5.5: Innovations by faculty in teaching and learning

Statement of Goals to be achieved by using the new and innovative teaching methods

1. Enhanced Engagement: The prime aim of practicing innovative teaching methods at the Chemical Engineering Department is to capture the students' attention and promote active engagement in the learning process. This helps in deeper understanding and retention of course material.

2. Reducing the Complexity of Subject Matter: New and innovative teaching methods are adopted for teaching the complex topic in a subject in a more effective way.

3. Catering to Diverse Learning Styles: The various students in a class can have diverse learning preferences and styles. By incorporating a variety of teaching methods, faculty can accommodate different learning styles of learners.

4. Promotion of Critical Thinking and Problem-Solving Skills: Innovative teaching methods involve active learning activities, such as group discussions, problem-solving exercises, and case studies, which encourage students to think critically, analyze information, and apply concepts to real-world situations.

5. Promotion of Self and Collaborative Learning: One of the important goals of using new and innovative techniques of teaching at the Chemical Engineering Department is to promote self and collaborative learning among the students of the Chemical Engineering Department.

6. Continuous Improvement and Innovation: The new teaching methods used by faculty members for making continuous improvement in the teaching styles. Embracing new teaching methods encourages faculty to continuously experiment, innovate, and refine their instructional approaches.

New and innovative teaching methods for content delivery

1. **Problem-Based Learning (PBL):** In PBL, students were presented with real word problems (such as from industry), and case studies and the students worked in groups to solve the problem. The faculty guides the students appropriately and facilitates in approaching the correct solution by emphasizing the significance of the results in addressing practical engineering challenges. Enhanced engagement of the students in learning the specific topic can be effectively achieved through this method.

2. **Audio/Video Tools:** Most of the faculty members at the Chemical Engineering Department utilize audio/video tools such as YouTube Videos, NPTEL videos, animated PowerPoint presentations, etc. for content delivery in combination with teaching using chalk and board. The use of these tools is effective in better visualization of abstract concepts, enhancing comprehension and retention of course material, demonstrating the complex engineering processes in a comprehensible and repetitive way, increasing remote accessibility of course materials, etc.
3. **Virtual Laboratories:** The Chemical Engineering Department adopted a practice of conducting and including at least one virtual experiment for the various laboratory courses wherever possible. Virtual laboratories offer opportunities for repeatable experiments and self-paced learning to the students. Virtual laboratories facilitate experiential learning by allowing students to engage in hands-on experimentation, data collection, and analysis in a controlled virtual environment.
4. **Google Classroom:** Google Classroom is the freely available online platform which is effective in managing, organizing, and delivering the course content. Google Classroom provides the flexibility and tools needed to facilitate effective teaching and learning experiences for students. Faculty members of the Chemical Engineering Department use the Google Classroom platform for important announcements related to the course, posting assignments, conducting quizzes, etc.
5. **Flipped Classroom:** The course coordinator provides the recorded video on the specific content before initiating the respective topic in the classroom. Learners can watch the video and learn the underlying concept at their own pace before attending the class. Based on the content in the video learners are encouraged to solve the numerical problem in the classroom. This flipped method of teaching is effective in promoting the self as well as collaborative learning.
6. **Use of Representative Models:** Faculty members at the Chemical Engineering Department also use the various representative models for explaining the concepts and processes in the respective course. The use of models in teaching demonstrates processes and equipment and facilitates conceptual understanding.
7. **Simulation-Based Learning:** Faculty members at the Chemical Engineering Department plan and conduct the various laboratory courses using important and available software. Simulation-based learning in chemical engineering provides realistic replication of industrial processes, promotes experiential learning, enables iterative experimentation and analysis, and offers risk-free exploration of complex systems.

New and innovative teaching methods for content delivery- methodologies and developments

Sr no	Teaching Method	Name of staff	Resources available	Implementation	Observation	Significant/Innovation aspect	Goals achieved
1	Problem-Based Learning (PBL)	S J Kulkarni	Industrial projects, Problem based events, quizzes	Projects, miniprojects	Many mini projects are continued by final year students as major project	The miniproject/project concept	Enhanced Engagement and reducing complexity
2	Audio/Video Tools	J V Mapara, S J Kulkarni, N D Galande, S P Tekade, S D Ayare, S P Jadhav, V B Sawant	Elrc, Internet, video system, NPTEL	Class rooms with ICT tools	Students are encouraged to use NPTEL and other online contents.	Elrc contains 35-40 lectures of all subjects. Student access the recorded lectures of their teachers anytime.	Catering to Diverse Learning Styles, Continuous Improvement and Innovation, Continuous Improvement and Innovation
3	Virtual Laboratories	J V Mapara, S J Kulkarni, S P Tekade, S H Gharat	Internet	Virtual laboratories conducted by teachers	It is observed that the students are keen on virtual leaning as they find it interesting. The virtual laboratories for all courses will be conducted.	Virtual laboratories conducted for almost all Laboratory subjects(at least one)	Enhanced Engagement
4	Google Classroom		Internet		Used by few faculties		Enhanced Engagement
5	Flipped Classroom	S J Kulkarni, S P Tekade	Internet, library, books, e books, project reports, tutored video lectures	Students encouraged to access the online /Elrc content in advance	There is increasing interest among students about tutored video lectures.	In tutored video lectures, students are encouraged to watch certain video lecture with 8 -10 minutes interval. Then have a small discussion about the concept and watch for another 8 -10 minutes. In class, they are encouraged to discuss the same concept.	Catering to Diverse Learning Styles, Enhanced Engagement, Promotion of Critical Thinking and Problem-Solving Skills
6	Use of Representative Models	S P Tekade, S H Gharat, S J Kulkarni	Models, equipments available in laboratories, charts, tables.	Charts, models, previous projects made available. Models for	The models are being developed fabricated for understanding of basic concepts in chemical engineering with guidance from	The models for fundamental concepts are being fabricated and aligned with Second year miniprojects for 2024-25 and	Enhanced Engagement

				understanding the concepts are used for better understanding.	Institute of Chemical Technology.	will be used to demonstrate the concepts for future batches.	
7	Simulation-Based Learning	S H Gharat	CFD laboratory, computer application laboratory, software, expertise, guidance	Projects based on simulations	Students having interest in Software and simulation adopt the projects aligned to it.	Papers are published by few students in Scopus journals. CFD tool is also used for innovate projects.	Enhanced Engagement, Reducing the Complexity of Subject Matter
8	Paper/article writing(Self learning with guidance)	S J Kulkarni, S P Tekade	Library, guidance	Review papers, book chapters	Few students are capable write review on project/miniproject topic	Many students published book chapters/ papers in Scopus indexed books/ journals.	Promotion of Self and Collaborative Learning
9	Assessment and evaluation	All faculty	Internet, Google subscription	Online examination during pandemic, now used for module wise/session wise tests	Session wise tests are being conducted from January 2025. Session learning outcome being assessed based on test after each session	Online content about project report available for 2019-20, 2020-21. Session learning outcome being assessed based on test after each session.	Enhanced Engagement
10	Submissions	All faculty	Internet, Google subscription	Google form used for PPT. project report submission for primary assessment/corrections	Project report submission for primary assessment/corrections minimizes students' efforts for getting checked the project and miniproject reports repeatedly.	PPTs available online. Also students friendly system for assessment of review and report preparation	Enhanced Engagement
11	Experiential learning methodologies	S J Kulkarni, S P Tekade, S H Gharat	Practical set ups	The practical conducted in laboratories repeated for actual conditions	This component is to be gradually increased.	The readings are taken at laboratory conditions and then atmospheric conditions/ outside laboratories.(Especially for the experiments depending on humidity, temperature, wind, eq. diffusivity calculation)	Promotion of Critical Thinking and Problem-Solving Skills, Promotion of Self and Collaborative Learning, Continuous Improvement and Innovation

12	Synthesis of products	J V Mapara	Inventories, chemicals, instruments, glassware	Manufacturing of different products	Increased interest of students towards the branch	The products will be produced in more quantity and tested, commercialized.	Enhanced Engagement, Promotion of Self and Collaborative Learning
13	Virtual Industrial visit	S J Kulkarni	Internet	Through Google meet	It was possible to have industrial visit to remotely located plant	The resource person explained the unit operations in pharmaceutical industry in detail	Enhanced Engagement, Reducing the Complexity of Subject Matter
14	Virtual experiment conduction	S J Kulkarni, S H Gharat, S P Tekade, J V Mapara,	Internet	Through Google meet	Recorded lab sessions	Recorded videos of lab conduction are available all the time of Erc	Enhanced Engagement, Reducing the Complexity of Subject Matter, catering to student diversity
15	Panel discussion	S J Kulkarni	Internet Google meet	Google meet for connecting to industrial experts	Resource persons discussed the SDGs at length	Experts explained their own initiatives towards sustainable development	Enhanced Engagement, catering to the student diversity.

1. Virtual Laboratories

Sr. No.	Course	Topic	Course Coordinator
1	Mass Transfer Operations II	Flow Through Packed Bed	Dr. S. J. Kulkarni
2	Fluid Flow Operations	Venturimeter, Reynolds Number and Stokes Law	Prof. S. P. Jadhav
3	Heat Transfer Operations	Double Pipe Heat Exchanger	Dr. S. D. Ayare
4	Chemical Technology	Soap Preparation	Prof. J. V. Mapara
5	Numerical Methods in Chemical Engineering	Six Various Numerical Techniques	Prof. S. P. Jadhav
6	Industrial and Engineering Chemistry II	Preparation of Sols	Prof. S. K. Dhawale
7	Chemical Reaction Engineering II	Kinetics in Mixed Flow Reactor	Dr. S. P. Tekade
8	Pollution Control Technology	Determination of Alkalinity	Prof. J. V. Mapara

2. Self Learning/ Flip Learning

Sr. No.	Course	Teaching Aid	Topic	Course Coordinator
1	Pollution Control Technology	NPTEL Lecture	Plum Behaviour and Gaussian Dispersion Model	Prof. J. V. Mapara
2	Modelling Simulation and Optimisation	NPTEL Lecture	Overview of Setting up of Property Environment	Prof. J. V. Mapara
3	Chemical Reaction Engineering II	Video Lecture	Fluid-Fluid Non-catalytic Heterogeneous Reactions	Dr. S. P. Tekade
4	Chemical Reaction Engineering II	NPTEL Lecture	Segregation Model	Dr. S. P. Tekade
5	Mass Transfer Operations I	Tutored Video Instructions	Various Topics	Dr. S. J. Kulkarni

3. Experiential Learning

Sr. No.	Course	Topic/Method	Course Coordinator
1	Mass Transfer Operations I	Nanomaterials	Dr. S. J. Kulkarni
2	Heat Transfer Operation	Conduction	Dr. S. D. Ayare
3	Heat Transfer Operation	Convection	Dr. S. D. Ayare
4	Fluid Flow Operations	Measurement of Flowrates and Velocity	Dr. S. H. Gharat
5	Instrumentation Process Dynamics and Control	Effect of Disturbance on Heating System	Dr. S. H. Gharat
6	Pollution Control Technology	Industry Visit to Common Effluent Treatment Plant at Lote MIDC	Prof. J. V. Mapara
7	Pollution Control Technology	Visit to Waste Disposal Plant in Campus	Prof. J. V. Mapara
8	Industrial and Engineering Chemistry II	Industry Visit Krishna Antioxidants Pvt Ltd at Lote MIDC	Prof. S. K. Dhawale

4. ICT Tools/GATE Classes/ Pre-requisite Courses

Sr. No.	Course	Details	Course Coordinator
1	Mass Transfer Operations I	Online Lecture on Google Meet	Dr. S. J. Kulkarni
2	Industrial and Engineering Chemistry I	Quiz using Google Quiz	Prof. S. K. Dhawale
3	Industrial and Engineering Chemistry II	Quiz using Google Quiz	Prof. S. K. Dhawale
4	Petroleum Refining Technology	Wordwall	Prof. J. V. Mapara
5	Instrumentation Process Dynamics and Control	Wordwall	Dr. S. H. Gharat
6	Transport Phenomena	Wordwall	Prof. S. P. Jadhav
7	Fluid Flow Operations	GATE Classes	Dr. S. H. Gharat
8	Instrumentation Process Dynamics and Control	Pre-requisite Course	Dr. S. H. Gharat
9	Industrial and	Quiz using Google Quiz	Prof. S. K. Dhawale

Department of Chemical Engineering GIT Lavel

	Engineering Chemistry I		
10	Industrial and Engineering Chemistry II	Quiz using Google Quiz	Prof. S. K. Dhawale
11	Petroleum Refining Technology	Wordwall	Prof. J. V. Mapara
12	Fluid Flow Operations	Wordwall	Dr. S. H. Gharat

Department of Chemical Engineering GIT Lavel

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GIT GHARDA INSTITUTE OF TECHNOLOGY

Report on Virtual Laboratory

Name of Subject: CRE II (Sixth Sem, 2022-23)

Name of Experiment: Polymerization Reactor

URL: http://vlabs.iitkgp.ac.in/cpd/exp8/index.html

Date: 28 April 2023

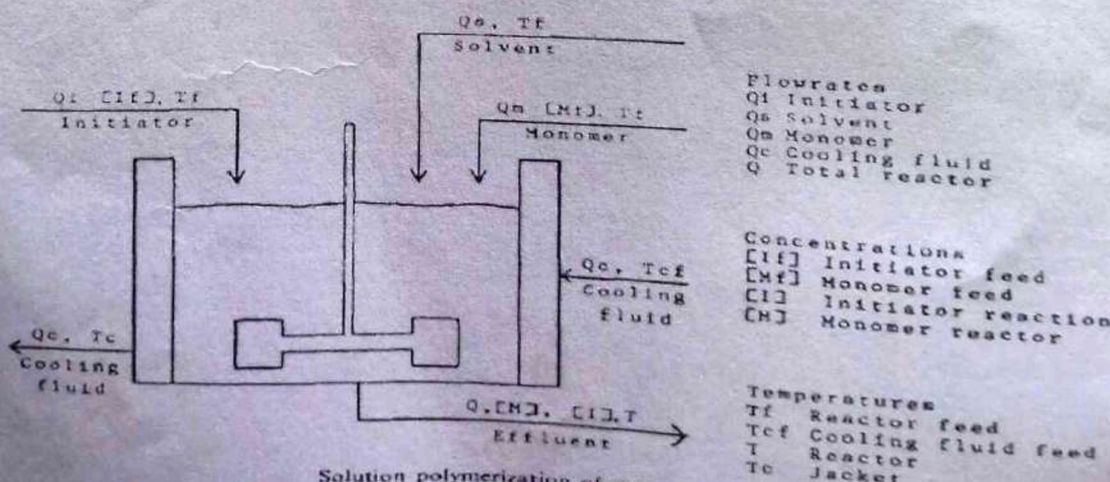
Virtual laboratory for the practical on Polymerization Reactor was conducted for the students of Chemical Engineering on 28th April 2023. The virtual laboratory and experiment was hosted by Indian Institute of Technology Kharagpur on their URL.

