MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE GWALIOR(M.P.)

CHEMICALENGINEERINGDEPARTMENT

Volume7/Issue 2 April 2024–June 2024

VISION

To be a leader in Chemical Engineer
The challenges of process

Industries needsand societal

MISSION

Share state of the art knowledge and

To adopt good pedagogical practices

order excellence. achieve

Develop research culture and create

ABOUTTHE DEPARTMENT

The Chemical Engineering Department was started in 1996 it offers B.E. and MTech. Courses in Chemical Engineering. Department was started with 30 students in undergraduate but latter on realizing the importance and need for Chemical Engineers, intake capacity raised to 60 in 2013-14. MTech. Course was started in 2013-14 with specialization in Chemical Engineering. The Department started with vision developing itself into academic excellence in Chemical Engineering and associated areas in order to develop competitive professionals and experts having knowledge, skills and attitude to serve the society and nation.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

PEO1: Develop innovative products and services in the field of Chemical Engineering and Allied Engineering disciplines.

PEO2: Make use of Chemical Engineering with modern experimental and computational skills in higher education and research.

NPTEL /ATAL/ COURSERA/ INTERNSHALA COURSE ATTENDED BY THEFACULTY

Coures	NameofFaculty	DetailsofCourse
NPTEL COURSES	Prof. Anish P. Jacob	1. Got Elite Certificate in the 12 week NPTEL Course on “Surface Facilities for Oil and Gas Handling” in April 2024.
	Prof. Shivangi Sharma	1. Got Elite + Silver Certificate in the 08 week NPTEL Course on “Waste to energy Conversion” in April 2024.

Elite

NPTEL Online Certification

(Funded by the MoE, Govt. of India)

This certificate is awarded to

ANISH P JACOB

for successfully completing the course

Surface Facilities for Oil and Gas Handling

with a consolidated score of **60** %

Online Assignments	20.78/25	Proctored Exam	39.14/75

Total number of candidates certified in this course: **22**

Devendra Jalihal

Prof. Devendra Jalihal
Chairperson,
Centre for Outreach and Digital Education, IITM

Jan-Apr 2024

(12 week course)

Prof. Andrew Thangaraj
NPTEL, Coordinator
IIT Madras

Indian Institute of Technology Madras

FREE ONLINE EDUCATION swayam शिक्षित भारत, उन्नत भारत

Roll No: NPTEL24OE03S1169500006 To verify the certificate No. of credits recommended: 3 or 4

Elite

NPTEL Online Certification

(Funded by the MoE, Govt. of India)

This certificate is awarded to

SHIVANGI SHARMA

for successfully completing the course

Waste to Energy Conversion

with a consolidated score of 75 %

Online Assignments	24.58/25	Proctored Exam	49.98/75

Total number of candidates certified in this course: 924

Prof. Kaushik Ghosh,
Professor(Chemistry)
Coordinator CEC

Jan-Mar 2024

(8 week course)

Prof. Ranjana Pathania,
Professor (BSBE)
Coordinator (NPTEL)

Indian Institute of Technology Roorkee

swayam

Roll No: NPTEL24CH29S449000924 To verify the certificate No. of credits recommended: 2 or 3

FDP/STC ATTENDED (OUTSIDETHE INSTITUTE)

Coures	NameofFaculty	DetailsofCourse
FDP/STC ATTENDED BY NPTEL COURSE	Prof.AnishP.Jacob	1. Got FDP certificate for completing the 12 weeks NPTEL course on "Surface Facilities for Oil and Gas Handling" in April 2024.
	Prof Shivangi Sharma	1. NPTEL Faculty Development program on "Waste To Energy Conversion"(Jan-March2024,8 weeks)Elite 75%

NPTEL-AICTE
Faculty Development Programme

(Funded by the MoE, Govt. of India)

This certificate is awarded to

ANISH P JACOB

for successfully completing the course

Surface Facilities for Oil and Gas Handling

with a consolidated score of **60** %

Prof. Andrew Thangaraj
NPTEL Coordinator
IIT Madras

(Jan-Apr 2024)

Roll No: NPTEL24OE03S1169500006 Duration of NPTEL course : 12 Weeks

The candidate has studied the above course through MOOCs mode, has submitted online assignments and passed proctored exams.
This certificate is therefore acceptable for promotions under CAS as per AICTE notifications dated 16th Nov, 2023, similar to other refresher / orientation courses.
F.No. AICTE / RIFD / FDP through MOOCs / 2023

NPTEL-AICTE
Faculty Development Programme

(Funded by the MoE, Govt. of India)

This certificate is awarded to

SHIVANGI SHARMA

for successfully completing the course

Waste to Energy Conversion

with a consolidated score of **75** %

Prof. Andrew Thangaraj
NPTEL Coordinator
IIT Madras

(Jan-Mar 2024)

