rolling resistance
 - Heat build-up and durability
- Vulcanization: sulfur-based and peroxide-based cross-linking

Module 3: Tyre Processing and Component Manufacturing

- Extrusion of tread and sidewalls
- Calendering for rubber sheet production and steel cord reinforcement
- Bead construction and assembly
- Tyre building processes: manual vs. automated tyre assembly
- Curing and vulcanization processes:
 - Compression moulding
 - Influence of curing parameters (temperature, pressure, time)

Module 4: Tyre Performance Testing and Quality Control

- Testing of tyre components (tensile strength, hardness, elongation, etc.)
- Whole tyre performance tests:
 - Rolling resistance
 - Traction and braking tests
 - Wear and tear resistance
 - Heat build-up and endurance tests
- Non-destructive testing methods (X-ray inspection, shearography)
- Compliance with international standards (ISO, ASTM, ECE regulations)

Module 5: Innovations, Challenges, and Sustainability in Tyre Manufacturing

- Advances in material science for tyres (nanomaterials, bio-fillers)
- Smart tyre technology (self-healing tyres, sensors in tyres)
- Sustainability challenges: tyre recycling and re-treading
- Impact of electric vehicles (EVs) on tyre design
- Case studies of innovative tyre designs (run-flat tyres, airless tyres)

Reference Books:

1. **"Rubber Compounding: Principles, Materials, and Techniques"** by Brendan Rodgers
2. **"The Science and Technology of Rubber"** by James E. Mark, Burak Erman, and Frederick R. Eirich
3. **"Engineering with Rubber: How to Design Rubber Components"** by Alan N. Gent
4. **"Rubber Technology Handbook"** by Werner Hofmann
5. **"Chemistry, Manufacture, and Applications of Natural Rubber"** by Shinzo Kohjiya and Yuko Ikeda
6. **"Tyre Compounding for Improved Performance"** by M. S. Evans
7. **"Reinforcement of Rubber: Visualization of Nanofiller Networks and Their Impact on Material Properties"** by Juergen Roeder
8. **"Principles of Polymer Processing"** by Zehev Tadmor and Costas G. Gogos
9. **"Handbook of Polymer Foams and Technology"** by Daniel Klempner and Kurt C. Frisch
10. **"Non-Destructive Testing Methods for Tyres"** by Michael H. Baker


Principals



Dr. Chithra Gopinath
Assistant Professor
Drawing & Disbursing Officer
T.K.M. College of Arts & Science
Kollam - 691005, Kerala.



Course Coordinator

Dr. Divyankumar K.V. 

2216	57829	Minil Madhav	Madhav	Madhav	Madhav	Madhav	Madhav	Madhav	Madhav	Madhav	Madhav	Madhav	Madhav
2217	58218	Rakesh.S	Rakesh	Rakesh	Rakesh	Rakesh	Rakesh	Rakesh	Rakesh	Rakesh	Rakesh	Rakesh	Rakesh
2220	57649	Aparna s Ajay	Aparna	Aparna	Aparna	Aparna	Aparna	Aparna	Aparna	Aparna	Aparna	Aparna	Aparna
2221	57647	Athira Vijayan	Athira	Athira	Athira	Athira	Athira	Athira	Athira	Athira	Athira	Athira	Athira
2222	58114	fathimashihab S	Fathima	Fathima	Fathima	Fathima	Fathima	Fathima	Fathima	Fathima	Fathima	Fathima	Fathima
2224	58174	Nayana Anil S	Nayana	Nayana	Nayana	Nayana	Nayana	Nayana	Nayana	Nayana	Nayana	Nayana	Nayana
2225	57655	Nithya S G	Nithya	Nithya	Nithya	Nithya	Nithya	Nithya	Nithya	Nithya	Nithya	Nithya	Nithya
2226	57665	Sreelekshmi S	Lekshmi	Lekshmi	Lekshmi	Lekshmi	Lekshmi	Lekshmi	Lekshmi	Lekshmi	Lekshmi	Lekshmi	Lekshmi
2227	57830	Swathi R	Swathi	Swathi	Swathi	Swathi	Swathi	Swathi	Swathi	Swathi	Swathi	Swathi	Swathi
2229	58153	Nizam A.	Nizam	Nizam	Nizam	Nizam	Nizam	Nizam	Nizam	Nizam	Nizam	Nizam	Nizam
2230	57662	Alfiya Ansar	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya
2231	57966	Alfiya M	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya	Alfiya
2232	58137	Amina S	Amina	Amina	Amina	Amina	Amina	Amina	Amina	Amina	Amina	Amina	Amina
2233	57925	Asmiya A S	Asmiya	Asmiya	Asmiya	Asmiya	Asmiya	Asmiya	Asmiya	Asmiya	Asmiya	Asmiya	Asmiya
2235	57954	Sulthana Rahman M	Sulthana	Sulthana	Sulthana	Sulthana	Sulthana	Sulthana	Sulthana	Sulthana	Sulthana	Sulthana	Sulthana

Course Coordinator
Dr. Diveshkumar K.V.