Aim: To study polymerization reactor for polymerization of styrene

Procedure:

Open the "Tank Liquid Inlet" slowly to get the Tank filled up with the desired liquid .The height of the liquid in the Tank should be below the red mark position mentioned on the left wall of the Tank. Now slowly open the "tank liquid outlet", so that the liquid filled height in the tank get constant otherwise the experiment will not start (Tank Liquid Inlet rate=Tank Liquid Outlet rate). The data given as input should be ensured to be of following ranges for getting stable steady state. A literature search was undertaken to find reactor conditions and parameters used in industry for free radical initiated bulk and solution styrene polymerizations. The literature values were used to establish ranges for the control system experiment parameters. Following lists reactor parameters found in literature and the corresponding range considered for each parameters.

Experimental Set Up:



Solution polymerization of styrene in a CSTR

Polymerization reactor

INTRODUCTION PROCEDURE SIMULATOR ASSIGNMENT QUIZ REFERENCES

Introduction

Styrene (vinyl benzene, styrene monomer SM) is a colorless to yellowish oily liquid with a distinctive aromatic odor. It is sparingly soluble in water but soluble in alcohols, ethers and carbon disulfide. It is chemically reactive and undergoes polymerization readily (by heat, light or peroxide catalysts). Polymerization results in volumetric shrinkage (17%) and exothermic heat (17.8 Kcal/mole).

The Process model for the free radical solution polymerization of styrene in a jacketed continuous stirred tank reactorreactor (CSTR) involves reaction kinetics, a material balance and an energy balance. The cooling jacket uses water as the cooling fluid to remove heat generated by exothermic polymerization.

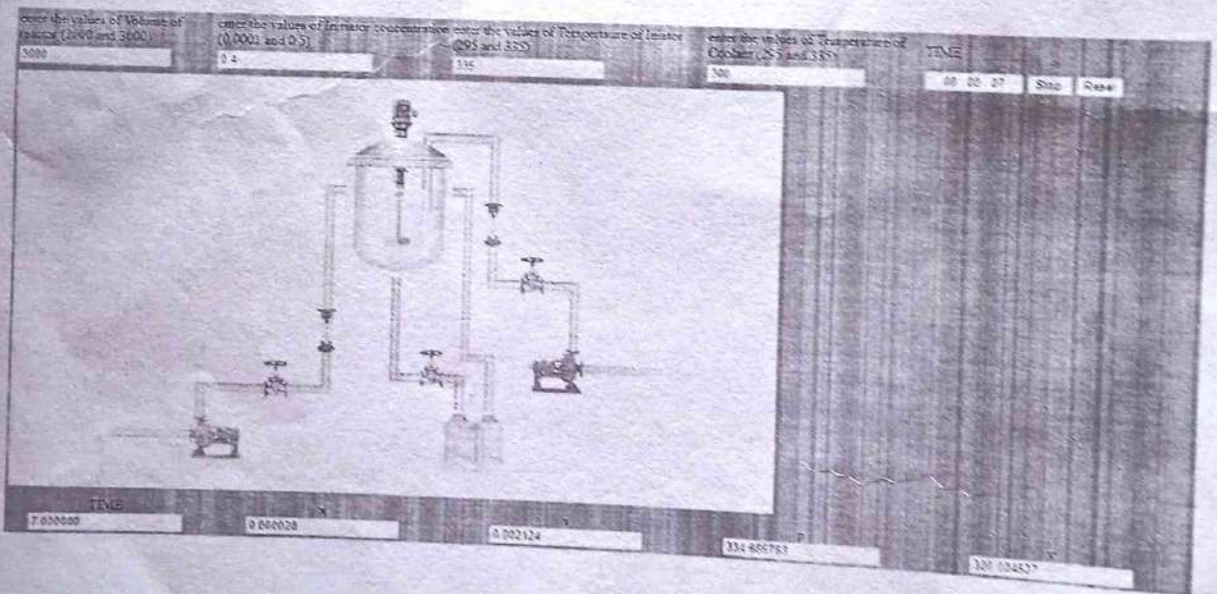
Steady-state: It is a situation in which all state variables are constant despite parallel processes that strive to change them.

Quasi-steady-state: It is also known as pseudo-steady-state, in this assumption the concentration of the intermediate complex does not change on the time scale of product formation.

Mass balance: It is an analysis of system based on the application of conservation of mass, it is also known as material balance.

Energy balance: It is first law of thermodynamics which states the law of conservation of energy, specialized by thermodynamical systems.

Rate expression: For a chemical reaction, the equation that links the reaction rate with concentrations of reactants

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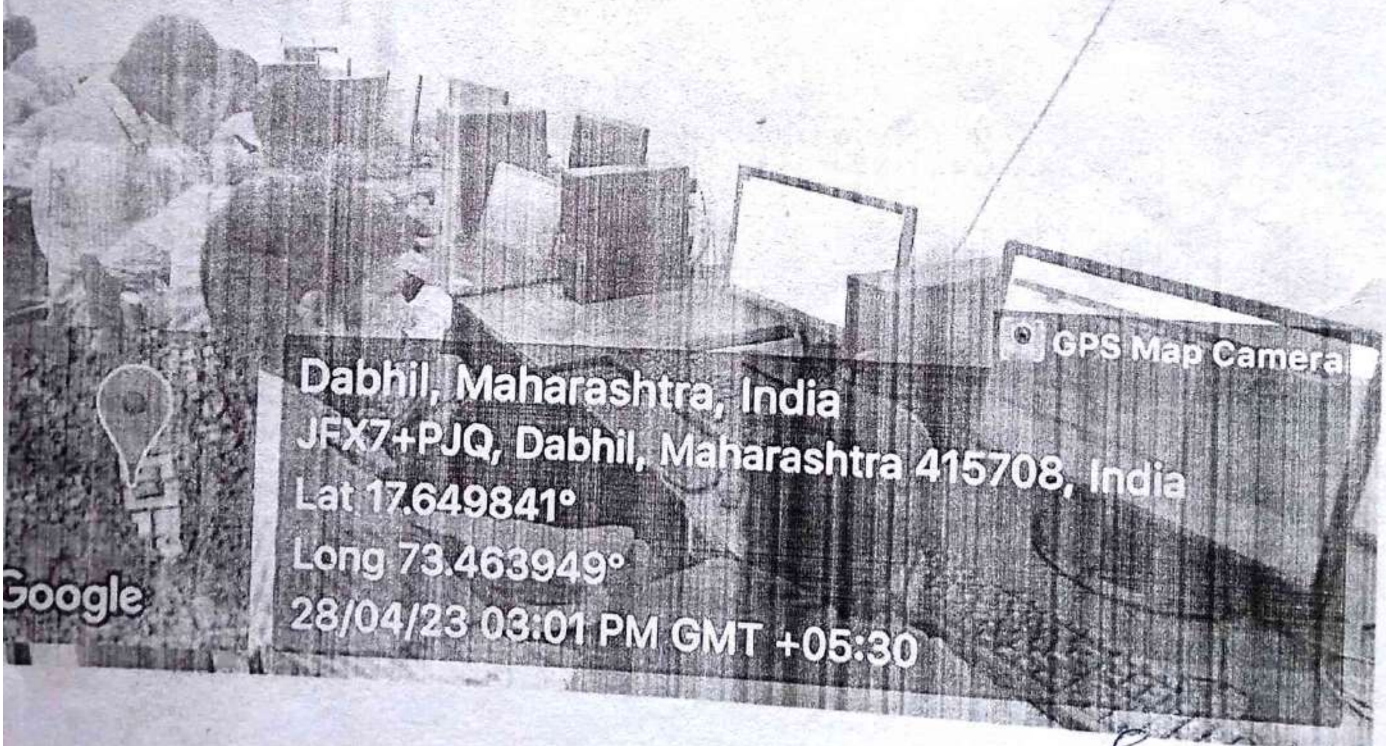
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Dr. Sunil J Kulkarni <sjkulkarni@git-india.edu.in>
to TE, HOD

Wed, Apr 19, 2023, 10:03 AM

Dear all,
Virtual labs are becoming an important aspect of technical education. In this regard,
MTO II virtual lab sessions will be conducted as per following time table in computer application Lab as per following schedule
Batch 1 : 12.00 to 1.00 noon, 20.04.2023
Batch 2: 4.00 to 5.00 pm, 20.04.2023
Batch 3: **12.00 to 1 noon, 21.04.2023**

Please come with simple graph papers and writing material.

Please go through the link
Virtual Labs (vlabs.ac.in)https://uorepc-nitk.vlabs.ac.in/exp/flow-through-packed-bed/

With Warm Regards
Dr. Sunil Jayant Kulkarni
Google scholar orcid academia
Researchgate Books linkedin
Twitter facebook page

Dr. Sunil J Kulkarni <sjkulkarni@git-india.edu.in>
to Satish

Wed, Apr 19, 2023, 10:17 AM

Please make necessary arrangements. Also photos of the session (Geotagged) are required.

× Virtual lab MTO - en20120661@ × | Pressure Calculation for Manome × | +

nitk.vlabs.ac.in/exp/flow-through-packed-bed/simulation.html

Flow through Packed Bed

ED BED

Demo | Data | Evaluation

0

EVALUATE

ic	Reynolds no.	Friction factor × 10^4

Reynolds no.	Friction factor x 10^4
8735.98658	0.00050
7018.54031	0.00060
5558.03481	0.00107
4178.66851	0.00097
3340.23016	0.00106

Activate

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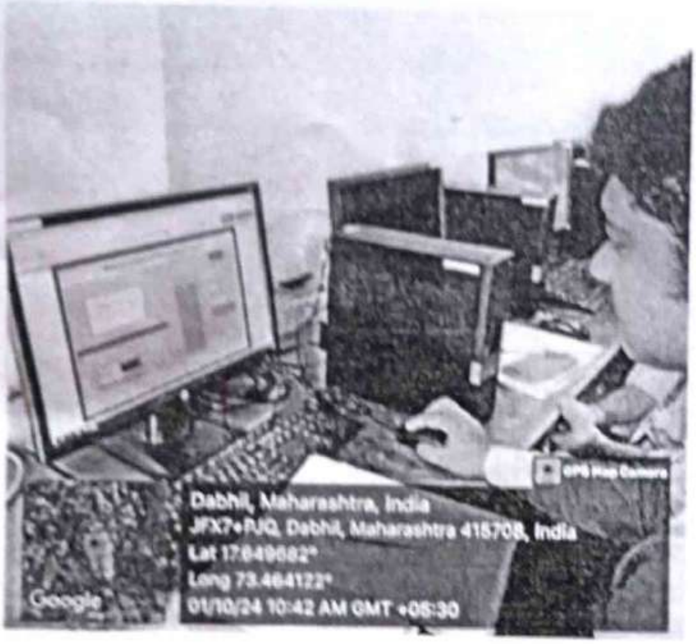
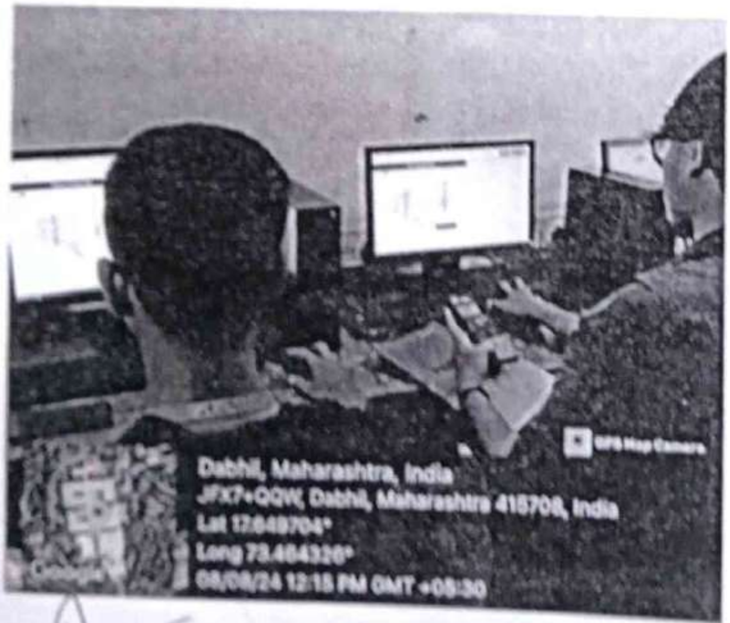
Report on virtual Lab- Fluid Flow Operations

Follwing experiments were conducted in virtual mode for fluid flow operations lab.