Roll No: NPTEL24CH295449000924 Duration of NPTEL course : 8 Weeks

The candidate has studied the above course through MOOCs mode, has submitted online assignments and passed proctored exams.
This certificate is therefore acceptable for promotions under CAS as per AICTE notifications dated 16th Nov, 2023, similar to other refresher / orientation courses.
F.No. AICTE / RIFD / FDP through MOOCs / 2023

National or International Paper Publications SCI/UGC/SCOPUS with DOI number

Name of Faculty: Dr. Shourabh Singh Raghuwanshi
Research Title: Valorization of citrus waste using reactive distillation for sustainable biodiesel production- 30 April 2024
https://doi.org/10.1016/j.cdc.2024.101141

Name of Faculty: Prof. Shivangi Sharma
Research Title: Valorization of citrus waste using reactive distillation for sustainable biodiesel production- 30 April 2024
https://doi.org/10.1016/j.cdc.2024.101141

Name of Faculty: Prof. Anish P. Jacob
Research Title: Chromium (VI) removal from water using different bio-adsorbents: Comparison and scope in the treatment of local water bodies with economic analysis" in Desalination and Water Treatment.
https://doi.org/10.1016/j.dwt.2024.100314

Chemical Data Collections 51 (2024) 101141

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Data Article

Valorization of citrus waste using reactive distillation for sustainable biodiesel production

Shourabh Singh Raghuwanshi, Shivangi Sharma *, Tanish Kasera

Department of Chemical Engg., Madhav Institute of Technology & Science, Gwalior, M.P, 474005, India

ARTICLE INFO

Keywords:
Reactive distillation
Biodiesel production
Waste-to-energy
Orange peel, Sustainable energy
Process intensification

ABSTRACT

Except for orange juice, the remainder is major waste created during orange processing. Indeed, this residue is an issue in the citrus business since its chemical makeup is more complex than other agro-industrial wastes like peels and seeds. Orange peels conceal within them valuable resources in the form of wax and aromatic oil, comprising a mixture of hydrocarbons and other chemical compounds. While in India, orange peels are typically perceived as domestic waste or consigned to landfills, they possess a rich history of traditional applications in medicine and insect repellent. This study aims to produce biodiesel from orange peel oil via trans-eterification process in reactive distillation transforming waste into wealth. Experimental outcomes demonstrate that revamping the reboiler duty and reflux ratio within specified ranges achieves the highest purity level of 96 %, corresponding to a reboiler duty of 6824.28 BTU/hr and a reflux ratio of 4.

Reactive distillation being highly complex and non linear in nature, a time varying control study is must. In view of this, dynamic simulations is performed that reveal at methanol flow rate of 0.07 liters per minute, a reboiler duty of 6810 BTU/hr can be retained corresponding to highest purity level. Characterization of the B20 biodiesel from orange oil (comprising 20.00 % biodiesel and 80.00 % diesel) showcases its suitability, with a basic pH of 7.6, a density of 872 kg/m^3, a viscosity of 2 cSt, and a flash point of 180 °C.

Economic Analysis is another important aspect of any research. Comparison between the two production processes were made in terms of the economic indicators such as Return-On-Investment (ROI) and payback period. The simulation results show that the reactive distillation catalyzed is more economically advantageous than the conventional process for biodiesel synthesis due to a much higher ROI, and lower payback period.

Specifications table

Subject area	*Chemical Engineering*
Compounds	*Methanol, Citrus Sinensis, Biodiesel*
Data category	*Synthesized, computational simulations*
Data acquisition format	*Experimental outcomes demonstrate that adjusting the reboiler duty and reflux ratio within specified ranges achieves the highest purity level of 96 %, corresponding to a reboiler duty of 6824.28 BTU/hr and a reflux ratio of 4. Additionally, dynamic simulations reveal that a methanol flow rate of*

(continued on next page)

Desalination and Water Treatment 318 (2024) 100314

Contents lists available at ScienceDirect

Desalination and Water Treatment

journal homepage: www.sciencedirect.com/journal/desalination-and-water-treatment/

Chromium(VI) removal from water using different bio-adsorbents: Comparison and scope in the treatment of local water bodies with economic analysis