[Signature]



Principal



Dr. Chitra Gopinath
Assistant Professor
Drawing & Disbursing Officer
T.K.M. College of Arts & Science
Kollam - 691005, Kerala





TKM College of Arts and Science, Kollam – 691005

Department of Chemistry


B.Sc. Chemistry (2021 Admission) – (2023-2024 Batch)

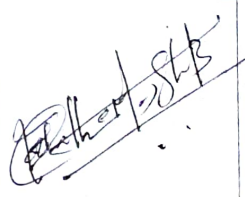



Certificate Course in Tyre Compounding & Processing Techniques (Enrolment Register)





Class No.	Admission No.	Name (Address, Phone number and E-mail ID)	Signature
2201	57791	Mohammed Syedali M Zam Zam Manzil , Beskkulam P.O Kollam 8136850744 mohammedsyedalipkm@gmail.com	
2202	57972	Adhila S Punnavila Veedu Nedumpoma P.O Kuleppadam. 9048062490 adhiladhila02@gmail.com.	

2203	58316	<p>Ayisha S</p> <p>Sanila cottage, Snehadana Nagar - 227 Eravipuram, P.O., Kollam 9744788658, 9847788658 Sanilaayisha@gmail.com</p>	
2204	57982	<p>Basima Siyad</p> <p>Siyad Manzil, Kammalloor (P.O) Kollam - 691576 8606056960, 9037357312 basimasiyad23@gmail.com</p>	
2207	57652	<p>K Megha shaji</p> <p>Affham Veedu, Puthala Kodiyil TKMC Perar PO, Kollam - 691005, 9544832005, 9946234094 kmeghashaji@gmail.com kmeghashaji02@gmail.com</p>	
2209	57645	<p>Nandana B R</p> <p>Changanayil Veedu, Edatarampara, Elanadu. PO, Aycor Kollam - 691533, 7736977023, 8848597408 nandana23082003@gmail.com</p>	

2210	57935	Shahanaz Nizam Eik House Thattarakonam PO, Peroor, Kariyode, Kollam phone no: 9400169537 email Id: Shahanaznizam59@gmail.com	Shahanaz
2211	58307	Sreelekshmi P S Sreemathy Ulasom, perumpuzha P.O Kollam Phone no: 9495868029 Email Id: Sreelakshmisreenivar156@gmail.com	<u>Sul</u>
2212	58161	Thanseena Sharief M R Hashir Manzil Kollamkara Chandanthope PO, Kollam Phone no: 9947253187 email ID: thanseena thanzi46@gmail.com	<u>Thani</u>
2213	58080	Vyshnavi MA Makayilan Thunali, perukkannai perumpuzha (P.O) 94 9188478433 vyshnavianil003@gmail.com	Vyshnavi

2216	57829	Minil Madhav Puthuparambil Veedu Kundayam P.O Pathanapuram. 6235584910 minilmasdhav@gmail.com.	<u>Madhavo</u>
2217	58218	Rakesh.S Moonam Kizhakkathil Vengai P.O Saslkanscotta 9746875831 rakeshrakeshs9595@gmail.com	
2220	57649	Aparna s Ajay Akshaya, Neevanil, Pennad P.O Kollam. 9037773931 Kichuappu2033@g-mail.com.	<u>Aparna</u>
2221	57647	Athira Vijayan Vijaya Bhavan, Chengamanadu P.O, Kottarakkasa, Kollam 8848145357. athira vijay 1729 @ g mail . com .	<u>Athira</u>

2222	58114	fathimashihab S Thevcola zhibikath veedu, Edavattom, Chendannathope PO. Kollam 8590736749 fathimashihabs@gmail.com	
2224	58174	Nayana Anil S Meerakshi Bhavanam Kadavoor perinad P.O Kollam 6988881041 mithunnayana7463@gmail.com	
2225	57655	Nithya S G Sailalayam Nedungalam PO Paravur 8129685229. Nithyasreedhar2@gmail.com	
2226	57665	Sreelekshmi S Sreemayam Cherumodu Vellimar P.O kollam 9146438275 sreelekshmi974@gmail.com	

2227	57830	Swathi R Nandanam, Nedukayam, P.P.M.P.O Punalur 89. 7907792642 swathy'subash 37@gmail.com	
2229	58153	Nizam A. Chazuvila Veedu Nedumpanna (P.O) Kullappadom 7034643273 nizamzashced 227@gmail.com	
2230	57662	Alfiya Ansar Ameena Masjid Manakkad nagar 101 vadakkuvila Po. Kollam 9072242533 alfiyaansar1555@gmail.com	
2231	57966	Alfiya M Vilappurath Veedu, Thattarkonam P.O Peroor 8137423178 alfiya.kamal0@gmail.com.	

2232	58137	Amina S Pallitthekkalil Veedu punukkannoor Alummoodu P.O Kollam 9207825021 Amina.salaudheen302@gmail.com	<u>Amina S</u>
2233	57925	Asmiya A S kolaggeel, Peruvos kutlichisa Thurappo kollam-5 4736567541 asmiyamaria003@gmail.com	<u>Asmiya</u>
2235	57954	Sulthana Rahman M Sabee Manzil Bazimul aluila Marawa nagar kilibolloo po kallumthazhar kollam sulthanarahman22@gmail.com	<u>Sulthana</u>

Course Coordinator.

Dr. Diveshkumar K.V. Steth



Principal.

Dr. Chithra Gopinath

Assistant Professor
Drawing & Disbursing Officer
T.K.M. College of Arts & Science
Kollam - 691005, Kerala.