1. Venturimeter
2. Reynolds number
3. Stokes law





Mrs. S.P. Jadhav

Course Coordinator

Dr.S.J.Kulkarni

HOD,Chemical Engg. Dept

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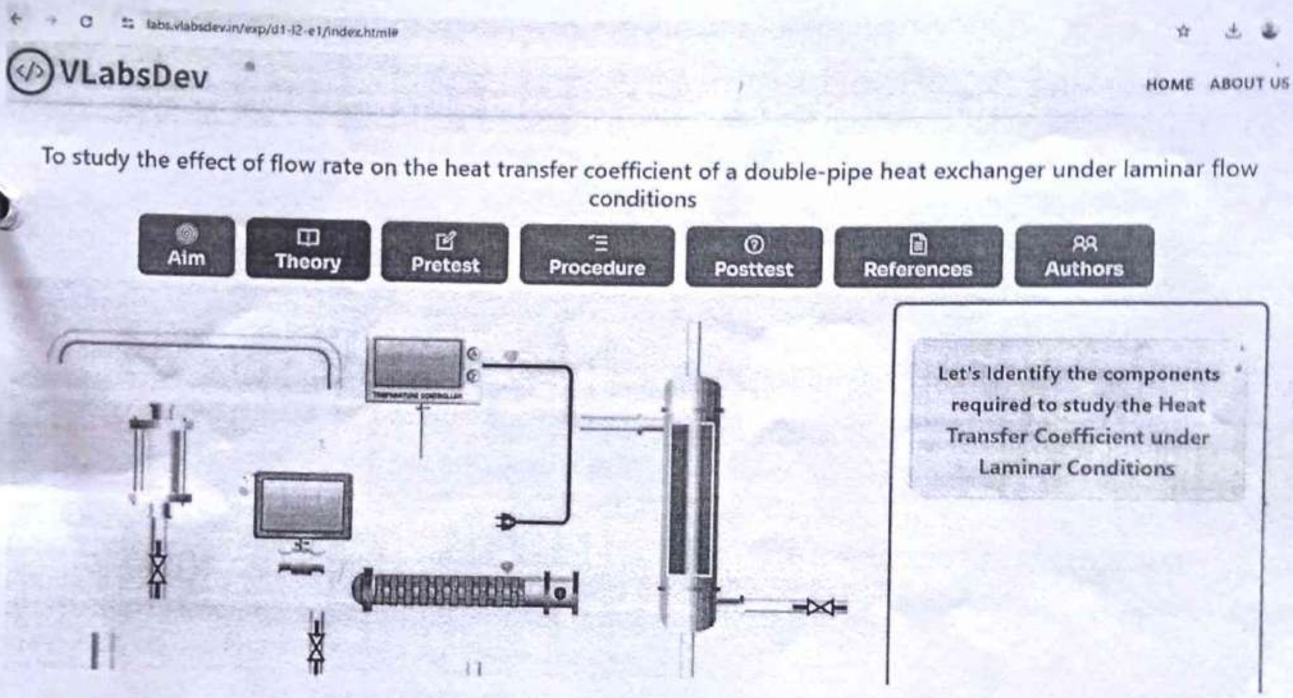
One Page Report for Virtual Lab

Aim: To study the effect of flow rate on the heat transfer coefficient of a double-pipe heat exchanger under laminar flow conditions.



Pre Test

Question 1: Which of these terms is associated with laminar flow?

A Eddies
B Stream lines
C Streak lines
D Contours

Question 2: Which of the following is more correct for turbulent flow?

A Efflux time
B Reynolds number
C Entry effect
D Eddies

C1 2023-24.

Exploring Saponification for Soap Preparation

Introduction:

The primary goal of this virtual lab is to delve into the saponification reaction, a fundamental process in soap preparation. Recognizing the importance of soaps and detergents in maintaining personal and public health, the experiment aims to provide chemical engineering students with practical insights into the synthesis of soap from fatty acids. Fatty acids, crucial components of plants, animals, and microorganisms, are explored in terms of their saturated and unsaturated forms.

Theory:

Fatty acids, characterized by a long hydrocarbon chain and a carboxyl group, are either saturated or unsaturated. Stearic and palmitic acids represent saturated fatty acids, while oleic and linoleic acids exemplify unsaturated fatty acids. Long-chain fatty acids exist as triglycerides in fats and oils, forming esters with glycerol. The distinction between plant and animal sources of fatty acids is highlighted, with plant-derived fats typically high in unsaturated and low in saturated fatty acids.

Saponification Process:

Soaps, sodium or potassium salts of long-chain fatty acids, are produced through the alkaline hydrolysis of triglycerides. The resulting soap molecules consist of a polar head (hydrophilic) and a non-polar hydrocarbon tail (hydrophobic). The saponification reaction is exothermic, liberating heat. Salting out of soap involves the precipitation of soap from the suspension by adding common salt.

Types of Soap:

Soaps are classified into hard soap (sodium salt of fatty acids) and soft soap (potassium salt of fatty acids). The former is suitable for laundry purposes, while the latter, producing more lather, is used in toiletries and shaving soaps. Soap solutions exhibit alkaline properties due to free alkali ions, rendering them slippery to the touch.

Learning Outcomes:

The virtual lab aims to achieve several learning outcomes for students, including understanding terms like soap, saponification, salting out, hard soap, and soft soap. Students also identify the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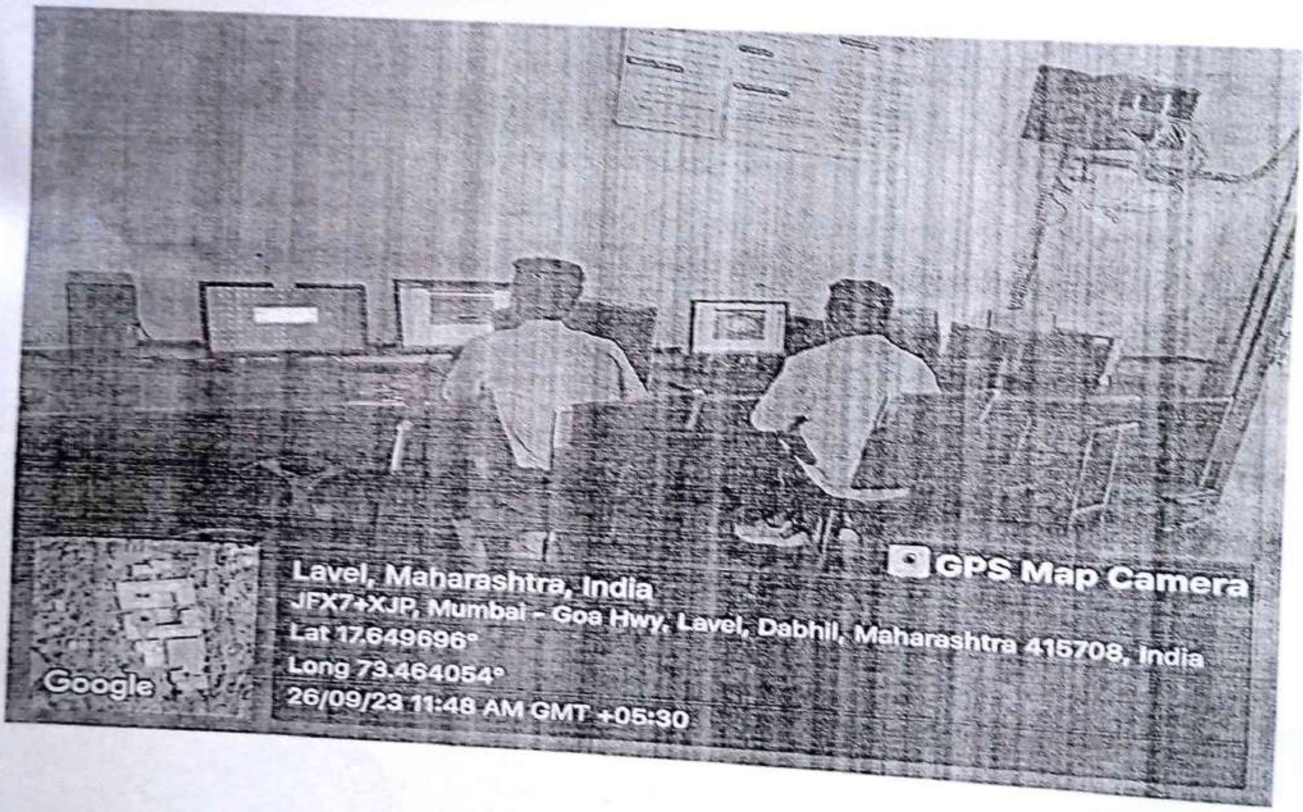
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Google

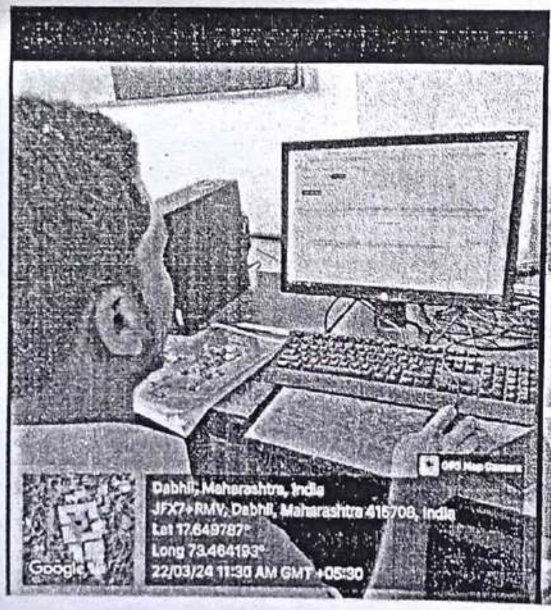
GHARDA INSTITUTE OF TECHNOLOGY GIT
At Post Lavel Tal Khed, Dist.Ratnagiri-415708 (MS)
Department of Chemical Engineering.

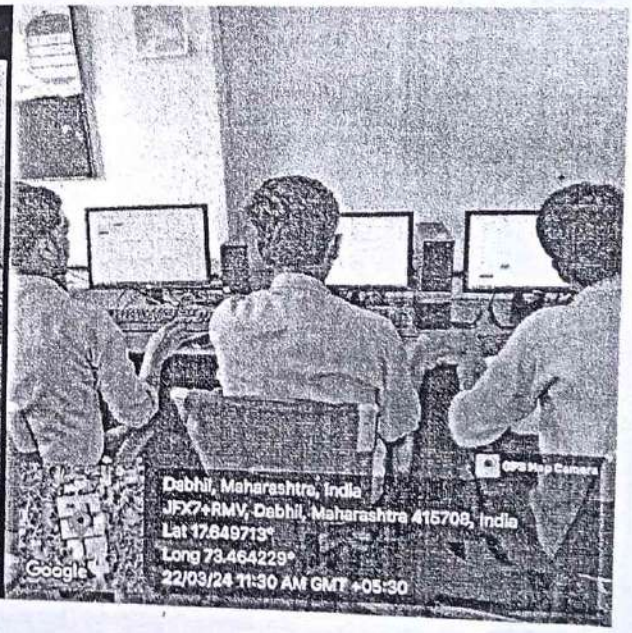
Date: 22nd March 2024

Virtual lab on Numerical Methods in Chemical Engineering

A virtual lab experiment was successfully conducted for the *Numerical Methods in Chemical Engineering* course, with a total of 27 students actively participating in the practical session. The experiment focused on key numerical techniques widely used in engineering problem-solving. Students performed six critical methods:

1. Bisection method
2. Newton Raphson method
3. Secant Method
4. Trapezoidal method
5. Simpsons 1/3rd rule
6. Simpsons 3/8 th rule





Subject teacher

Signature of HOD

Head
Department of Chemical Engineering
Gharda Institute of Technology
A/P. Lavel, Tal. Khed, Dist. Ratnagiri.

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At Post Lavel Tal Khed, Dist.Ratnagiri-415708 (MS)

Department of Chemical Engineering.

Date: 05th October 2023

Virtual lab on study of Venturimeter

A virtual lab experiment was successfully conducted for the Fluid Flow Laboratory, enabling students to explore key concepts in a simulated environment. A total of 17 students actively participated, gaining hands-on experience with fluid mechanics principles through interactive modules. The virtual setup provided a safe and cost-effective alternative to physical experiments while ensuring thorough understanding and engagement. Students appreciated the clarity of concepts and the flexibility of the virtual platform, making the session both educational and effective. Such initiatives highlight the integration of technology into modern engineering education.

Subject teacher

Signature of HOD

Head
Department of Chemical Engineering
Gharda Institute of Technology
A/P. Lavel, Tal. K... Dist. Ratnagiri.

2023-24
Virtual Lab.
ICE-II

Preparation of Sols

AIM:-

Sols are those colloidal systems where a solid is dispersed in liquid. Sols have also been classified as lyophobic colloids. Lyophobic sols cannot be prepared by simple mixing of dispersed phase and the dispersion medium. Two special techniques are employed for the preparation of lyophobic colloids: broadly classified as 'top-down' or 'dispersion' methods and 'bottom-up' or 'condensation' methods. In 'top-down' or 'dispersion' methods, larger macro-sized particles are broken down to colloidal size. On the other hand, in 'bottom-up' or 'condensation' methods particles of colloidal size are produced by aggregation of atoms, ions or molecules. We shall follow the 'bottom-up' or 'condensation' method to prepare Fe (OH)3 colloid.