Anish P. Jacob, Praveen Soni*

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ARTICLE INFO

Keywords:
Bio-adsorbent
Cost analysis
Titration
Electroplating

ABSTRACT

Tannery industries are an important part of India's economy. India has huge production and consumption of footwear in the world. Leather goods and footwear exports in India were set to reach $5.26 billion in 2022–23. These tannery industries require 40m3 of fresh water per ton of raw material.The water released by these industries are highly contaminated with Cr(VI). Apart from tannery industries,other industrial processes like electroplating, pigmentation also release chromium into the environment. Cr(VI) has adverse effects on humans health, animals and plants. Bio-absorbents exhibit good absorption capacity for Cr(VI). Five different bio-adsorbents have been used,which were collected from wastes.There is hardly any research that shows relation between percentage removal of chromium with respect to size of bio-adsorbents.This study is presented in the same direction. A stock solution was prepared in the laboratory that had similarity in chromium concentration with tannery effluent.Titration (quantitative analysis) was used.On comparison, it was found that pomegranate peel and water chestnut shell showed better Cr(VI) absorption capacity upto 97.83%. A schematic idea has been proposed for the removal of Cr(VI) from drinking water used in rural areas. Economic analysis of the use of these bio-absorbents has proven it to be a better option for Cr(VI)capture.

1. Introduction

Heavy metal pollution in water is a big problem today. Many industries produce waste and release it into the environment and pose a threat to living things. Chromium metal is an important element in the tanning and electroplating industries. It occurs mainly in zero, trivalent and hexavalent oxidation states. The chemicals formed in the six oxidation states are called chromate CrO4 and dichromate Cr2O7. The World Health Organization reported that the maximum total chromium (VI) concentration in drinking water is 0.05 mg/l [1]. Cr(VI) easily enters human foods and causes lung cancer, skin, stomach, itching, liver, etc. [2-4].

The biosorption process of pomegranate peel can remove 100% Cr (VI) from 20 mg/l [5]Cr(VI) solution in 3 min at 313 K. Isotherm and kinetic studies show that the system follows pseudo-second-order kinetics of physicochemical bio-adsorption, respectively [5].

In the biosorption process, pH value and separation of functional groups (-OH, -COOH and -NH2) on the surface of the bio-adsorbents are very important. Bio-adsorption was also performed on peach stones,orange peels,fleece. Biosorption of anions is effective in acidic medium [3].

Chemical reduction and precipitation with caustic soda are the traditional physicochemical methods for removing Cr(VI). This procedure generates a lot of sludge, which again contributes to secondary pollution when disposed of, and it also uses a lot more chemicals than necessary. Additional therapies that are offered include reverse osmosis, ion-exchange, and electrolysis are costly, high-energy procedures that are also inefficient at removing metal ions found in huge volumes of waste water at lower concentrations [6].

The Initial concentration of Cr(VI) and contact time were found to be important in the adsorption of Cr(VI) from solution (20–120 mg/l) by walnuts. The decrease in Cr(VI) removal percentage is associated with the reduction of metal ions to the active site, resulting in depletion of active sites in the bio-adsorbent. Powdered walnut kernels are rich in secondary metabolites, and carboxyl groups and polyhydroxyl groups are the main groups among amines [7].

Abbreviations: WCSP, Water chestnut shell powder; UTLP, Used tea leaves powder; PPP, Pomegranate peel powder; RHP, Rice husk powder; WKP, Walnut kernel powder; FAS, Ferrous ammonium sulphate; CETP, Common tannery effluent treatment plant

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Faculty Received Award/Prize

Name of the Faculty: Prof. Anish P. Jacob

Award Title: Recognised as NPTEL MOTIVATED LEARNER for Jan - Apr 2024

INNOVATION INTRODUCE

ONLINE FEEDBACK USING MOODLE

The constraints of pen and paper method of receiving feedbacks are many, which render the whole process meaningless.The main constraints in this method are- cost of printing which increases with the increase in number of questions. Moreover, the students lose interest in filling those never-ending sheets of paper, and the sheets from the booklets also. In such scenario, the data obtained, from the feedback are not complete and are unreliable. In addition to that, this data can't be analyzed deeply, without investing tremendous amount of resources.

In such a scenario, this year, the student feedback about different Faculty member and courses has been obtained using an online platform, MOODLE. Use of MOODLE for obtaining feedback has resulted in overwhelming participation from students. Moreover, the completeness of data is also guaranteed. The length of feedback questionnaire can be increased without any problem. In addition to that, the data obtained can be analyzed in multitude ways, very easily.

INTRODUCTION OF NPTEL COURSES UNDER SWAYAM

During the last few years, the awareness among engineering students about media has increased exponentially. The inclination among present day students is towards learning from online platforms, where they can learn at their own pace in social their own time, at a place of their choice. SWAYAM is an initiative whose motive is to exploit this tendency of students for online learning.

The lectures of the courses are available on YouTube platform, where a student can watch them and learn. These courses also include assignments given by Instructors assigned to these courses. These assignments are submitted using Google Classroom, which facilitates transparency and continuity in the evaluation of students. Moreover, a student receives prompt results.

EDITORIALBOARD

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Composed by: Miss. Khushi Tiwari (0901CM211006)