THEORY:-

Preparation of a Sol: Fe(OH)3 Colloid

Fe (OH)3 colloid can be prepared in two ways: by peptization method and by hydrolysis method. In the peptization method, a freshly prepared precipitate is converted into colloidal solution by the addition of a suitable electrolyte. The electrolyte added acts as peptizing agent or dispersion agent by adsorbing onto the surface of tiny particles in precipitate and keeping them suspended in solution due to electrostatic repulsion. For example, if freshly prepared ferric hydroxide precipitate is shaken with a small quantity of FeCl3 (peptizing agent) solution, a dark reddish brown colloidal solution of Fe(OH)3 is formed. On the other hand, if a concentrated solution of FeCl3 is heated, hydrolysis occurs producing colloidal Fe(OH)3 particles and aqueous HCl. Some of HCl may escape as gas. The dark brown solution turns darker as a precipitate of Fe(OH)3 forms.

$$FeCl_3\ (aq) + 3H_2O\ (l) \rightarrow Fe(OH)_3\ (s) + 3HCl\ (aq)$$

To start the experiment do the following:

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Website: www.git-india.edu.in, Email: principal@git-india.edu.in

Date: 05/4/2024

Department of Chemical Engineering

Report on Virtual Laboratory

Subject: Chemical Reaction Engineering II

Class: TE Chemical (VI Sem)

URL: https://uorepc-nitk.vlabs.ac.in/exp/mixed-flow-reactor/index.html

Date of Conduction: 06/04/2024

Name of Experiment: Reaction Kinetics Studies in Mixed Flow Reactor

The simulation based experiment was conduccted to determine the rate constant for the saponification of ethyl acetate with NaOH at different temperatures using a mixed flow reactor(continuous stirred tank reactor).

$$CH_3COOC_2H_5\ (A) + NaOH\ (B) \rightarrow CH_3COONa + C_2H_5OH.$$

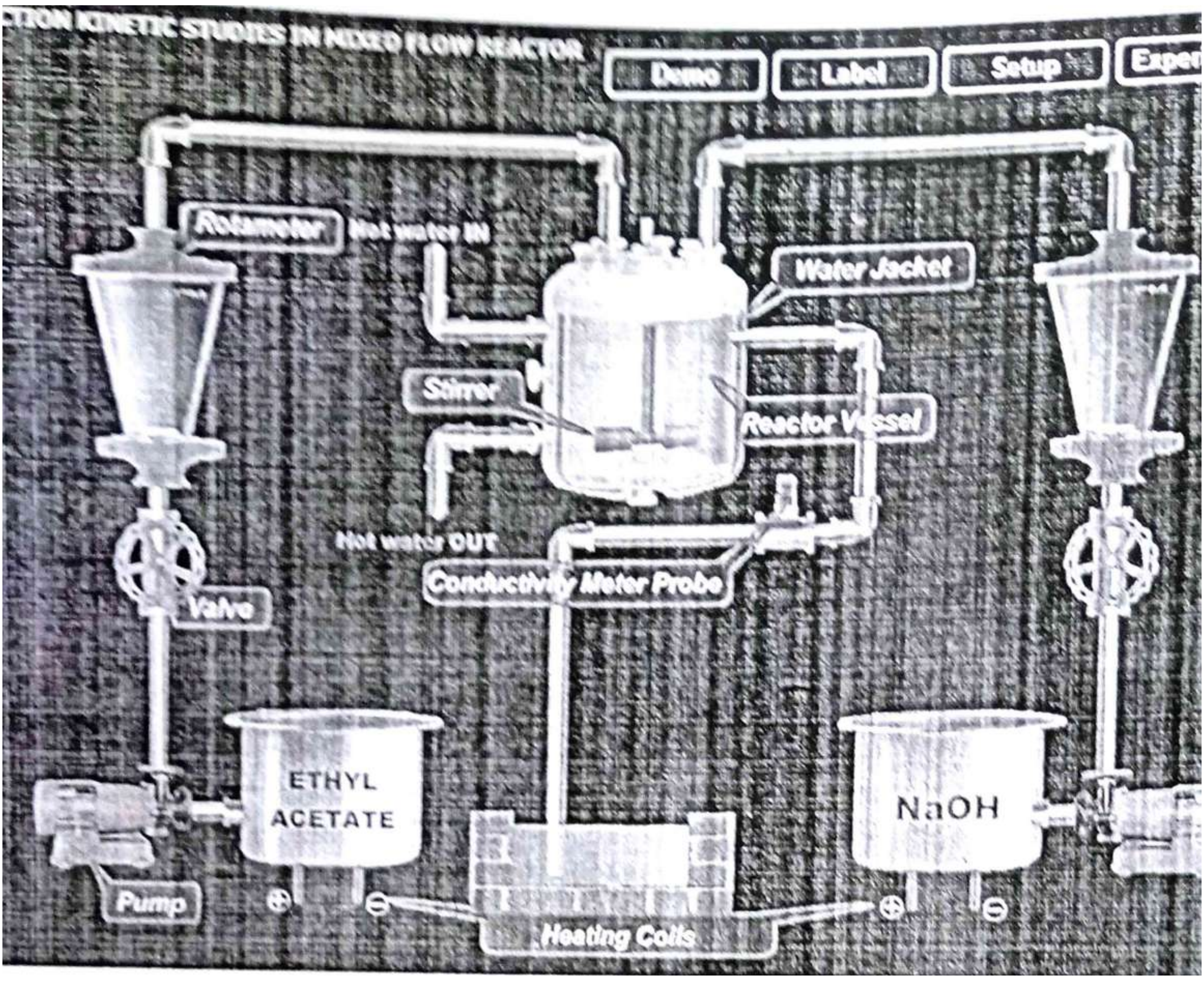
It is an elementary reaction. Ethyl acetate is the limiting reactant.

The continuous stirred-tank reactor (CSTR), also known as back mix reactor, is a common ideal reactor type in chemical engineering. Perfect mixing is assumed in case of Ideal CSTR .

In a perfectly mixed reactor, the output composition is identical to the composition of the material inside the reactor, which is a function of residence time and rate of reaction. The ideal CSTR model is often used to simplify engineering calculations and can be used to describe research reactors. In practice it can only be approached, in particular in industrial size reactors. Space tin is the time required to process one reactor volume of feed at specified condition. =V/volumetr flow rate of feed.

Students followed the procedure given on the portal and performed the simulation. The readings of conductivity were converted to concentration of NaOH and then the conversion was determined. Using the kinetic data, the rate constant of the reaction was determined. 28 students attended this virtual laboratory

Outcome: Students were able to perform the reaction and obtain the kinetic data. The students have successfully determined the kinetics of the reaction.


CTION KINETIC STUDIES IN MIXED FLOW REACTOR
Demo
Label
Setup
Exper
Rotameter
Hot water IN
Water Jacket
Stirrer
Reactor Vessel
Hot water OUT
Conductivity Meter Probe
Valve
ETHYL
ACETATE
NaOH
Pump
Heating Coils

REACTION KINETIC STUDIES IN MIXED FLOW REACTOR

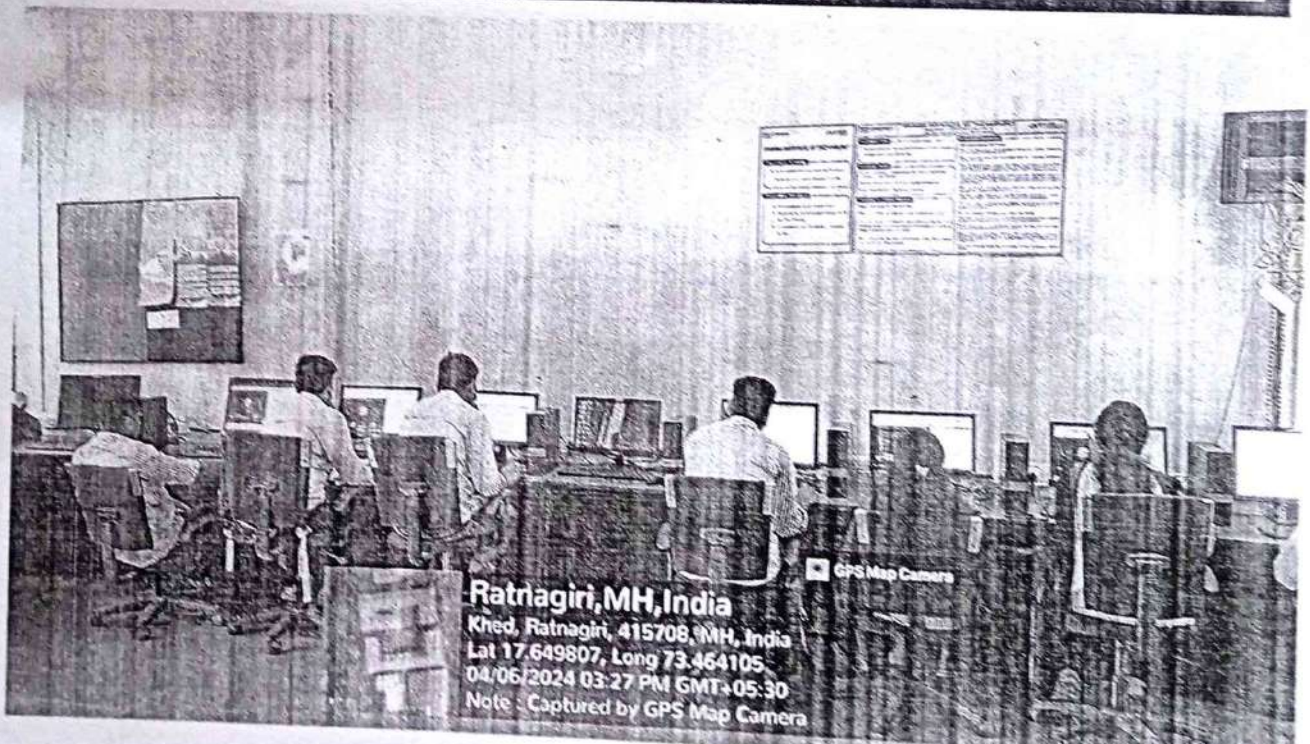
Demo | Label | Setup | Experiment

Observations

Ethyle Acetate Flowrate (Litre per Hour)	NaOH Flowrate (Litre per Hour)	Conductivity (milliSiemens/cm)
0.63	5.63	158.91
4.38	9.38	97.9
7.5	13.13	85.22
12.5	20.63	81.37
17.5	25.63	73.41

Remove Selected Readings | Clear all Readings | Email This Table

Experimental Data | Observations

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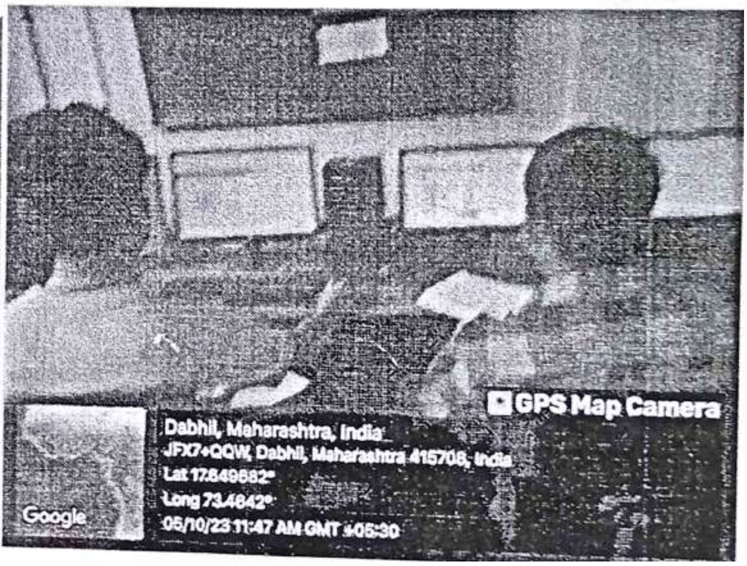
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Report on Video Lecture

Name of Course: Chemical Reaction Engineering II

Date: 20/04/2023

Topic: Fluid-Fluid Reactions –Cases and Concentration Profiles

URL: https://drive.google.com/drive/folders/1Y9pdJXeHAOr1shV4X1FPrqHsWX3x8GS6

The video lecture on Fluid-Fluid Reactions explored various cases and concentration profiles associated with interactions between different fluid systems. The lecture aimed to provide a comprehensive understanding of the dynamics involved in these reactions and their implications in various applications. The lecture commenced with an overview of fluid-fluid reactions, emphasizing their importance in chemical engineering, environmental science, and other related fields. The following cases of fluid-fluid reactions and their concentration profiles were discussed during the lecture,

- Instantaneous reaction with low concentration of liquid reactant
- Instantaneous reaction with high concentration of liquid reactant
- Fast reaction with low concentration of liquid reactant
- Fast reaction with high concentration of liquid reactant
- Intermediate reaction rate with low concentration of liquid reactant
- Intermediate reaction rate with high concentration of liquid reactant
- Slow reaction in main body of liquid, by considering resistances
- Slow reaction in main body of liquid, without resistances

The outcome of the video lecture is enriched understanding of fluid-fluid reactions, practical insights from case studies, identification of influencing factors, interactive learning through Q&A, and inspiration for further study of the topic. The educational value of the lecture is evident in the diverse perspectives and practical applications covered, contributing to the professional development of the students.

Dr. S. P. Tekade
Course Co-ordinator

SJK

TUTORED VIDEO INSTRUCTIONS

Aim: To facilitate self learning and better understanding of the concepts

- **Objective:**
- To make available learning resource for weak and absent students.
- To provide the learning experience according to students ability to absorb.
- To ensure that student remember important definitions and formulae by repeated exposure to the same topic.

Methodology;

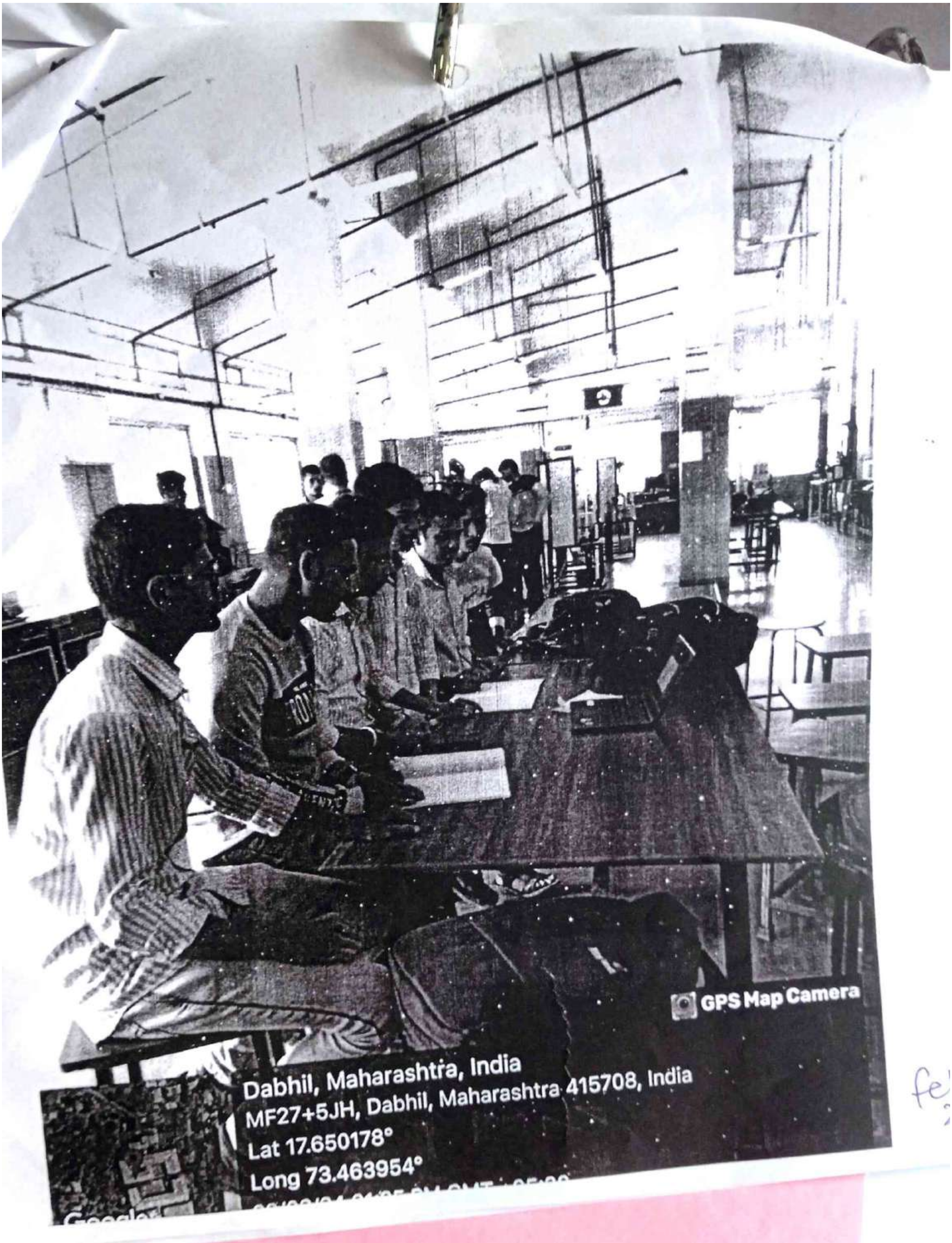
1. Videos of about 30-50 minutes will be sent to the students.
2. The students will be advised to watch them in the group of 5.
3. Students should pause the video every 5 minutes, discuss the concept for 2 minutes and then continue.
4. Students can choose the place and time.
5. Students will send geotagged photographs of the activity.
6. The discussion on the tutored video topic will be held in the class.
7. This methodology will be followed for the topic required deep understanding along with conventional teaching.

Outcome

- Weak students will understand the concepts better
- Group discussion will increase the communication skill and technical speaking proficiency.
- Students will be able to interact and discuss various aspects of the learnt topic.

S.J. Kulkarni

Head
Department of Chemical Engineering
Gharda Institute of Technology
A/P. Lavel, Tal. Khed, Dist. Ratnagiri.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1 of 25

EXPERIENTIAL LEARNING NANO

Nano - Exp. learning -

Fri, May 3, 2:41 PM (12 days ago)

Dr. Sunil J Kulkarni <sjkulkarni@git-india.edu.in>
to bechemical2324

IDENTIFY THE NANOMATERIALS YOU USE THROUGHOUT A DAY. AND FIND OUT THE NANOMATERIALS USED IN THAT APPLICATION. ALSO FIND THE FABRICATION METHOD FOR THAT. UPLOAD A ONE PAGE REPORT ON ABOVE THINGS .

here
https://forms.gle/jVbkfPtKJinByEGr6

With Warm Regards
Dr. Sunil Jayant Kulkarni
Asso. Professor, Chemical Engg. [EXT: 152]
Dean (R and D)
Gharda Institute of Technology
A/P - Lavel, Tal - Khed, District - Ratnagiri.
Pin code - 415 708.
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S.P.A.C.E. ★ Chemical Engineer ★ CHE

One Page Report for Experiential Learning

Aim: Heat Transfer through Conduction

Objective: The primary aim of this experiment is to understand the concept of heat transfer through conduction using a metal rod. By observing how heat moves from a hotter region to a cooler one, the experiment helps to visualize the process of conduction and the factors that affect it.

Materials Used:

- Aluminum Metal rod
- Heat source (e.g., burner)
- Thermometers or thermal sensors
- Heat-resistant gloves

Procedure:

1. The metal rod was secured with one end exposed to the heat source (burner) while the other end was left at room temperature.
2. The burner was ignited to provide a consistent heat source at one end of the rod.
3. Observations were made on how the temperature increased at different points along the rod over time.
4. If wax was used, it was placed at different points along the rod to visually indicate when the rod reached a temperature high enough to melt the wax.

Observations:

- Heat traveled from the heated end of the metal rod to the cooler end, demonstrating the conduction process.
- The temperature along the rod increased gradually, with the section closest to the heat source heating up first and the furthest point heating last.
- A visible change, like melting of the wax, indicated the progression of heat through the rod.

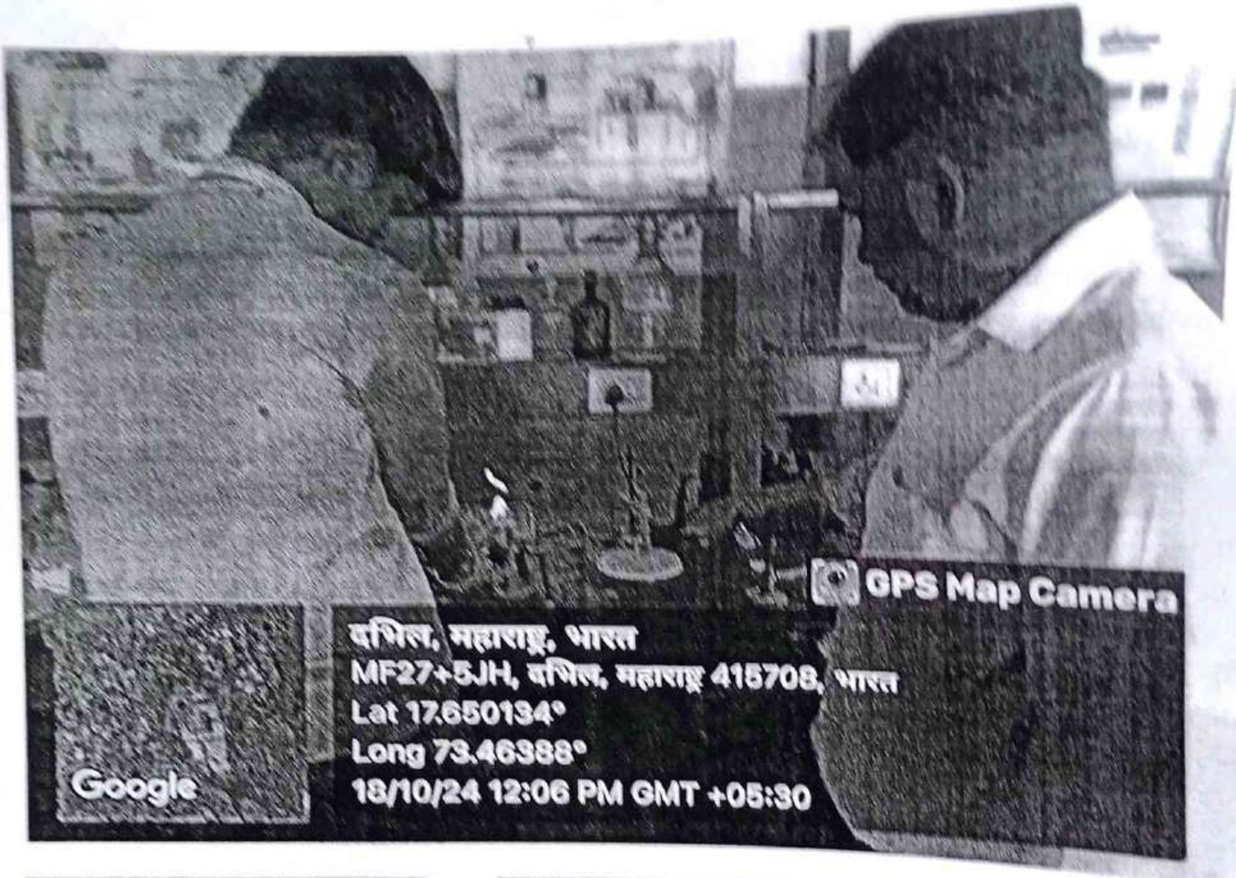
Results and Analysis:

- The experiment confirmed that heat transfer through conduction in metals occurs because of the kinetic energy of particles transferring energy to adjacent particles.
- Metals, due to their free-moving electrons, conducted heat more efficiently than other materials.
- A temperature gradient was observed, indicating that heat flows from the high-temperature region (near the heat source) to the lower temperature regions (farther from the heat source).

material to transfer kinetic energy, which is why metals are excellent conductors of heat. The experiment also reinforced the concept that materials with higher thermal conductivity will conduct heat faster than those with lower conductivity.

Applications:

Understanding heat conduction is crucial in everyday applications, such as the design of cookware, thermal insulation, and heat exchangers in



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Website: www.git-india.edu.in, Email: principal@git-india.edu.in

GIT/CHEM/IV/2023-24/

Date:- 19th March 2024

To,
The Manager,
CETP,
Lote - 415722

Subject:- Permission for one day Industrial Visit.

Dear Sir,

As you may be aware, Gharda Institute of Technology is one of the most reputed Engineering Institutions in Maharashtra and known for its excellent record in academics and co-curricular activities. The College offers Bachelor degree course in Chem, Extc, civil, Comp, IT, Mech. The state-of the-art facilities and competent faculty provide an excellent climate for the all-round development of the students.

As a part of the curriculum, the students are required to undertake Industrial Visits to a few industries of repute. We feel it will be fruitful that the students with academic background have a glimpse of the industry in order to have a better appreciation of practical applications of theory.

In the above background, we would like to send a batch of about 35 students of Chemical Engineering Department branch of third year accompanied by 2 staff members to visit your esteemed industry.

I request you, to kindly accord the necessary permission for the above visit and arrange for guiding the students.

We assure you that our students will observe the rules and regulations that are prescribed by your company for the visitors and will in no way disturb the functioning of the company during their visit.

We shall be grateful for a favorable response.

Thanking You,

Yours faithfully,

19/3/2024

HOD Chemical Engineering Department

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GHARDA INSTITUTE OF TECHNOLOGY
DEPARTMENT OF CHEMICAL ENGINEERING

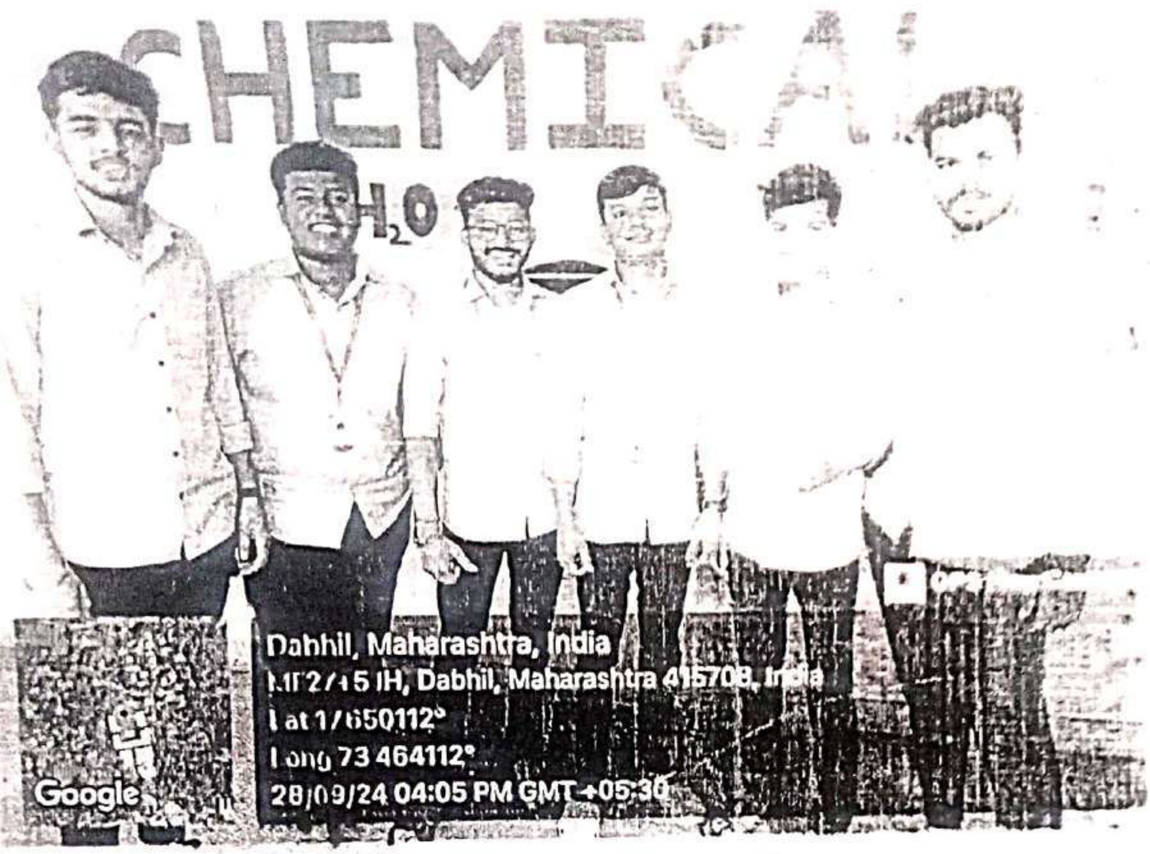
Experiential learning Methodologies
Subject: Mass Transfer Operations-I

Activity 1: Calculation of diffusion coefficient of acetone in open beaker at ambient temperature(Completed on 28.09.2024)

The diffusion of acetone in air involves the process by which acetone molecules spread out and mix with air molecules. Here are some key points about the process:

1. **Molecular Properties**: Acetone (C_3H_6O) is a small, volatile organic compound. Its low molecular weight and relatively high vapor pressure facilitate its diffusion in air.
2. **Concentration Gradient**: Diffusion occurs due to differences in concentration. Acetone will move from areas of higher concentration (e.g., near a spill) to areas of lower concentration until equilibrium is reached.
3. **Temperature Influence**: Higher temperatures increase the kinetic energy of the molecules, enhancing diffusion rates. Acetone evaporates more quickly in warmer environments.
4. **Factors Affecting Diffusion Rate**:
   - **Temperature**: Higher temperatures increase diffusion speed.
   - **Molecular Weight**: Lighter molecules diffuse faster.
   - **Air Movement**: Wind or ventilation can enhance diffusion by dispersing acetone more rapidly.

Procedure: Students are asked to take the difference in weight of acetone after 10 minutes intervals in different conditions of atmosphere. The loss in weight converted into flux and Mass Transfer coefficient is calculated and compared.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Experiment No. Experintial Learning Date :

Activity - 1

Observation Table :-

Time	Inner Acetone wt	Outer Aceton
0	62.25	61.450
10	61.097	57.686
20	60.309	53.945
30	59.380	50.246
40	58.343	45.521
50	57.265	41.124

Calculation :-

$P_{A_1} = 39.997$ kPa T = 303K Pt = 101.325

molecular wat = 58.08 A = 133.51×10^{-4} m^2

* for inner

1) $NA = \frac{\text{moles}}{\text{area} \times \text{Time}}$

$NA = \frac{62.25 - 61.097}{133.51 \times 10^{-4} \times 58.08 \times 600} = 2.47 \times 10^{-3} \frac{mo}{sec}$

$NA = \frac{62.25 - 59.350}{0.775 - 1600} = 2.05 \times 10^{-3} \frac{mol}{sec \cdot m^2}$

$NA = \frac{62.25 - 58.343}{0.775 \times 2400} = 2.03 \times 10^{-3}$

Result :- for Inner (in lab)

N_A (flux) $\frac{mol}{m^2 \cdot s}$	KG $\left(\frac{mol}{m^2 \cdot s \cdot kpa}\right)$	Ky $\left(\frac{mol}{m^2 sec}\right)$	KC = m/s
2.47×10^{-3}	5.17×10^{-5}	6.25×10^{-3}	0.156
2.08×10^{-3}	5.2×10^{-5}	5.26×10^{-3}	0.131
2.05×10^{-3}	5.12×10^{-5}	5.19×10^{-3}	0.129
2.09×10^{-3}	5.22×10^{-5}	5.29×10^{-3}	0.132
2.142×10	5.35×10^{-5}	5.426×10^{-3}	0.135

for Outer (In corridor)

N_A (flux) $\frac{mol}{m^2 \cdot s}$	KG $\left(\frac{mol}{m^2 \cdot s \cdot Kpa}\right)$	Ky $\left(\frac{mol}{m^2 \cdot sec}\right)$	K_G = m/s
8.09×10^{-3}	2.02×10^{-4}	0.020	0.512
8.06×10^{-3}	2.015×10^{-4}	0.0204	0.510
8.03×10^{-3}	2×10^{-4}	0.0203	0.508
8.39×10^{-3}	2.09×10^{-4}	0.0212	0.531
8.72×10^{-3}	2.18×10^{-4}	0.022	0.5518

Conclusion :-

In this ~~experimental~~ experiential learning activity we calculated molar flux & mass Transfer Coefficient in this we can see that molar flux is greater in corridor.

Virtual Lab.   BCE.

ChemReaX™ a chemical reaction modeling and simulation app from ScienceBySimulation

General Reactions | Acid Base Titrations | User Guide | FAQ | Tutorials | Exercises

Quick steps: • Click "Reaction Selector" to choose a pre-defined titration reaction or choose your own titrand and titrant • Enter the titrand and titrant concentrations, the initial volume of the titrand, and the total amount (volume) of titrant added • Click "Run the Reaction" to simulate the titration

Select Reactants	Search/select species using dropdown lists or choose a pre-defined reaction from Reaction Selector	Type	Initial Volume (L)	Total Amount Added (L)	Concentration (moles/L)	Equilibrium Constant, K
Analyte/Titrand	HCl	Strong Acid	0.5		0.5	100000
Reagent/Titrant	NaOH	Strong Base		0.5	0.5	100000

Run the Reaction | Clear All

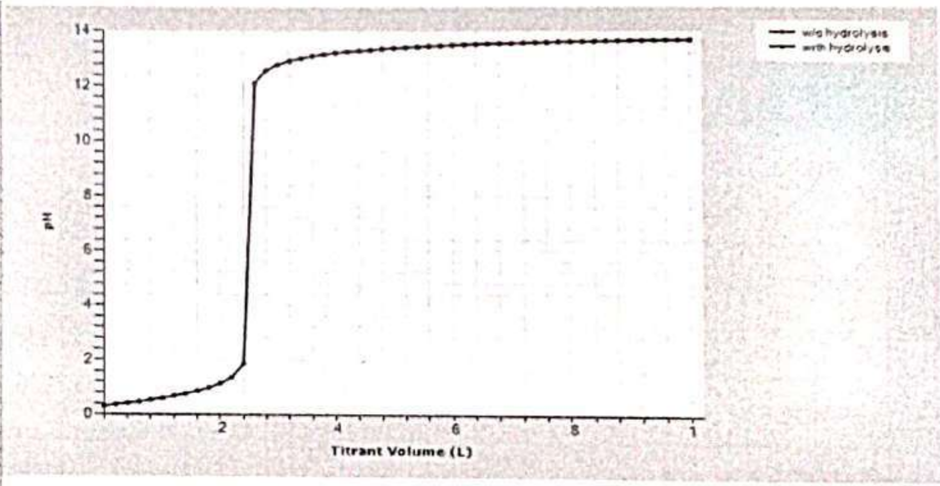
Reactions:

Titrand 1st ionization	HCl (aq)	+	<-->	H(+) (aq)	+	Cl(-) (aq)
Titrand 2nd ionization	n/a	+	<-->		+	
Titrant ionization	NaOH (aq)	+	--->	Na(+) (aq)	+	OH(-) (aq)
Water autoionization	H2O (liquid)	+	<-->	H(+) (aq)	+	OH(-) (aq)
Hydrolysis	n/a	+	<-->		+	
Hydrolysis	n/a	+	<-->		+	

K data from CRC Handbook of Chemistry and Physics

Simulated Titration: (@ T = 298.15K)

Titrant Volume (L)	pH	pH (no hydrolysis)
[illegible]	[illegible]	[illegible]



Innovative Experiment

Subject: Basic Chemical Engineering Lab

S.E. Chemical Engineering

Semester-III

Year:2024-25

Freezing Point Depression

Introduction: (Initial Observation)

In a hot summer day the ice-cream street vendor was making ice-cream, right in the street in a steel pot without a freezer or electricity. How could he produce such a cold environment to freeze milk and make ice-cream under the hot sun using some crushed ice?

Adding salt to ice to make it colder. Why does salt make the ice colder? Can other chemicals do the same?

Knowing how chemicals can modify freezing point or boiling point of liquids, can help us control the conditions or produce products that otherwise we would not be able to produce.

In this work you will study the effects of various solutes on the freezing points of water. Find out what property of a solute is effective in reducing the freezing point. Does freezing point depression have any thing to do with the amount of solute?

Information Gathering:
Study about the physical and chemical properties of salt and water. Find out how salt can reduce the freezing point of water. Read books, magazines or ask professionals who might know in order to learn about the relation between freezing point depression and other properties of solutes and solvents. Learn about mole, molal solutions and molar solutions. Keep track of where you got your information from.

Following are samples of information that you may find.

Mole is the amount equivalent to the atomic or molecular weight of the atom or

molecule in grams.

One mole sodium is 23 grams sodium. One mole water is 18 grams water. One mole Sodium Hydroxide is 40 grams sodium hydroxide.

A molality is the number of moles of solute dissolved in one kilogram of solvent.

To make a one molal solution of sodium chloride (NaCl) , measure out one kilogram of water and add one mole of the solute, NaCl to it. The atomic weight of sodium is 23 and the atomic weight of chlorine is 35. Therefore the formula weight for NaCl is 58, and 58 grams of NaCl dissolved in 1kg water would result in a 1 molal solution of NaCl.

Molarity is the number of moles of a solute dissolved in a liter of solution.

A molar solution of sodium chloride is made by placing 1 mole of a solute into a 1-liter volumetric flask. (Taking data from the example above we will use 58 grams of sodium chloride). Water is then added to the volumetric flask up to the one liter line. The result is a one molar solution of sodium chloride.`

Question/ Purpose:

What do you want to find out? Write a statement that describes what you want to do. Use your observations and questions to write the statement.

The purpose of this project is to compare different solutes for their effects on reducing the freezing point of water.

* I want to know which substance is a better anti-freeze for water? Water soluble substances have different chemical and physical properties. For example they are solids and liquids; They have different molecular weights, different densities, and different freezing points. I want to know which specific property of a substance causes a reduction in the freezing point of water.

Identify Variables:

When you think you know what variables may be involved, think about ways to change one at a time. If you change more than one at a time, you will not know what variable is causing your observation. Sometimes variables are linked and work together to cause something. At first, try to choose variables that you think act independently of each other.

The independent variable (manipulated variable) is the type of solute.

Dependent variable is the freezing point of the solution.

Constants are the mass water, mass of solute, and experiment procedures.

Hypothesis:
Based on your gathered information, make an educated guess about what types of things affect the system you are working with. Identifying variables is necessary before you can make a hypothesis.

Experiment Design:
Design an experiment to test each hypothesis. Make a step-by-step list of what you will do to answer each question. This list is called an experimental procedure. For an experiment to give answers you can trust, it must have a "control." A control is an additional experimental trial or run. It is a separate experiment, done exactly like the others. The only difference is that no experimental variables are changed. A control is a neutral "reference point" for comparison that allows you to see what changing a variable does by comparing it to not changing anything. Dependable controls are sometimes very hard to develop. They can be the hardest part of a project. Without a control you cannot be sure that changing the variable causes your observations. A series of experiments that includes a control is called a "controlled experiment."

Experiment 1: Compare the freezing point depression of water with same mass of different solutes.

Introduction: In this experiment same amounts of various solutes are added to water and the resultant freezing points of the solutions are determined.

Material:

Ice

Sugar (Sucrose, $C_{12}H_{22}O_{11}$)

Salt (NaCl)

ethylene glycol (commercial automotive antifreeze)

Other water soluble substance that you may want to test. For example you may want to add urea (a well known fertilizer), Isopropyl alcohol, or glycerin, to the list of material that you test.

Equipment:

test tubes

thermometer

400-mL beaker (or a 10 ounce Styrofoam cup)

100-mL graduated cylinder

stirring rod

Preparation of Ice Bath:

1. Fill the large beaker 3/4 full with ice.
2. Cover the ice with 1/4 to 1/2 inches of table salt.
3. Stir this ice-salt mixture with a stirring rod and make sure the temperature drops to at least -10°C.

Procedure:

1. Prepare a solution of NaCl by adding 10 grams of NaCl to 100 mL of water. Mix until all crystals dissolve.
2. Prepare a solution of sugar by adding 10 grams of sugar to 100 mL of water. Mix until all crystals dissolve.
3. Prepare a solution of ethylene glycol by adding 10 grams of antifreeze to 100 mL of water. Mix until all crystals dissolve.
4. Place a test tube that is 1/2 full of water in the ice bath.
5. Stir the water in the test tube gently with a thermometer while keeping track of the temperature.
6. When the first ice crystals appear on the inside wall of the test tube, record the temperature. This should be the freezing point of the liquid. (In this step water is the pure solvent).
7. Repeat steps 4-6 with the prepared NaCl, sugar and ethylene glycol solutions.
8. Record your results in your results table

Your results table may look like this:

Solute	Water (mL)	Solute (grams)	Freezing Point

None (pure Water)	100	0	
NaCl	100	10	
Sugar	100	10	
Ethylene Glycol	100	10	

Which substance is a better anti-freeze?

Experiment 2: Compare the freezing point depression of water with same moles of different solutes.

Introduction: In this experiment same number of moles (molecule grams) of various solutes are added to water and the resultant freezing points of the solutions are determined. In this way all solutions will have the same number of solute molecules. This experiment is based on the following information:

One mole of any substance consists of 6.022×10^{23} molecules of that substance. The number 6.02 times 10 to the 23rd is known as Avogadro's number.
For example:

- 18 grams of water contains 6.022×10^{23} water molecules.
- 58 grams of NaCl contains 6.022×10^{23} NaCl molecules.
- 342 grams of sucrose consists of 6.022×10^{23} molecules of sucrose.

To make a one mole solution of NaCl, you place one molecule gram of NaCl in a beaker and then add water to that to bring the volume to 1 liter. Molecular mass of NaCl is 58, so one molecule gram of NaCl is 58 grams of NaCl. To Calculate the molecular weight of any substance, you can add the atomic weights of the atoms that form one molecule of that substance. So the molecular weight of NaCl is calculated by adding the molecular weight of Sodium (23) and Molecular weight of Chlorine (35).

Material:

Ice

Sugar (Sucrose, $C_{12}H_{22}O_{11}$)

Salt (NaCl)

ethylene glycol (commercial automotive antifreeze, $C_2H_6O_2$)

Other water soluble substance that you may want to test. For example you may want to add urea (a well known fertilizer), Isopropyl alcohol, or glycerin, to the list of material that you test.

Equipment:

test tubes

thermometer

400-mL beaker (or a 10 ounce Styrofoam cup)

100-mL graduated cylinder

stirring rod

Preparation of Ice Bath:

1. Fill the large beaker 3/4 full with ice.
2. Cover the ice with 1/4 to 1/2 inches of table salt.
3. Stir this ice-salt mixture with a stirring rod and make sure the temperature drops to at least -10°C.

Procedure:

1. Prepare a solution of NaCl by adding 5.8 grams of NaCl to 100 mL of water. Mix until all crystals dissolve.
2. Prepare a solution of sugar by adding 34 grams of sugar to 100 mL of water. Mix until all crystals dissolve.
3. Prepare a solution of ethylene glycol by adding 6.2 grams of ethylene glycol to 100 mL of water. Mix until all crystals dissolve.
4. Place a test tube that is 1/2 full of water in the ice bath.
5. Stir the water in the test tube gently with a thermometer while keeping track of the temperature.
6. When the first ice crystals appear on the inside wall of the test tube, record the temperature. This should be the freezing point of the liquid. (In this step water is the pure

solvent).

7. Repeat steps 4-6 with the prepared NaCl, sugar and ethylene glycol solutions.

8. Record your results in your results table

Your results table may look like this:

Solute	Water (mL)	Solute (grams)	Freezing Point
None (pure water)	100	0	
NaCl	100	5.8	
Sugar	100	34	
Ethylene Glycol	100	6.2	

Which substance is a better anti-freeze when added at a ratio of 1 molecule gram to each Liter of water?

Experiment 3: (Optional)

I developed this experiment after observing the results of the previous experiment and gathering some more information. I learned that most solutions made by dissolving one mole solute in one liter of water have the same freezing point. In other words the freezing point depression of water is the same with one mole of any solute. The exceptions are the solutes that are very volatile and the solutes that ionize. The freezing point of water reduces by 1.86°C for each mole of a substance in 1 Kg of water. This ratio can be written as $\Delta T = (1.86)(m)$.

ΔT is the freezing point depression.

m is the molality of solution (the number of moles of solute added to 1 kg of water)

This is a very important piece of information because it can be used to determine the molecular mass (mole) of unknown substances. Often chemists try to identify an unknown substance. Knowing the molecular mass of an unknown can be very helpful in such identifications.

<u>Molecular Mass Determination From Freezing Point Depression</u>

1. Dissolve 10 grams of Urea in 100 mL of water.

2. Freeze this solution in the same manner as in the previous experiment. Be sure to record

the freezing point temperature.

3. Calculate the molecular mass of this solute based on the freezing point depression.

   $\Delta T = (1.86)(m)$

   $\Delta T = (1.86)[(\text{grams of solute} \div \text{Molecular mass}) \div \text{kg of water}]$

   $\text{Molecular mass of solute} = [(1.86)(\text{grams of solute})] \div [(\Delta T)(\text{kg of solvent})]$

   Since we used 10 grams of solute in 0.1 kg of water, we can write:

   $\text{Molecular mass of solute} = 186 \div \Delta T$

Cleanup:

All solutions may be flushed down the drain with plenty of water.

Molecular mass of solute = $186 \div \Delta T$

Materials and Equipment:

Material:

ice

Sugar (Sucrose, $C_{12}H_{22}O_{11}$)

Salt (NaCl)

ethylene glycol (commercial automotive antifreeze)

Equipment:

test tubes

thermometer

400-mL beaker (or a 10 ounce Styrofoam cup)

100-mL graduated cylinder

stirring rod

Since commercial antifreeze is primarily ethylene glycol, it is highly toxic and should not be ingested. The ice used in the experiment could become contaminated with antifreeze by accident; students should be warned not to eat the ice. Goggles must be worn throughout the experiment.

Results of Experiment (Observation):

Experiments are often done in series. A series of experiments can be done by changing one variable a different amount each time. A series of experiments is made up of separate experimental "runs." During each run you make a measurement of how much the variable affected the system under study. For each run, a different amount of change in the variable is used. This produces a different amount of response in the system. You measure this response, or record data, in a table for this purpose. This is considered "raw data" since it has not been processed or interpreted yet. When raw data gets processed mathematically, for example, it becomes results.

Results table:

Solute	Water (mL)	Solute (grams)	Freezing Point
None (pure water)	100	0	
NaCl	100	5.8	
Sugar	100	34	
Ethylene Glycol	100	6.2	

Following is a sample of some additional results from similar experiments and observations.

Note that the electrolyte molecules break down to ions, resulting an increase in the number of particles. That is why in the temperature depression formula suggested below, another variable (i) is added.

The freezing point of solutions depend upon the concentration of solute particles. The freezing points of water solutions are always lower than that of pure water. The change in freezing point caused by the presence of a solute dissolved in water can be calculated from the equation,

$\Delta T = (1.86)(m)(i)$,

where 1.86 is the molal freezing point depression constant for water, m is the molality of the solution, and i is the number of particles produced per formula unit.

Molality = moles of solute/kg solvent

Since freezing point depression depends upon the number of particles in solution, a one molal solution of an electrolyte (NaCl), which dissociates in water, lowers the freezing point more than a one molal solution of a non-electrolyte (sucrose). The freezing point of a one molal solution of NaCl is actually -3.37°C, only 1.81 times that of a non-electrolyte, not the -3.62°C that would be expected if NaCl molecules were completely dissociated. This difference is believed to be due to the inter-ionic attractions that prevent the ions from behaving as totally independent particles. The activity or effective concentration of the ions is less than what we expect from the actual concentration. Some of the ions may exist as solvated units called ion pairs. The more dilute the solution of an electrolyte, the more widely separated are the ions, and less are the interionic attractions,. Consequently, the effective ion concentration closely approaches the actual ion concentration.

Calculations:
Write your calculations in this section of your report.

Summary of Results:
Summarize what happened. This can be in the form of a table of processed numerical data, or graphs. It could also be a written statement of what occurred during experiments.

It is from calculations using recorded data that tables and graphs are made. Studying tables and graphs, we can see trends that tell us how different variables cause our observations. Based on these trends, we can draw conclusions about the system under study. These conclusions help us confirm or deny our original hypothesis. Often, mathematical equations can be made from graphs. These equations allow us to predict how a change will affect the system without the need to do additional experiments. Advanced levels of experimental science rely heavily on graphical and mathematical analysis of data. At this level, science becomes even more interesting and powerful.

Conclusion:
Using the trends in your experimental data and your experimental observations, try to answer your original questions. Is your hypothesis correct? Now is the time to pull together what happened, and assess the experiments you did.

Related Questions & Answers:
What you have learned may allow you to answer other questions. Many questions are related. Several new questions may have occurred to you while doing experiments. You may now be able to understand or verify things that you discovered when gathering information for the project. Questions lead to more questions, which lead to additional hypothesis that need to be tested.

Possible Errors:
If you did not observe anything different than what happened with your control, the variable you

changed may not affect the system you are investigating. If you did not observe a consistent, reproducible trend in your series of experimental runs there may be experimental errors affecting your results. The first thing to check is how you are making your measurements. Is the measurement method questionable or unreliable? Maybe you are reading a scale incorrectly, or maybe the measuring instrument is working erratically.

If you determine that experimental errors are influencing your results, carefully rethink the design of your experiments. Review each step of the procedure to find sources of potential errors. If possible, have a scientist review the procedure with you. Sometimes the designer of an experiment can miss the obvious.

References:

Holtzclaw, H.F., Robinson, W.R., and Nebergall, W.H.,*College Chemistry with Qualitative Analysis*, D. C. Heath and Company, Lexington, MA, 1984, p. 359. This work discusses colligative properties.

http://www.oswego.edu/wsep/fp-s.htm

Molarity, Molality and Normality
http://genchem.rutgers.edu/mw5exp.html
Demonstrating molar mass determination
http://genchem.rutgers.edu/mwfp.html
http://wwwchem.csustan.edu/chem1112/mwfpdep.htm
Molecular weight by freezing point depression

https://www.scienceproject.com/projects/intro/Senior/SC029.asp

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A/P: LAVEL, TAL.KHED, DIST.RATNAGIRI.
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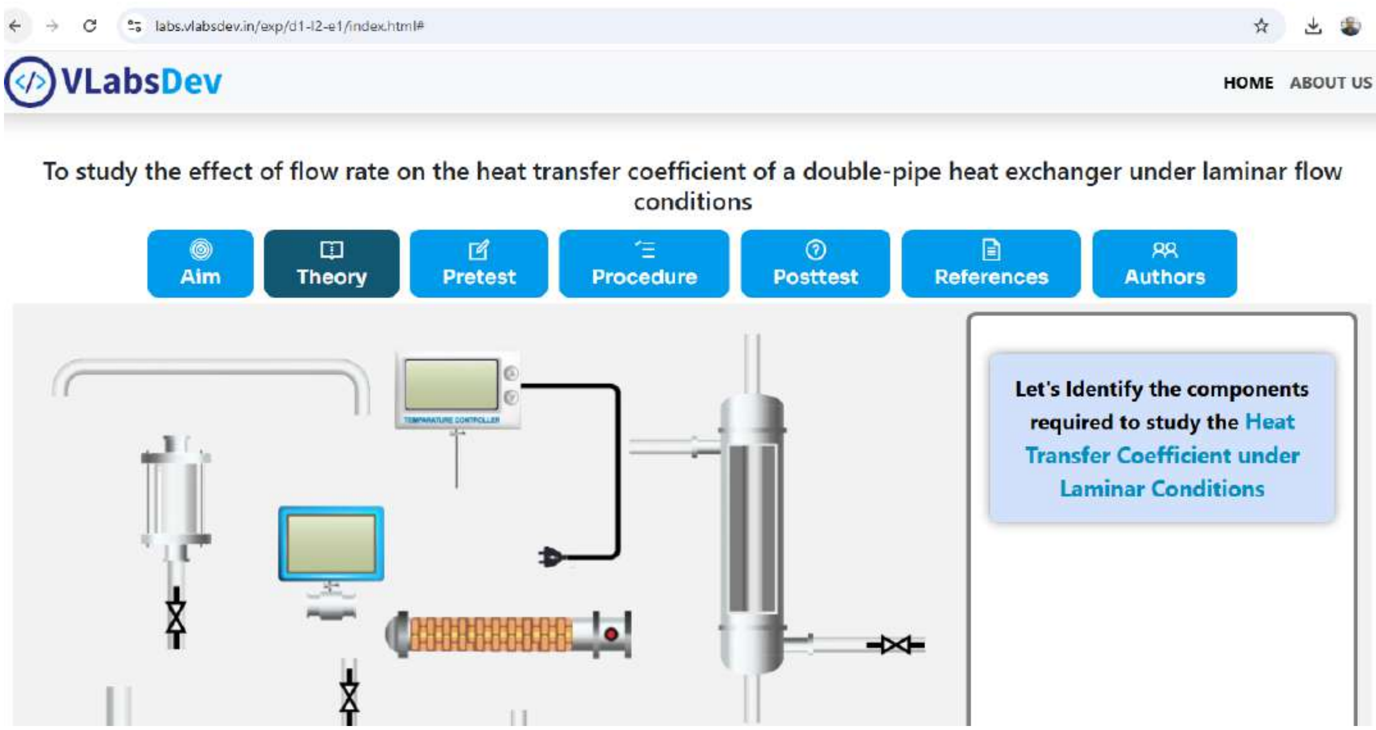
One Page Report for Virtual Lab

Aim: To study the effect of flow rate on the heat transfer coefficient of a double-pipe heat exchanger under laminar flow conditions.



Pre Test

Question 1: Which of these terms is associated with laminar flow?

A Eddies

B Stream lines

C Streak lines

D Contours

Question 2: Which of the following is more correct for turbulent flow?

A Efflux time

B Reynolds number

C Entry effect

D Eddies

Question 3: Which of the following is more correct for Laminar flow?

A ○ Parabolic profile

B ○ Stokes law

C ○ Boundary layer

D ○ Efflux time

Question 4: Which of the following is more appropriate for Reynolds experiment?

A ○ Radial dispersion

B ○ Dye

C ○ Axial dispersion

D ○ Diffusion

Question 5: Which of the following is more appropriate for Turbulent flow?

A ○ Hagen-Poiseuille

B ○ Fanning

C ○ Darcy

D ○ Both b & c

Procedure

1. The components of the experimental set-up will be displayed on the screen. Based on the item displayed as 'text' click on the correct component. Hints will be provided for wrong selection. Points will be deducted for the hints provided.
2. The components of the experimental set-up will be displayed on the screen. They have to be dragged and dropped at the requisite locations to assemble the experimental set-up. Hints will be provided for wrong selection. Points will be deducted for the hints provided.
3. A new screen with the dimensions of the heat exchanger will appear. Based on these, the user should calculate the inside heat transfer area, equivalent diameter of annulus, cross-sectional area of inner tube and annulus respectively. Points will be deducted for the hints provided.
4. Click on the C.W. valve to open it fully.
5. Click on the glass section valve to open it.
6. Move the slider to the first division.
7. Click on the Power Button 'P' to switch on the pump.
8. Click on Power Button 'H' to switch on the heater.
9. Click on Set Temperature to select the temperature.
10. Click on the GREEN Button of the Timer to start and wait for 15 min (900 s) to attain steady state.
11. Click on the RED Button to stop the timer when the Timer shows 900 s.
12. Click on the Glass Section valve to close it and immediately click on the GREEN Button of the timer to start it.

13. Click on the RED Button to stop the timer when the fluid in the glass section reaches the arrow level.
14. Click on the Glass Section valve to open it.
15. Click on the RESET Button of the Timer.
16. Enter the Hot and Cold fluid inlet and outlet temperatures along with the time in the Table displayed on the screen.
17. Repeat the steps from 6 to 16 for 2nd to 8th slider positions.
18. The table with the fluid properties will be displayed on the screen along with the areas and equivalent diameter calculated earlier. Also, a table with the temperatures and time along with the various entities to be calculated will be displayed.
19. The various entities namely, v, u, m, Q, LMTD and U have to be calculated. The formulae for the same shall be visible by moving the cursor on the headings of the respective columns.
20. After entering the calculated value, click on the CAL Tab. If the value is correct, proceed for the next calculation, else a message RECALCULATE will appear.
21. Click on NEXT for the next screen to appear.
22. Additional quantities need to be calculated and entered in the table displayed. The formulae for the same shall be visible by moving the cursor on the headings of the respective rows. After each calculation click on the CAL Tab. If the value is correct, proceed for the next calculation, else a message RECALCULATE will appear.
23. Click on NEXT for the next screen to appear.
24. Two additional tables for calculating Prandtl number, Reynold's number along with heat transfer coefficients will be displayed. The formulae for the same will be visible by moving the cursor on the respective headings. After each calculation click on the CAL Tab. If the value is correct, proceed for the next calculation, else a message RECALCULATE will appear.
25. A CAUTION or ERROR message may be displayed if the value of Reynold's number exceeds the laminar flow range.
26. Click on NEXT for the next screen to appear.
27. Based on the table showing m, hi_exp and hi_theo, plot a graph by clicking on PLOT GRAPH tab.
28. Select the data for x and y axis respectively for experimental and theoretical data points.
29. Based on the plot displayed, the tabs Is Deviation Observed? YES/NO will appear. Click on the appropriate tab.

CERTIFICATE

This is to certify that the project entitled **"PREPARATION OF TOPICAL SOLUTION OF MINOXIDIL API FOR THE PURPOSE OF HAIR REGENERATION"** is a bonafide work of **Mr. Gaikwad Vaibhav Santosh, Mr. Warvatkar Chaitanya Suresh, Mr. Kadav Dipesh Dipak** under guidance of prof. **S. J. Kulkarni** in Gharda Institute of Technology, Lavel submitted to the University of Mumbai in partial fulfillment of the requirement for the award of degree of **Bachelor of chemical Engineering** in academic year of 2023-24.

Dr. S. J. Kulkarni	**Dr. S. P. Tekade**
PROJECT GUIDE	**HEAD OF DEPARTMENT**
EXTERNAL EXAMINER	**Dr. P. B. Patil**
	PRINCIPAL

DATE:

PLACE: Gharda Institute of Technology, Lavel

MONTAGE CHEMICALS PVT. LTD.

FACTORY : W-38, M.I.D.C. AREA MORIVALI, AMBARNATH (W) - 421 505
TEL : 2171 3174 / 2173 3175 • FAX : 91-22-2173 3173 • Email : [illegible]

[illegible]/2023

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Mr. **Chaitanya Suresh Warvatkar** of Gharda Institute of Technology (GIT) has successfully completed his internship at our Ambernath location (W-38, MIDC Morivali, Ambernath, Dist. Thane, 421505, MH) from 31/05/2023 till 16/06/2023.

His conduct during the period of the internship was good and he took interest in his work.

For **Montage Chemicals Pvt. Ltd.**

Sunita Wable
Head- HR
Email: [illegible]

1. Audio/Video Tools

sites.google.com/git-india.edu.in/mto1-5chemical/home

INTRODUCTION

Subject Teacher : Dr Sunil Jayant Kulkarni

Qualification : phD chemical Tech

Contact : 9833497367

Email : mto1@git-india.edu.in

Notification

- 1. Quiz is scheduled on 7.9.2020 @10am.

Prerequisites

1. Knowledge of chemistry, physics, physical chemistry, mathematics.
2. Knowledge process calculations (Material and energy balance).
3. Basics of unit operations.
4. Basic understanding of equilibrium.
5. Understanding of physical and chemical properties of compounds.
6. Students should have basic knowledge of properties such as heat capacity, enthalpy, sensible heat and SI system of units.

Objectives

1. To understand the basic principles of mass transfer by diffusion in gases, liquids and solids.
2. To understand types of mass transfer coefficients and then the basic of interphase mass transfer.
3. To understand the operations of various equipment's used for gas-liquid contact.
4. To understand the gas absorption, absorption with chemical reaction.
5. To study drying and draw drying curve and calculate time of drying. To study working principles of different types of dryers.
6. To study humidification-dehumidification and calculations for number of stages, HTU, NTU and HETP.

Course Outcomes

1. The students will be able to understand the molecular diffusion, classification of various mass transfer operations and their principles.
2. Students will be able to determine mass transfer coefficients.
3. Students will be able to determine interfacial concentrations, overall and individual mass transfer coefficients.
4. Students will be able to select contact pattern/equipment for absorption, drying, humidification and perform calculation for HTU, NTU, HETP.
5. Students will be able calculate number of stages, minimum solvent requirement for gas absorption.
6. Students will be able to determine time of drying and understand the concept efficiency of cooling tower, adiabatic saturation and perform calculations for cooling tower.

DOWNLOAD

- Syllabus
- Teaching plan 2023-24
- Execution plan 202324
- Syllabus sem V/VI R19
- Teaching plan 2022-23
- Practical plan 2022-23
- Teaching plan
- Teaching plan 2021-22

QUESTION PAPERS

- MU Dec 18, QP

VIDEOS / LECTURES 2021-22

- 1 introduction
- 2 Molecular diffusion-Ficks law
- 3 Steady state molecular diff for fluids and rese and in laminar flow
- 4 Diffusion of liquids
- 5 Diffusivity of liquids/gases
- 6 Problems on equimolar counter diff and diff. of A thru non diffusing B
- 7 Calculation of diffusivity
- 8 Diffusion through solids
- 9 Mechanism-diffusion through solids
- 10 Masstransfer coefficients-fundamentals
- 11 Convectivemass transfer coefficient
- 12 Theoriesof mass transfer
- 13 Interfacemass transfer
- 14 Problemson Interface mass transfer
- 15 Equationof continuity
- 16 Contactpatterns
- 17. Problems-- contact patterns
- 18.Problem-counter current pattern
- 19.Analogies
- 20. mass transfer equipments, classifications, principles, choice
- 21.equipment for gas liquid contacts- tray towers
- 22. Equipments- liquid dispersed gas continuous
- 23.Gas absorption introductionDVtvFB0/view?usp=sharing
- Class test 1
- 24.Gas absorption
- 25.Absorption(packed bed problem)

GHARDA FOUNDATION — GIT

GHARDA INSTITUTE OF TECHNOLOGY

DEPARTMENT OF CHEMICAL ENGINEERING

Experiential learning Methodologies
Subject: Mass Transfer Operations-I

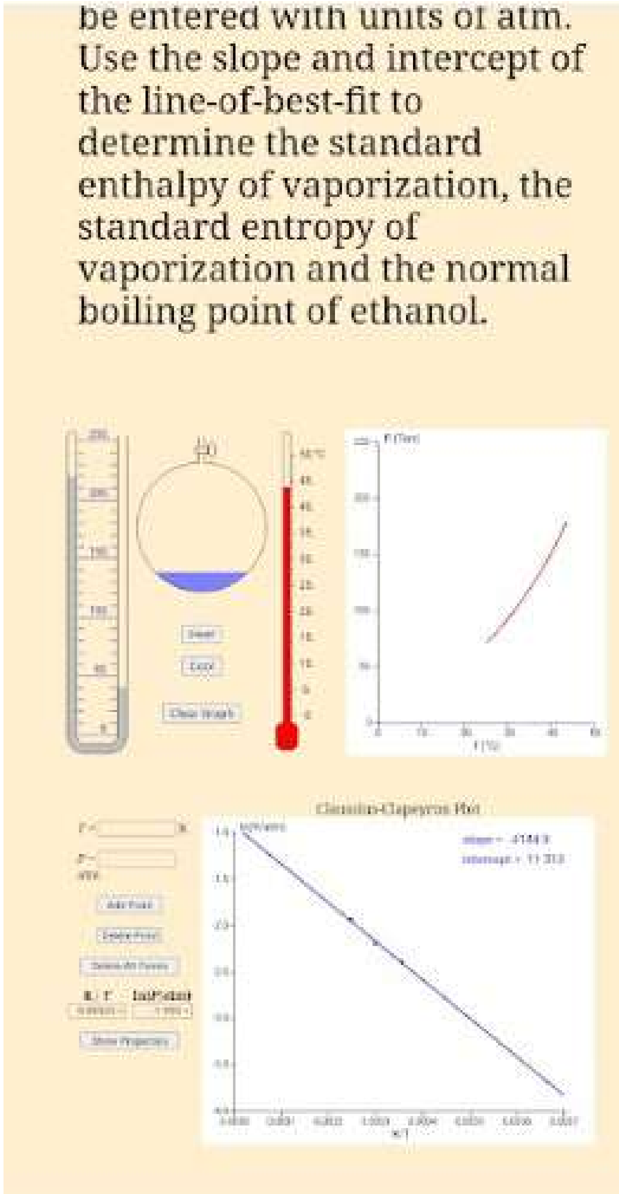
Activity 1: Calculation of diffusion coefficient of acetone in open beaker at ambient temperature(Completed on 28.09.2024)

The diffusion of acetone in air involves the process by which acetone molecules spread out and mix with air molecules. Here are some key points about the process:

1. **Molecular Properties**: Acetone (C_3H_6O) is a small, volatile organic compound. Its low molecular weight and relatively high vapor pressure facilitate its diffusion in air.
2. **Concentration Gradient**: Diffusion occurs due to differences in concentration. Acetone will move from areas of higher concentration (e.g., near a spill) to areas of lower concentration until equilibrium is reached.
3. **Temperature Influence**: Higher temperatures increase the kinetic energy of the molecules, enhancing diffusion rates. Acetone evaporates [illegible] in warmer environments.
4. **Factors Affecting** Diffusion Rate:
   - **Temperature**: Higher temperatures increase diffusion [illegible]
   - **Molecular Weight**: Lighter molecules diffuse faster.
   - **Air Movement**: Wind or ventilation can enhance [illegible] dispersing acetone more rapidly.

Procedure: Students are asked to take the difference in weight of acetone after 10 minutes **intervals in different** conditions of atmosphere. The loss in weight [illegible] converted into **flux and Mass** Transfer coefficient is calculated and [illegible]

Virtual Laboratories



Innovations in teaching learning

Use of recorded videos for better understating, use of Google tools for module wise tests, industrial projects, paper writing, Use of online content like notes, video lectures, notes. In corporation of videos, experiential learning, video lectures for content delivery, Virtual experiments, video lectures, panel discussion, tutored video lectures, models, charts, simulation based projects.

2023-24

Use of recorded videos for better understating, use of Google tools for module wise tests, industrial projects, paper writing, Use of online content like notes, video lectures, notes. In corporation of videos, NPTEL video lectures for content, Experiment conduction under different conditions.

2022-23

E-learning, video lectures and experiments through Google meet (recorded), online examinations, orals, online Industrial visits, online submissions, video lectures, Review paper guidance.

2021-22